ASHB Research Library – Members' Area (Updated: November 2024)

The following reports are available to ASHB members through the ASHB Research Library:

IS-2024-200 Next-Gen Professional Monitoring: Scaling Verification

Authored by Daniel Holcomb and Jennifer Kent, Parks Associates, June 2024

This whitepaper addresses the challenge of false alarms in residential security and their impact on law enforcement's responsiveness. It explores how false alarms slow down emergency response times and diminish the value of professional monitoring services. The report advocates for adopting advanced verification technologies, such as TMA-AVS-01, and explores the role of video verification and AI in reducing false alarms. It positions these technologies as critical for maintaining the reliability of security services in an evolving market.

IS-2024-199 LoRaWAN for Smart Water Metering: Enhancing Efficiency and Sustainability

Published by Netmore, July 2024

This whitepaper highlights how LoRaWAN technology supports smart water metering through Advanced Metering Infrastructure (AMI). It details benefits like improved leak detection, water conservation, and operational efficiency. LoRaWAN is presented as an ideal solution due to its low cost, long battery life, and strong signal coverage, making it suitable for water meters in difficult-to-reach locations. Case studies from Yorkshire Water and Western Municipal Water District demonstrate how utilities can reduce water loss and operational costs while improving customer satisfaction.

IS-2024-198 Global Real Estate Perspective – Highlights

Published by JLL, August 2024

This mid-2024 report provides an overview of the global real estate market, noting economic resilience, falling inflation, and improving investor confidence. It highlights sector-specific trends, such as renewed interest in logistics, living spaces, and data centers, and the stabilization of commercial property prices. Despite uncertainties around interest rates and geopolitics, early signs of recovery in commercial real estate investment are emerging. The report offers insights into capital flows, sector performance, and evolving investment strategies.

IS-2024-197 Future-Proof Lighting Control: How Hybrid Lighting Control Brings New

Opportunities

Published by Helvar, September 2024

This whitepaper explores the advantages of hybrid lighting control systems that combine wired and wireless technologies. It highlights their flexibility, scalability, and adaptability for evolving building needs. The paper emphasizes the benefits of hybrid systems in terms of energy efficiency, user experience, and long-term cost savings, positioning them as essential for modern commercial building design and energy management.

IS-2024-196 Fostering Effective Energy Transition: Insight Report

Published by the World Economic Forum in collaboration with Accenture, June 2024

This report outlines the need for a balanced global energy transition, focusing on equity, security, and sustainability. It presents data-driven insights using the Energy Transition Index (ETI) and benchmarks nations' progress toward sustainable energy goals. While the report acknowledges improvements in renewable energy and electric vehicles over the past decade, it stresses the unevenness of progress across regions. Key challenges include energy affordability, geopolitical tensions, and investment shortfalls in developing nations.

IS-2024-195 Experience Matters: What's Driving Consumer Choice and Experience Across Places and Spaces?

Published by JLL, September 2024

Based on JLL's 2024 Global Consumer Experience (CX) survey, this report underscores the increasing importance of consumer-centric design in real estate development. It reveals a growing demand for "destination" spaces that blend physical and digital experiences to foster social connection. The report provides key insights for real estate developers and investors on how to cater to evolving consumer preferences, create spaces that encourage community engagement, and improve long-term ROI through experience-led design.

IS-2024-194 Developing an Effective Vape Detection Solution

Published by Motorola Solutions, September 2024

This guide offers a detailed exploration of vape detection technology, explaining how various types of sensors (particulate, gas, and combination) can be integrated into existing security systems. It highlights the importance of vape detection in schools and public spaces, where vaping is becoming a widespread issue. The paper focuses on the HALO Smart Sensor, a multifunctional device capable of detecting vaping, air quality changes, and safety threats, and provides guidance on the legal and privacy considerations for implementing these systems.

IS-2024-193 Considerations for Building a Cyber-Resilient City

Authored by Luke Antoniou, SmartCitiesWorld in collaboration with Paradox Engineering,

September 2024

This report highlights the increasing importance of cybersecurity in modern cities, focusing on three core areas: embedding security-by-design, addressing human factors through education and awareness, and establishing strong processes for vulnerability management and incident response. The report provides practical steps for city leaders to enhance cyber resilience, safeguard critical infrastructure, and ensure public safety in a rapidly digitalizing urban environment.

IS-2024-192 Charge at Home: Guidelines for Billing Company Cars in the Home Sector

Published by Phoenix Contact Smart Business GmbH, July 2024

This guideline offers fleet managers practical advice on managing the billing of electric company cars charged at home. It covers the technical, legal, and financial aspects of home charging, providing solutions like wall box installations and automated billing systems. Phoenix Contact's Charge Repay Service is highlighted as a flexible solution for simplifying billing processes and ensuring smooth operational management of home-charged vehicles in company fleets.

IS-2024-191 Decarbonization in the Built Environment: Addressing Embodied Carbon in MEP Systems

Published by the Sustainable Buildings Task Force, November 2023

This whitepaper addresses the overlooked issue of embodied carbon in mechanical, electrical, and plumbing (MEP) systems, which can account for up to 70% of embodied carbon in refurbishment projects. It outlines strategies to reduce carbon emissions in MEP systems, such as using low-carbon materials, conducting whole-life carbon assessments, and adopting circular economy principles. The paper calls for collaboration and innovation to decarbonize these systems, alongside efforts to reduce operational carbon.

IS-2024-190 Transforming Energy Demand

Published by the World Economic Forum in collaboration with PwC, January 2024

This whitepaper explores how businesses can reduce global energy consumption by 31% by 2030, potentially saving $2 trillion annually. It outlines strategies for improving energy efficiency across buildings, industry, and transportation sectors using existing technologies. Key levers include energy savings, efficiency improvements, and value chain collaboration. The paper advocates for public-private partnerships to balance energy demand and supply as part of the global journey towards net zero.

IS-2024-189 Transforming Commercial Real Estate Through Digitalization

Published by Siemens Smart Infrastructure, February 2024

This whitepaper discusses how the Siemens Xcelerator platform can help commercial real estate

(CRE) companies achieve key goals like reducing operational costs, improving sustainability, and enhancing occupant well-being. By integrating smart IoT systems, data analytics, and energy management, Siemens demonstrates how CRE portfolios can be optimized for future-proofing, decarbonization, and long-term profitability in a competitive and evolving market.

IS-2024-188 Technology of the Connected Home and Building: Delivering on Safety, Comfort, and Convenience

Authored by David Renno, Renesas Electronics, March 2024

This whitepaper explores the increasing demand for intelligent, connected devices in homes and buildings. It highlights how Wi-Fi, Bluetooth, and NFC technologies enable smart devices to enhance safety, comfort, and convenience. The paper also discusses trends like machine learning and AI, explaining how Renesas' connectivity products help manufacturers build efficient, low-power smart devices that offer seamless integration across modern home and building ecosystems.

IS-2024-187 Cracking The Code: Unleash Your Smart Buildings Strategy With The Power Of Facility Data

Published by Forrester Consulting, commissioned by Johnson Controls, March 2024

This whitepaper examines how smart building technologies can improve operational efficiency, security, and sustainability. Based on a survey of over 1,100 security leaders, the report highlights challenges like organizational silos, non-integrated systems, and lack of technical expertise. It advocates for partnerships with external providers and the integration of AI and IoT to generate real-time data insights that enhance security and drive sustainability in smart building operations.

IS-2024-186 Strategic Cybersecurity Talent Framework

Published by the World Economic Forum, April 2024

This whitepaper addresses the global cybersecurity talent shortage, estimated at nearly 4 million experts. The Strategic Cybersecurity Talent Framework (CTF) outlines four key areas: attracting talent, improving education, reforming recruitment, and enhancing retention. It presents strategies for building sustainable cybersecurity talent pipelines and calls for collaboration between the public and private sectors to close the workforce gap and meet increasing cybersecurity demands.

IS-2024-185 Smart Metering: The Connectivity State of Affairs

Authored by Mattias Carlsson, Berg Insight, April 2024

This report examines the growing role of smart metering in global energy transformation, with a focus on cellular connectivity. It details the acceleration of smart meter deployments in regions like Europe, North America, and Asia-Pacific, particularly in countries like China, Japan, and India.

The report discusses connectivity challenges and highlights Giesecke+Devrient's cellular IoT solutions to simplify and manage smart metering rollouts, particularly in remote areas.

IS-2024-184 Smart Buildings Enable Efficient Spaces That Foster Health, Well-Being, and Productivity

Published by Forrester Consulting, commissioned by Johnson Controls, February 2024

This whitepaper emphasizes the role of smart buildings in improving health, well-being, and productivity for occupants. It highlights the need for unified building systems, integrated data, and strategic partnerships to address challenges like indoor air quality (IAQ) and energy efficiency. The paper explores how smart buildings can help meet sustainability and productivity goals while improving operational efficiency through technical and strategic collaborations.

IS-2024-183 Smart Building Technology: Managing Transformational Change

Authored by Michael Moran and Michelle Brigoli, Microshare, January 2024

This whitepaper outlines best practices for managing transformational change when introducing smart building technologies. It stresses the importance of preparing stakeholders—tenants, staff, and customers—by communicating the vision, addressing privacy concerns, and demonstrating early benefits. The paper advocates a four-phase approach, including articulating the vision, identifying stakeholders, and showcasing the technology's impact, to ensure a smooth transition to smart building solutions.

IS-2024-182 Retrofit for Purpose: The Role of Finance in Enabling Decarbonization through Non-Residential Building Retrofits

Published by Siemens Financial Services, January 2024

This whitepaper highlights the importance of flexible financing models in decarbonizing non-residential buildings. It explores how energy-efficiency-as-a-service (EaaS) models can enable building retrofits without upfront capital, helping buildings meet 2030 and 2050 climate targets. The report estimates that these financing solutions could reduce emissions by over 210 MtCO2e annually by 2030 across key regions like the U.S., Europe, China, and India.

IS-2024-181 Reducing Embodied Carbon in Cities: Nine Solutions for Greener Buildings and Communities

Published by the World Economic Forum in collaboration with Accenture, April 2024

This whitepaper explores how cities can reduce embodied carbon emissions in construction through nine innovative solutions. These solutions focus on policy frameworks, low-carbon ecosystems, and promoting circular economy strategies. The report emphasizes the need for collaboration across sectors and highlights case studies that showcase successful approaches to reducing embodied carbon, contributing to the decarbonization of the built environment.

IS-2024-180 How to Maintain Constantly Evolving Smart Buildings

Published by Trane Technologies, June 2024

This whitepaper discusses the future of smart building systems and the need for adaptable technologies to meet modern building demands. It covers advancements in AI, connectivity, and predictive maintenance that are transforming building management. The report stresses the importance of integrating open standards like BACnet Secure Connect and utilizing both wired and wireless technologies to maintain seamless modernization and long-term success.

IS-2024-179 Get Set for the 5th Industrial Revolution: Real Estate Strategies for an AI-Powered World

Published by Forrester Consulting, March 2024

This report explores how AI and advanced computing will reshape the real estate industry, highlighting strategies for navigating the 5th Industrial Revolution. It discusses key trends, including AI's convergence with natural sciences, the reshaping of labor markets, and the demand for energy-efficient infrastructure. Real estate professionals are encouraged to adopt a "fast iteration" mindset to adapt to rapid technological changes and leverage AI to enhance business models and building functions.

IS-2024-178 Delivering on the European Green Deal: A Private-Sector Perspective

Published by the World Economic Forum in collaboration with Accenture, January 2024

This report examines the role of the private sector in advancing the goals of the European Green Deal (EGD), which aims to make the EU climate-neutral by 2050. It evaluates how companies are aligning with EGD targets in areas like climate, energy, and decarbonization. The report offers recommendations for policymakers and industry leaders to accelerate progress through innovation, regulatory harmonization, and financing while maintaining momentum in Europe's green transition.

IS-2024-177 Building Trust through an Equitable and Inclusive Energy Transition

Authored by Sarah Moin and the World Economic Forum, January 2024

This whitepaper explores the importance of equity, justice, and inclusivity in the global energy transition. It emphasizes that neglecting these aspects can hinder progress and erode trust. The paper identifies challenges like unequal energy access, job displacement, and rising costs, and proposes solutions such as stakeholder collaboration, targeted investments, and inclusive policies to ensure a fair and socially responsible energy transition.

IS-2024-176 A Glimpse into the Invisible World of Near-Infrared (NIR): Exploring Its Applications and Potential

Published by Broadcom, February 2024

This whitepaper offers a comprehensive analysis of near-infrared (NIR) technology and its applications in industries like surveillance, safety, and energy monitoring. It highlights the advantages of NIR LEDs, such as invisibility, energy efficiency, and compatibility with silicon-based photodetectors. Broadcom's NIR solutions are positioned as critical components in modern industrial and commercial systems, enhancing functionalities like 24/7 monitoring and early fire detection.

IS-2024-175 2024 State of Physical Access Trend Report

Authored by Chris Price, IFSEC Insider, June 2024

This report explores trends in the physical access control market, including the rise of mobile credentials, biometrics, and open standards. It examines how hybrid work patterns have accelerated demand for more flexible and secure access systems, and the convergence of physical and cybersecurity needs. The report also emphasizes sustainability, with organizations increasingly prioritizing low-energy hardware and mobile credentials to reduce their environmental impact.

IS-2024-174 Smart Homes: Pioneering Age-Friendly Environments in China for Enhanced Health and Quality of Life

Authored by Ingy Shafei et al., Flinders University, May 2024

This report examines how smart homes can support older adults in China by allowing them to live independently with minimal assistance. It discusses the benefits of smart home technologies for older adults, such as reduced costs compared to other care options. The report also addresses challenges, including the high literacy rates required to adopt these technologies and resistance from older adults to learning new systems, while offering strategies to overcome these barriers.

IS-2024-173 Navigating Liquid Cooling Architectures for Data Centers with AI Workloads

Authored by Paul Lin et al., Schneider Electric, June 2024

This report discusses six common liquid cooling architectures for data centers, focusing on how they optimize energy consumption without compromising server performance. It explains the design of Cooling Distribution Units (CDUs), their components, and various heat rejection methods. The report helps data center operators choose the best liquid cooling mechanism for AI workloads, balancing energy efficiency and performance.

IS-2024-172 Gridlocked: The Barriers to Smart Grid Market Development

Authored by Matthew Purnell, Juniper Research, June 2024

This report examines the potential of smart grids to improve energy supply and demand

coordination while integrating renewable energy sources. It predicts $290 billion in savings by 2029 through smart grid technologies but notes several challenges, including high capital costs, regulatory uncertainties, and increased cybersecurity risks. The report emphasizes the role of battery energy storage in addressing renewable energy intermittency and highlights software-driven benefits like automated fault detection.

IS-2024-171 Cracking the Smart Building Code: A Spotlight on Data Centers

Published by Forrester Consulting, March 2024

This report presents findings from a survey of 305 smart building decision-makers at data centers. It reveals the need for integrated systems to achieve goals like improved security, reduced carbon emissions, and operational efficiency. However, only 7% of respondents reported fully integrated systems. The report underscores the importance of sustainability in data centers, with smart building solutions being key to meeting climate targets and improving energy transparency.

IS-2024-170 Smart Buildings Technology: The Future of Connectivity in Commercial Real Estate

Published by BUILDINGS, July 2024

This ebook covers topics such as hybrid workforces, intelligent sensors, and the integration of GPT AI with BIM models in commercial real estate. It includes case studies on smart buildings and a checklist for implementing smart technologies. The paper highlights how smart building automation and connectivity are revolutionizing facility operations, creating more efficient, responsive, and adaptive environments.

IS-2024-169 Smart Buildings 2024 Summer Edition

Published by Consulting & Specifying Engineer, July 2024

This ebook presents a series of roundtable discussions by experts on topics like electric vehicle fleet goals, new approaches to HVAC design, ASHRAE standards, and improving indoor air quality in K-12 schools. It emphasizes the role of smart buildings in energy efficiency and sustainability, offering insights into how smart technologies can enhance the performance and comfort of educational and commercial spaces.

IS-2024-168 More Housing, Less Carbon: Policy Principles to Reduce Embodied Carbon in Canada's Housing Sector

Authored by Gabriel Eidelman & Shoshanna Saxe, Canadian Standards Association, May 2024

This report proposes four policy principles to reduce embodied carbon in Canada's housing sector. It highlights how current climate plans focus on reducing operational energy use but neglect emissions from construction materials and methods. Drawing on lessons from leading jurisdictions like Denmark and the UK, the report advocates for translating technical solutions into public policy to address the environmental impact of new construction.

IS-2024-167 Heat Exchange

Published by the Canadian Climate Institute, July 2024

This report discusses the steps energy utilities in Canada must take to achieve net zero by 2050. It highlights the early stages of clean energy transition planning and the challenges regulators and policymakers face. The report provides recommendations for accelerating the transition while ensuring affordability and reliability, offering guidance for provincial governments on how to protect customers and adapt to a net-zero energy landscape.

IS-2024-166 Commercial Building Technical Application Guide

Published by Wesco International, January 2024

This guide provides best practices and smart solutions for building contractors, integrators, and facility managers looking to design future-ready commercial buildings. It covers network infrastructure, lighting, security, A/V systems, and safety, with a focus on sustainability initiatives. The guide emphasizes Wesco's expertise in advisory collaboration, project deployment, and supply chain management, offering a comprehensive resource for building, modernizing, and maintaining commercial facilities.

IS-2024-165 Healthy Buildings in a Changing Climate: Improving Health with Multi-Unit Residential Building Retrofits

Authored by Raidin Blue & Betsy Agar, The Pembina Institute, July 2024

This report examines the intersection of climate change, building conditions, and occupant health, focusing on multi-unit residential buildings (MURBs). It identifies four climate-related health risks: extreme heat, flooding, infectious diseases, and wildfire smoke. The report advocates for deep retrofits that include upgrades to ventilation, heating, and cooling systems to improve health outcomes, particularly for vulnerable populations, while addressing climate-related risks.

IS-2024-164 The Ultimate Guide to Access Control Systems

Published by Avigilon Corporation, April 2023

This whitepaper provides an in-depth exploration of access control systems and their critical role in enhancing security for commercial and residential properties. It explains how access control systems regulate entry using electronic credentials, smart devices, and advanced technologies. The paper also discusses various policies, system components, and the advantages of integrating access control with broader building management solutions, offering a comprehensive guide for organizations looking to improve property security.

IS-2024-163 Sustainability in Real Estate: Integrating Software Solutions for a Greener Tomorrow

This whitepaper discusses the pivotal role of sustainability in the real estate sector and how smart software solutions can drive greener, more efficient buildings. It highlights real estate's significant contribution to global greenhouse gas emissions (39%) and presents case studies from projects like the Bullitt Center and Zero Carbon Building, demonstrating how technology and sustainability efforts are reshaping the industry. The paper argues for the integration of digital solutions to meet environmental goals while enhancing property values and operational efficiencies.

IS-2024-162 Smart Cities: Promoting Urban Governance in India

This whitepaper examines India's Smart Cities Mission, focusing on how integrating technology with governance can address urban challenges and contribute to sustainability, urban rejuvenation, and economic growth. Drawing on insights from Arthur D. Little and the Centre for Policy Research, it explores the impact of smart city technologies in areas like ecology, mobility, and economic development. Key examples include integrated command centers and data-driven governance, highlighting the importance of digital solutions for improving urban service delivery and resilience.

IS-2024-161 School and Campus Security: A Guide to Security Systems, Cameras, Door Locks, and Devices

This whitepaper outlines the essential security technologies needed to protect educational facilities, from video surveillance to access control and lockdown procedures. It provides key considerations for implementing integrated security systems in both K-12 schools and university campuses. The report emphasizes the role of advanced technologies like video analytics, cloud-based access control, and biometric devices in enhancing campus safety and preparedness.

IS-2024-160 Reduce Energy Consumption in Buildings with AC Cloud Control

This whitepaper explores how cloud-based solutions can significantly improve the energy efficiency of building air conditioning systems. It advocates for retrofitting existing AC units with cloud control, especially in commercial buildings where AC systems account for up to 70% of energy use. Smart technologies like Intesis AC Cloud Control integrate with Building Management Systems to enable remote control and demand response, reducing energy waste and carbon emissions.

IS-2024-159 Transitioning Industrial Clusters towards Net Zero: National Policy Enablement for Industrial Decarbonization – Part II

This whitepaper discusses the role of industrial clusters in global decarbonization efforts, emphasizing the need for national policies that support renewable energy, hydrogen development, and carbon capture technologies. The report highlights how public-private collaborations are essential for transforming industrial clusters into sustainable ecosystems, contributing to net-zero goals, and advancing smart city initiatives.

IS-2024-158 Mastering Hybrid Work - A Comprehensive Guide for Productivity, Security, and Collaboration

This whitepaper explores the benefits of hybrid work, emphasizing its potential to improve employee well-being, operational efficiency, and cost savings. It outlines strategies for seamless collaboration, robust security, and intelligent workspace management, positioning hybrid work as essential for future workplaces and smart cities. Cisco's solutions for secure, modernized work environments are key to supporting a distributed workforce.

IS-2024-157 How Sustainable Buildings Management Can Succeed with Building Automation

This whitepaper highlights the role of building automation in achieving sustainability goals. It showcases how automated systems in heating, ventilation, lighting, and safety can drastically improve energy efficiency and reduce CO_2 emissions. Using examples like myGEZE Control, the paper demonstrates how digital technologies can enhance building safety, comfort, and operational efficiency, advancing the transition to sustainable smart buildings.

IS-2024-156 Harnessing Open Data to Create Smart Communities

This whitepaper explores how small and mid-sized municipalities can use open data to develop smarter, more efficient, and sustainable communities. It emphasizes that smart city benefits like energy management and traffic optimization are achievable even without large budgets. Case studies from smaller communities, such as Morrisville, NC, illustrate how open data initiatives can enhance local services and improve citizen engagement.

IS-2024-155 Governing Smart Cities - Use Cases for Urban Transformation

This whitepaper addresses governance challenges in smart cities, focusing on model policies that promote privacy, open data, and inclusivity. It features case studies from Mexico City, Tsukuba, and Istanbul, demonstrating how cities are leveraging open data and ICT policies to improve public safety and digital inclusion. The paper underscores the need for responsible technology

governance to create safer, smarter, and more inclusive urban environments.

IS-2024-154 Future-Proofing Energy Efficiency with Networked Lighting Controls

Published by the DesignLights Consortium, August 2023

This whitepaper discusses the potential for substantial energy savings by integrating Networked Lighting Controls (NLCs) with LED systems in commercial and industrial buildings. It highlights how combining NLCs with other systems, particularly HVAC, can lead to further energy and demand reductions. The paper calls for updated energy efficiency policies to encourage wider adoption of NLCs, citing their long-term benefits in reducing energy consumption and costs.

IS-2024-153 Facilities of the Future - Safety and Security Meet Smart Buildings

Published by Cisco and Meraki, May 2023

This whitepaper examines how smart building technologies can address modern facilities management challenges. It highlights the limitations of legacy video surveillance systems and the benefits of cloud-managed IoT devices, such as smart cameras and sensors, for real-time monitoring and decision-making. The paper argues that smart buildings improve security, energy efficiency, and occupant comfort while supporting sustainability goals.

IS-2024-152 Emerging Insights for Achieving Circularity in the Built Environment

Co-published by the World Economic Forum and McKinsey, July 2023

This whitepaper explores how circular practices, such as material reuse and recycling, can significantly reduce CO_2 emissions in the built environment. The construction sector is responsible for 40% of global emissions, and the report highlights key strategies to reduce embodied carbon, including carbon recirculation and recycling demolition waste. Circularity is framed as a practical solution for reducing emissions while generating financial benefits and improving supply chain resilience.

IS-2024-151 Elegantly Connecting Your Smart Home Network

Published by the Thread Group, September 2023

This whitepaper explains how the Thread protocol enhances smart home connectivity by offering reliable, secure, and energy-efficient communication for IoT applications. It compares Thread to traditional IoT protocols like Wi-Fi and Bluetooth, emphasizing its mesh networking capabilities, which provide more robust and self-healing connectivity without relying on a central hub. The paper also discusses how Thread integrates with Matter, the new smart home standard, to enable seamless interoperability across devices from major brands.

IS-2024-150 Connected Life - The Path to a Smarter Ecosystem

Authored by Paulo Chaínho and Filipe Cabral Pinto, Altice Labs, April 2023

This whitepaper examines the evolution of the telecommunications industry towards a smarter ecosystem, focusing on connected homes and smart home standards like Matter. It explores how security, energy management, and entertainment systems are being integrated to create seamless user experiences. The paper also highlights how the COVID-19 pandemic accelerated digital interactions and transformed consumption patterns in smart homes.

IS-2024-149 Circularity in the Built Environment - Maximizing CO2 Abatement and Business Opportunities

Co-published by the World Economic Forum and McKinsey, December 2023

This whitepaper explores how circular practices, such as recycling and material reuse, can reduce embodied carbon in key building materials like concrete, steel, and aluminum. It highlights strategies for reducing emissions while unlocking business opportunities, positioning circularity as a solution for decarbonizing the construction sector and contributing to global climate goals.

IS-2024-148 Building Truly Sustainable Cities: How Connected Systems Can Help Cities Build Sustainability and Wellbeing Into Their Indoor and Outdoor Spaces

Authored by Sue Weekes, SmartCitiesWorld, in association with Signify, November 2023

This whitepaper examines how cities can achieve sustainability by integrating connected systems in both indoor and outdoor environments. It emphasizes the importance of technology in accelerating decarbonization and improving urban quality of life. The paper features case studies and expert insights on how energy-efficient lighting and building management systems can help cities meet climate goals while maintaining livability and resilience.

IS-2024-147 Decarbonizing the US Economy by 2050

Published by the US Department of Energy, April 2024

This report highlights the crucial role of the building sector in achieving the US's net-zero emissions target by 2050. It emphasizes the importance of creating resilient, energy-efficient residential and commercial structures to support decarbonization efforts. Key goals include improving indoor air quality, thermal comfort, and addressing environmental justice, as marginalized communities often face energy insecurity and pollution at disproportionate rates. The report advocates for collaboration between federal, state, and local governments on policies, funding, and workforce development to facilitate the transition to low-carbon technologies. It also stresses building efficiency, clean energy access, and ensuring that disadvantaged communities benefit from these upgrades.

IS-2024-146 Coupling and Quantifying Sustainability and Resilience in Intelligent Buildings

Authored by Al Qurneh, D.A. and others, April 2024

This study explores the financial and social benefits of integrating sustainability and resilience in intelligent buildings, using a Net Present Value (NPV) model to assess costs and returns.

Analyzing four smart buildings in Dubai, the report demonstrates that sustainable and resilient systems can provide high NPV, indicating profitability while safeguarding against unexpected failures. A social survey complements the financial analysis by quantifying the societal benefits of sustainable building practices. The report recommends further research into sustainability and resilience in smart buildings, reinforcing their importance in an era of climate variability and urbanization.

IS-2024-145 Climate Change and Respiratory Health in the Built Environment

Published by Tarkett, February 2024

This report addresses the impact of climate change on respiratory health, particularly in the built environment. It highlights how worsening air quality, due to both indoor and outdoor pollutants, exacerbates conditions like asthma and allergies. The report underscores the need for clean air solutions, citing extreme weather events and $165 billion in climate-related damages in the US in 2022 alone. Recommendations include improved ventilation, the use of low-VOC materials, and easy-to-clean surfaces, as well as products certified to be asthma and allergy-friendly to improve indoor air quality and overall health.

IS-2024-144 Air Pollution, Air Quality, and the Workplace

Published by Assurity Consulting, January 2024

This report focuses on air quality and pollution in workplaces, discussing the definitions, effects, and legislation surrounding air pollution. While air quality has improved in recent decades, it remains a significant concern, particularly in indoor work environments where poor air quality can lead to occupational diseases. The report stresses the need for regular air quality assessments and compliance with safety regulations. The pandemic has further underscored the importance of air quality in workplace design, leading to the adoption of technologies for monitoring and improving air quality to ensure worker health and safety.

IS-2024-143 A Journey Through Time to Emission-Free Logistics of the Future

Published by Johnson Controls, 2023

This report explores the global push toward emission-free logistics, emphasizing how technological advancements, regulatory frameworks, and supply chain cooperation are driving climate change mitigation. It outlines a holistic approach to sustainable logistics, with a focus on zero-emission distribution warehouses. Key milestones for achieving emission-free logistics include building automation, energy management, and predictive maintenance. The report also highlights how IoT and AI technologies can optimize the energy efficiency of logistics facilities, offering comprehensive solutions for a sustainable future.

IS-2024-142 The Untold Potential and Rationale of Industrial Electrification in the United States

This report, authored by Vincent Petit from Schneider Electric and released in June 2024,

examines how industrial electrification is key to the U.S. meeting its climate pledge of carbon neutrality by 2050. It highlights that while buildings and mobility sectors are often prioritized for decarbonization, the industrial sector also presents substantial untapped potential for carbon reduction. Schneider Electric's research suggests that the share of electricity in U.S. industry energy demand could increase significantly by 2030, leading to immediate reductions in fossil fuel use and CO_2 emissions. This report provides valuable insights into the opportunities for electrification and serves as a call for action to accelerate the decarbonization of industry.

IS-2024-141 Australians at Home in 2029

Australians@Home in 2029, authored by Steve Sammartino and commissioned by Samsung Electronics Australia, was published in January 2024 and explores how technology will reshape Australian homes by 2029. It highlights five key areas: AI integration in home environments, energy-efficient homes acting as power plants, soft robotics for household tasks, the symbiosis between smart homes and vehicles, and transparent display technologies. AI will drive a seamless, connected home experience, optimizing energy use and personalizing daily routines. These innovations will create smart homes that enhance efficiency, sustainability, and the quality of life, pushing forward smart building and smart city development.

IS-2024-140 Technology for Aging

Authored by Laurie M. Orlov of Aging and Health Technology Watch and published in January 2024, this report explores the latest trends in technologies for aging, focusing on the increasing role of AI, smart homes, and telehealth. AI is increasingly embedded in care solutions, enhancing health monitoring, fall detection, and caregiver support. The report emphasizes the importance of home renovations for aging in place, as many older adults require safer, more accessible living spaces. Additionally, telehealth and remote care technologies are expanding, enabling healthcare delivery from home. These advancements are integral to smart buildings, homes, and cities, supporting aging populations with improved safety, connectivity, and care.

IS-2024-139 Serving Residents Who Have Hearing Loss: How Providers Can Help Residents Live Their Best Lives

The March 2024 e-book, sponsored by Hamilton CapTel and presented by McKnight's Senior Living, discusses the challenges of age-related hearing loss in senior living communities and how providers can enhance residents' quality of life using technology and design. The e-book emphasizes the importance of hearing aids, captioned telephones, and simple interventions, while also addressing how interior design and acoustical engineering can create more supportive environments. It advocates for collaboration between senior living operators, family members, and staff to implement these solutions and optimize residents' overall experience.

IS-2024-138 Providing Personalized Care in Assisted Living is a Team Effort

Published in December 2023, this e-book, sponsored by Synchrony Health Services and presented by McKnight's Senior Living, emphasizes the value of interdisciplinary collaboration in

offering personalized care in assisted living communities. By following the "Four M's" Framework—Mobility, Mentation, Medications, and "What Matters"—the guide emphasizes person-centered healthcare, which enhances the resident experience, supports independence, and improves quality of life. With a focus on teamwork among healthcare providers, pharmacists, and caregivers, this e-book aligns with the shift toward value-based care and smart building systems that optimize resident safety, care coordination, and overall well-being.

IS-2024-137 Integrating Care Services - The Road to the Right Care for the Right Cost

Sponsored by McKnights with contributions from Synchrony Health Services and ALG Senior, and published in November 2023, this e-book explores how integrated care services in senior living and skilled nursing facilities improve patient outcomes through collaboration among pharmacy, rehab, and lab services. By focusing on value-based, person-centered care, it reduces costs, improves medication adherence, and lowers hospital readmissions. The approach is aligned with smart building concepts, where efficient systems and technologies improve operational efficiency and resident well-being. Integrated care in healthcare settings reflects how smart homes and cities connect services to optimize outcomes and enhance quality of life.

IS-2024-136 How to Decide - Aging in Place vs. Assisted Living

Published in May 2024 by Hartford Funds, this e-book explores the pros and cons of aging in place compared to moving to an assisted living community. While 77% of aging adults prefer to stay in their homes, the e-book highlights the potential health, social, and financial risks associated with aging in place. It also covers age-friendly home modifications, the cost of in-home support services, and the advantages of assisted living communities in terms of safety, mobility, social engagement, and healthcare.

IS-2024-135 How Real-Time Location Services Can Benefit Your Senior Living Community

The May 2024 e-book by Polina Braunstein, Kevin Harris, and Luke Waidmann from McKnights Senior Living examines how Real-Time Location Services (RTLS) improve safety, security, and operational efficiency in senior living communities. RTLS solutions, integrated with wearables, Wi-Fi, and Bluetooth, enable precise location tracking of residents and staff, minimizing response times and enhancing care coordination. The technology streamlines administrative tasks, reduces staff workload, and improves overall resident experience. These systems are integral to smart building environments, promoting seamless integration with IoT devices, enhancing connectivity, and enabling real-time data-driven decision-making.

IS-2024-134 Handwashing Survey Research Drives Industry Solutions

Authored by Bradley, a Watts Brand, and published in April 2024, this whitepaper reveals findings from the Healthy Handwashing Survey™, which has been tracking public restroom preferences for 15 years. The survey reveals Americans' growing demand for clean, hygienic, and touchless public bathrooms, with 86% preferring touchless fixtures. The paper emphasizes how these preferences are shaping restroom design, maintenance solutions, and the adoption of

modern, seamless, touchless technologies. Additionally, it highlights the importance of integrating these solutions to enhance user experience and boost business reputations.

IS-2024-133 Ensuring the Quality of Smart Home Devices Through Comprehensive Testing Methodologies

This whitepaper, written by Robert Yao and Thomas Chang from Allion Labs and released in November 2023, stresses the need for comprehensive testing methodologies to ensure the effectiveness of smart home devices. It discusses the necessity of real-house testing to ensure seamless functionality, interoperability, and user experience in real-world conditions. The paper contrasts lab testing with real-house environments, addressing challenges such as device diversity, network complexity, and rapid technological advancements. The insights are critical for ensuring the reliability, security, and performance of smart devices in smart homes, where user expectations demand consistent, high-quality experiences.

IS-2024-132 Empowering Utilities - Overcoming Challenges with Private Networks and 5G Technology

Released in June 2024, this whitepaper by T-Mobile for Business explores the rising challenges for utilities in balancing decarbonization goals, managing distributed energy resources (DERs), and addressing customer demand amid an increasingly complex energy landscape. A central theme is the role of private networks and 5G technology in overcoming these challenges by enabling more advanced, secure, and efficient grid operations. The whitepaper emphasizes how private LTE and 5G networks are critical for extending connectivity to the grid edge, where renewable energy sources, smart meters, and electric vehicle (EV) charging stations are integrated.

IS-2024-131 Effective Bundling - Pain Points and Expectations from Subscription Leaders

Authored by Kristen Hanich of Parks Associates and published in May 2024, this whitepaper explores the increasing complexity of the subscription services market, highlighting the role of bundling and partnerships in combating consumer fatigue and market fragmentation. The paper draws on interviews with executives from leading subscription service providers in video streaming, music, education, and productivity markets to understand effective bundling strategies, their challenges, and success factors. It also presents insights on how bundling with telcos (mobile and internet service providers) and other partners can drive growth, enhance customer retention, and differentiate services.

IS-2024-130 Connected Products - Enhancing Consumers' Lives With Technology

Published in January 2024 by the Capgemini Research Institute, this whitepaper explores the expanding role of consumer-facing connected products, with a focus on smart home devices, voice assistants, and health wearables. The study reveals that 67% of consumers consider connected products essential in their daily lives. While the report highlights the growing adoption of smart security systems and health wearables, it also addresses concerns surrounding

data privacy and sustainability. Consumers demand more user-friendly experiences, seamless product integration, and transparent environmental practices from organizations. The study emphasizes how companies can align with these expectations by enhancing data privacy measures, promoting modular product designs, and implementing circular economy practices.

IS-2024-129 AI and the Future of Care Work

The November 2023 whitepaper by Laurie M. Orlov from Aging and Health Technology Watch examines the growing role of Artificial Intelligence (AI) in addressing the care needs of the aging population. As life expectancy increases and the demand for elder care rises, the caregiving workforce is shrinking, exacerbated by burnout and turnover, particularly following the COVID-19 pandemic. This gap is leading to the growing adoption of AI to supplement and improve care delivery across various care settings, from home healthcare to senior living facilities and skilled nursing facilities (SNFs). The paper discusses AI's potential to revolutionize care by enhancing predictive capabilities, improving patient monitoring, and supporting healthcare workers.

IS-2024-128 State of the Market - Access Control Systems

Authored by staff writers from Brivo and Security Info Watch and published on January 3, 2024, this report briefly discusses the rising demand and preference for cloud-based solutions in physical space management and access control systems within an evolving market. This was written to address how companies are facing a variety of internal barriers. Such examples that were covered include lack of budget, uncertainty over the potential tangible and intangible ROI, and pain points such as upgrade challenges (hardware to subscription-based), communication infrastructure, and remaining current in a fast-paced landscape that remains top of mind for decision-makers. External factors like business trends (Ex. demographics and COVID-19) and user expectations also come into play when making long-term business investment decisions.

IS-2024-127 Middle Market - Lowering Barriers to the Smart Home

Co-authored by Jennifer Kent and Tam Williams from Parks Associates and Skybell, and published on May 2, 2024, this report discusses how companies offering smart tech and products should tailor their messaging, pricing, and product/service development to cater to various user groups, from Super Early Adopters to the Early Majority and the Middle, each with different priorities. Some of these issues are pragmatic benefits, endorsements from trusted sources, values of security services, comfort /peace of mind, and productivity. The players in the market need to create profiles to address barriers to entry and growing outreach efforts to older consumers and their caregivers by including features like easy-to-use and read interfaces. Other strategies are partnering up to offer bundles for seamless integration.

IS-2024-126 The Impact of Industry 5.0 on Smart Building Technologies

Authored by Michelle Joynson and published by Juniper Research in May 2024, this report covers how the 5th wave of the technological revolution is poised to build on the developments of the 4th wave. It covers a brief market overview of smart buildings and how with a stronger smart

grid big buildings can be provided with better power with upgraded sensors and software. There is a new emphasis on tracking data to reduce operational costs. Service providers that buildings use now have to stay current as leaders to leverage opportunities through strategic partnerships to offer holistic approaches. This paper also briefly touches on the difference between Traditional and Smart buildings (reduction of carbon footprint) before ending with a market forecast summary that speaks to benchmarks, evaluations, key trends, takeaways, and recommendations.

IS-2024-125 Smart Living - The Trends Transforming Our Homes

Published by Wired Score on July 2, 2024, this paper briefly explores the latest technological developments that are shaping luxury smart living in areas like Dubai throughout the Middle East. It covers how the standards of living are coming with stronger expectations, especially from the younger generations where there are shifting and changing work patterns. It goes over how top of mind are things such as comfort, connectivity, security, air quality, and better amenity options when it comes to deciding where to live. This paper is for those who want to know the business case for resilient smart buildings of the future that also focus on ESG outcomes, adaptable infrastructure, and energy performance management.

IS-2024-124 Building Better Schools - Challenges & Opportunities for the Design and Operation of Educational Facilities

Co-authored by Jeanie Fitzgerald, Janelle Penny, and AnneMarie Martin from Buildings, Architectural Products, and I+S, this report was published on January 16, 2024. This paper covers in-depth many of the problems and solutions for the futuristic design and operational management of educational institutions. From safety and security concerns to indoor air quality and lighting, these are all ideas that together can help with decarbonization and efficiency strategies. There are many products and/or technologies that are advertised in each section that can collect building data.

IS-2024-123 Breathing Success - How Better Indoor Air Quality Transforms Student Health and Test Scores

This report, authored by Victoria Wood from WellStat and published on February 2, 2024, covers the critical importance of indoor air quality in fostering better health and productivity among students in schools. IAQ is the silent influencer that affects cognitive abilities and academic outcomes from all the pollutants that originate either inside buildings or from external sources. One of the challenges to improving IAQ stems from a lack of budget from the province to address such operational challenges. Students as children and youth are more susceptible to illness due to their undeveloped immune systems. This paper gives examples such as lower levels of road traffic nearby and more celebrated room temperatures that can impact student success in the classroom. WellStat markets their wall mount for school use to have better data.

IS-2024-122 Breath of Fresh Air - The ROI of Indoor Air Quality (IAQ) Monitors

This report, authored by Victoria Wood of WellStat and released on May 5, 2024, highlights the need for corporate companies to allocate budget resources towards IAQ improvements, specifically in upgrading ventilation systems. This paper is a business case for the tangible benefits of workplace wellness initiatives. The benefit-to-cost ratio proves the correlation with employee morale and retention rates. IAQ is a valuable asset for long-term business sustainability and goes hand in hand with preventative maintenance and other energy-efficient measures.

IS-2024-121 The Building Intelligence Index

Published by RZero on April 8, 2024, this report examines the challenges faced by the commercial real estate sector in meeting emissions reduction guidelines. This paper covers how the use of technological innovation, responsive management systems, and performance analytics all play roles in the reduction of energy consumption and in tandem help with cost efficiencies. Factors such as the 4 Pillars (occupancy data, indoor air quality, energy use across the board, and indoor health are reviewed for how building owners and operators can make more informed decisions.

IS-2024-120 The Agile and Efficient Digital Building

Authored and published by Panduit on April 8, 2024, this white paper discusses the transformation of workspaces in terms of their design, construction, management, and user experience. Through the use of inter-connected technology platforms smart buildings can gather data on energy usage making them more efficient and easier to manage when it comes to optimizing operations from security to lighting. Another topic is on a converged IP infrastructure acting as the backbone with the use of Fibre Optic cabling and structured cabling.

IS-2024-119 Smart Buildings -Spring 2024 Edition

Published by Consulting Engineer on April 8, 2024, this eBook discusses the historical development of modern building control systems. It covers a futuristic view of what smart office buildings could look like and function with stronger facility management when it comes to retrofits, lighting and specialty projects for post-secondary university buildings. It also touches on how building control technologies, and open protocols can be integrated into multiple control systems. Offices can significantly reduce their carbon footprint by making everything in their buildings flow together instead of having everything separated.

IS-2024-118 Boosting Smart Office Building Performance with Data-Driven Solutions

Propmodo and Cohesion's report, released on March 18, 2024, examines how integrating workplaces can lead to greater efficiency in building operations. Using software systems to collect data can enhance the management of various real estate portfolios and streamline operations to remain adaptable to a competitive market. Building improvements such as predictive maintenance, lighting optimization and more efficient heating and cooling systems will allow companies to meet their ESG goals and reduce their carbon footprint.

IS-2024-117 A Path to Sustainable Building Operations

Authored and published by Frost & Sullivan on March 18, 2024, this eBook presents the business case for large industries and commercial buildings to incorporate ESG into their facility management plans as part of their sustainability initiatives. It's made plain that to reach their Net Zero targets executives must work to put together a road map and/or action plan on how to get there. The paper speaks of the 6P framework (Policies, Products, Processes, People, Partnerships, and Platforms) that these corporations can use.

IS-2024-116 Are the Great Outdoors the Next Great Office Design

This whitepaper, authored by Ghent and published in February 2023, explores the trend of incorporating outdoor work and meeting spaces into modern office design, highlighting the associated benefits. It highlights how outdoor environments can significantly enhance employee health, well-being, productivity, and overall experience. The paper draws on the biophilia hypothesis, which posits that humans have an inherent tendency to seek connections with nature, leading to reduced stress, improved mood, and increased creativity. The paper provides guidelines for integrating outdoor spaces into building designs and highlights the potential for such spaces to improve employee focus, productivity, and performance. It concludes by underscoring the advantages of outdoor workspaces for students and the broader community, promoting the idea that nature-infused environments contribute to a healthier, happier, and more productive society.

IS-2024-115 Understanding Elevator Communication Code Compliance 2023

Kings III Emergency Communications published a whitepaper in October 2023, providing a thorough guide on the essential role of compliant emergency communication systems in elevators, with a focus on their importance in modern, smart buildings. The whitepaper emphasizes the necessity of adhering to stringent ASME codes to ensure the safety and reliability of elevator emergency communication systems. The paper underscores the role of compliant elevator emergency communication systems in enhancing the safety and efficiency of smart buildings. By integrating advanced communication technologies and adhering to stringent codes, these systems contribute to the overall smart city infrastructure. This ensures that emergency responses are swift and effective, thereby improving the safety and quality of life for urban dwellers. The focus on modern solutions like cellular communication aligns with the broader goals of smart cities to leverage technology for better resource management and enhanced public safety.

IS-2024-114 The Ultimate Guide to IoT

"The Ultimate Guide to IoT" by COM4, released in May 2023, offers a thorough exploration of the Internet of Things (IoT), highlighting its transformative potential and the challenges it presents in creating smarter cars, homes, cities, and industrial sectors. As IoT continues to advance, the guide emphasizes the importance of reliable connectivity, robust security, and

effective data management to ensure the success of IoT solutions. The guide relates directly to smart buildings, homes, and cities by emphasizing IoT's role in creating intelligent environments. It covers applications like smart energy meters, automated refuse collection, and smart traffic systems, all of which contribute to more efficient, responsive, and sustainable urban living. By integrating IoT into these domains, cities can enhance public services, improve quality of life, and achieve significant economic and environmental benefits.

IS-2024-113 The Importance of Superior Indoor Air Quality (IAQ)

WellStat's October 2023 whitepaper highlights the pressing need to improve indoor air quality in urban areas, where nearly 90% of people's time is spent indoors. This paper underscores the multifaceted benefits of improved IAQ, focusing on health, economic, and environmental impacts. Grounded in scientific research, the paper explores how better air quality can foster good health, increase productivity, and drive significant financial savings. The whitepaper emphasizes that prioritizing IAQ in smart buildings, homes, and cities is essential for enhancing health, economic well-being, and environmental sustainability. By investing in superior IAQ technologies, we can ensure healthier living and working environments, drive financial savings, and contribute to a more sustainable future.

IS-2024-112 The Future of Sensors and Older Adults

Authored by Laurie M. Orlov of Aging and Health Technology Watch, this whitepaper examines the expanding role of sensor technology in aiding the aging population as the care workforce continues to shrink. The report delves into how sensors can enhance care delivery, improve the independence of older adults, and integrate with the Internet of Things (IoT) to provide advanced, data-driven insights. As technology advances, sensors are becoming essential in smart homes and smart cities, contributing to better health outcomes and more efficient care systems. The whitepaper underscores the transformative potential of sensor technology in improving the care and independence of older adults. By integrating with IoT and utilizing edge computing, sensors can provide detailed analytics and timely alerts, making them indispensable in smart homes and smart cities. As technology and standards evolve, the widespread adoption of sensors will significantly enhance the quality of life for older adults, making smart living solutions more efficient, affordable, and sustainable.

IS-2024-111 The Future of Heating and Cooling - Heat Pumps

Published in June 2023 by LG HVAC, this report explores the mechanics, types, and benefits of heat pumps, highlighting their role in improving energy efficiency and minimizing environmental impact. It highlights how heat pumps operate, their various configurations, and their significant advantages over traditional heating and cooling systems. The whitepaper underscores the importance of heat pumps as efficient, cost-effective, and environmentally friendly heating and cooling solutions. With technological advancements and support from government policies, heat pumps are poised for widespread adoption, playing a crucial role in the future of smart buildings, homes, and cities. By offering significant energy savings and reducing carbon emissions, heat pumps contribute to a sustainable and comfortable living environment.

IS-2024-110 The Evolution of Heat Pumps

Lennox's September 2023 whitepaper discusses the surge in demand and the technological evolution of heat pumps, underscoring their effectiveness as an energy-efficient choice for homeowners aiming to lower their carbon footprint, even in North America's coldest regions. The whitepaper highlights the increasing popularity of heat pumps, driven by their ability to provide year-round temperature control and significant energy savings. Heat pumps are a key component of smart homes and cities, offering energy-efficient, year-round comfort. As technology continues to advance, these systems will become even more effective and accessible, playing a vital role in the future of residential heating and cooling. With the support of government incentives and educational efforts, the adoption of heat pumps is set to grow, contributing to more sustainable and energy-efficient living environments.

IS-2024-109 The Beauty & Benefits of Biophilic Design in the Built Environment

In September 2023, BUILDINGS Magazine released "For the Love of Nature: The Beauty & Benefits of Biophilic Design in the Built Environment," exploring the significance and advantages of biophilic design in modern architectural practices. Biophilic design is an approach that incorporates natural elements into built environments to foster connections between people and nature, promoting physical and mental well-being. This design strategy is gaining popularity as urban planners and designers recognize its benefits, especially in the context of smart buildings, homes, and cities. The whitepaper explains the core principles of biophilic design, emphasizing the importance of integrating natural elements like plants, natural light, and organic shapes into built environments and highlights research showing that biophilic design can boost overall well-being. By integrating biophilic design principles, smart buildings, homes, and cities can create healthier, more sustainable environments that foster a deeper connection with nature, enhancing the overall quality of life for their inhabitants.

IS-2024-108 Revealing Long-Term Indoor Air Quality Prediction - An Intelligent Informer-Based Approach

Published in September 2023, this report by H. Liang and a team of experts from various organizations, including Broad Air-Conditioning Co., Ltd., examines the critical problem of indoor air pollution and its significant health implications. With individuals spending a considerable amount of time indoors, accurate prediction of indoor air quality is essential. The authors propose a neural network model, leveraging the Informer model integrated with a data-correlation feature extractor based on MLP (Multi-Layer Perceptron), to predict indoor air quality effectively. The report emphasizes the urgent issue of indoor air pollution and proposes am AI-based prediction model. By leveraging advanced AI techniques, this study presents a robust approach to enhancing indoor air quality management, contributing significantly to the development of smart, healthy, and sustainable living environments.

IS-2024-107 Ensuring Safety & Security for Today's Buildings: Practical Guidance for Owners and

Facility Managers

BUILDINGS Magazine's October 2023 publication, "Ensuring Safety & Security for Today's Buildings: Practical Guidance for Owners and Facility Managers," delivers comprehensive advice on modern safety and security practices for commercial properties. The whitepaper addresses the dual aspects of physical and cybersecurity, offering practical advice for facility managers to protect their buildings against a wide range of threats. The whitepaper advocates for a unified approach to physical and cybersecurity, emphasis on SaaS-based access control systems, biometrics, and multifactor authentication, provides ractical steps for facility managers to implement cybersecurity measures, and discusses the use of analytics to derive actionable insights from security data, enhancing operational efficiency and occupant safety. Facility managers are encouraged to adopt these advanced security measures and foster collaboration between departments to ensure the safety and security of their buildings. By leveraging modern technologies and data-driven insights, they can create safer, more efficient, and resilient smart buildings and cities.

IS-2024-106 Installing Efficient Heat Pumps

This whitepaper, published by Eurovent Certita Certification in June 2023, explores heat pump technology in detail, concentrating on market expansion, efficiency improvements, and optimal installation practices. It highlights the significant role of heat pumps in the transition to environmentally sustainable heating solutions and the importance of proper installation and certification to ensure optimal performance. The whitepaper calls for the widespread adoption of efficient heat pumps to meet environmental targets and improve energy performance. It encourages stakeholders, including manufacturers, installers, and policymakers, to support the transition to sustainable heating solutions through proper certification and best practices in installation and maintenance. By embracing these technologies, smart buildings and cities can achieve significant energy savings and contribute to a greener future.

IS-2024-105 Indoor Air Quality and CO2 Monitoring at Schools - Compliance with Legal Obligations

Praxas published this whitepaper in October 2023, emphasizing the essential role of healthy indoor air quality in educational spaces. It provides a comprehensive guide on the legal requirements, technical specifications, and best practices for CO2 monitoring in schools, focusing on the Dutch regulatory framework. The whitepaper concludes with a strong call to action, urging schools to implement regular CO2 monitoring, collaborate with experts for high-quality solutions, develop educational programs on air quality, and continuously adapt strategies based on new insights and technological advancements. By doing so, schools can create a healthier learning environment that complies with legal standards and supports student success.

IS-2024-104 How IoT is Reshaping Facility Management

Akenza.io published this report in May 2023, examining the various responsibilities of facility managers (FMs) in managing the safety, sustainability, and functionality of buildings and

infrastructure. It underscores the importance of modern building automation systems (BAS) and the integration of IoT solutions to meet the increasing demands for energy efficiency, carbon neutrality, and safe environments. The role of facility managers is evolving with the advent of smart building technologies and IoT solutions. By leveraging these advancements, FMs can enhance the sustainability, efficiency, and safety of buildings, contributing significantly to the development of smart homes and cities. The integration of digital tools and data-driven approaches will be essential for future-proofing building operations and achieving broader environmental goals.

IS-2024-103 Heat Pump Services for Hot Water Production in Industrial Processes

Published in October 2023, this whitepaper by BECIS examines the substantial contribution of industrial processes to global CO_2 emissions, primarily due to their dependence on fossil fuels. It explores the adoption of heat pump technology as a sustainable alternative to reduce emissions, improve energy efficiency, and lower operational costs in industrial settings. The adoption of heat pump technology for hot water production in industrial processes presents a sustainable alternative to fossil fuels. When combined with EaaS contracts, it lowers the barriers to adoption and enables industries to advance their sustainability goals. The principles and benefits discussed in this whitepaper can be effectively translated to smart buildings and smart cities, contributing to energy efficiency, reduced emissions, and a more sustainable future.

IS-2024-102 Digital and Sustainable Transformation of Buildings - Increasing Efficiency, Preserving Value

This whitepaper by Siemens AG, published September 2023, addresses the urgent need to reduce energy consumption and improve efficiency within the built environment. Buildings currently account for 40% of global energy consumption and CO_2 emissions, with a significant portion of this impact stemming from building operations. The whitepaper underscores the necessity for a digital and sustainable transformation of buildings to address the intertwined challenges of the energy crisis and climate emergency. By adopting smart technologies and leveraging data, buildings can significantly reduce their environmental impact, improve efficiency, and preserve their value for the future.

IS-2024-101 Best Practices to Keep Facility Management on Track

Yardi Systems released a whitepaper in September 2023 that examines the difficulties facility managers encounter, particularly high turnover and the loss of skilled personnel, leading to disruptions in building operations and increased costs. It highlights the importance of implementing strategies and technologies to streamline operations, bridge the knowledge gap, and efficiently onboard new staff. The paper emphasizes solutions such as advanced facility management software, e-learning programs, and outsourcing maintenance tasks to ensure continuity and optimize performance.

IS-2024-100 Air Pollutant Emissions and Possible Health Effects Associated with Electronic Air

Cleaners

Sponsored by the California Air Resources Board (CARB), this report, authored by Theresa Pistochini, Christopher Cappa, Deborah Bennett, and Francis Offerman, and published in September 2023, examines the emissions and potential health effects of electronic air cleaners, with a focus on how they alter indoor air chemistry. The study highlights that electronic air cleaners can emit reactive compounds such as ozone and formaldehyde, and generate ultrafine particles, which pose significant health risks. The report emphasizes the challenges in quantifying these emissions due to the variability in indoor environments and the complexities of indoor air chemistry. The report provides an overview of various electronic air cleaner technologies, including ion generators, electrostatic precipitators, and ultraviolet germicidal irradiation devices. It discusses the formation of harmful byproducts and the potential adverse health effects of these compounds.

IS-2024-099 Vertical Farming - The Future of Controlled Environment Agriculture and Food-production

Authored by Raja Kumar, Munish Kaundal, and Asma Fayaz from the Chardigarh Group of Colleges and published in December 2023, this report explores vertical farming as an innovative approach to controlled-environment agriculture, designed to tackle challenges like population growth, water scarcity, climate change, and urbanization. The integration of vertical farming into smart buildings promotes efficient land use, reduces dependency on climate conditions, and contributes to the development of green, clean, and healthy urban environments, aligning with the goals of smart city initiatives. This method requires less land and skilled labor, utilizing vertical space to cultivate plants in climate-controlled settings. By 2050, with the world population projected to reach 9.7 billion, vertical farming offers a potential solution to food insecurity by producing higher yields with organic and healthy food. Integrated into urban areas, vertical farming supports sustainable agriculture by using technologies like hydroponics, aeroponics, and aquaponics.

IS-2024-098 Repurposing Buildings for Farming

In October 2023, Becci Taylor and Eike Sindlinger from Arup published the report "Repurposing Buildings for Farming," which delves into how repurposing existing, unused buildings for next-generation agriculture can contribute to the development of smart cities and smart buildings. It highlights the benefits of retrofitting stranded assets for urban farming, such as reducing carbon emissions, regenerating neighborhoods, and providing local employment. By transforming disused structures into vertical farms, cities can enhance food security, reduce food miles, and promote sustainability. The report outlines practical scenarios for repurposing buildings, emphasizing how these initiatives can make urban environments greener and more resilient, aligning with the goals of smart city development. This innovative approach not only revitalizes buildings but also supports local food production, enriching urban communities and contributing to a regenerative future.

IS-2024-097 IoT Guide - Connected Environment

Authored by Matt Hatton from Transforma Insights, the GSMA report published in January 2024 delves into the transformative impact of IoT technologies on environmental sustainability, with a focus on air, water, and food. The report highlights how IoT applications can monitor and manage air quality, optimize water usage through smart meters and distribution networks, and enhance food production via crop and livestock management, vertical farming, and farm automation. These advancements not only address critical human needs but also contribute to reducing CO_2 emissions and improving overall environmental health. The report underscores the importance of IoT in creating smart cities by integrating advanced monitoring and control systems to promote sustainability.

IS-2024-096 A Roadmap to Support Decision-making for Vertical Farming in Canada

Prepared for the Canadian Agri-Food Policy Institute (CAPI) in May 2024, this report by Maria Carolina Romero Pereira, Kushank Bajaj, Luter Atagher, and Melat Adde presents a detailed roadmap to aid in the decision-making process for implementing vertical farming (VF) in Canada. The report highlights VF's potential to contribute to a more sustainable food system by addressing Canada's reliance on imported fruits and vegetables and enhancing supply chain resilience. It discusses the environmental, socio-economic, and trade policy considerations necessary for expanding VF in Canada. Supported by the RBC Foundation through RBC Tech for Nature, the report also underscores VF's relevance to smart cities and smart buildings, as it leverages advanced technologies and promotes sustainability within urban environments.

(IS-2024-095) The Smarter Home - Latest Trends in Smart Home

Published on September 20, 2023, this report from ESA Research highlights the growing adoption of smart home technology by mainstream consumers aiming to solve practical problems affordably. Of these devices, 46% were purchased online, with 64% of consumers choosing Amazon, Google, or Apple as their primary control platform. Additionally, 72% of buyers purchased more than one device last year, with 50% opting for a bundle. Security system owners favor adding cameras, video doorbells, and smart speakers or displays after their initial security system installation. The report also provides selling strategies for security system dealers.

(IS-2024-094) The Smart Building of the Future

The March 22, 2024, report from Johnson Controls outlines a vision of a truly smart building. Building on advancements in connectivity, these structures will harmoniously intertwine with human and environmental ecosystems, fostering sustainability and enhancing experiences. The smart building trifecta includes energy efficiency, electrification, and digitization. Smart buildings prioritize occupant comfort, safety, and well-being by offering adaptive and flexible space options, data-driven sustainability, and operational efficiencies. Unified data, ubiquitous connectivity, and AI-enabled analytics, combined with a digital twin, will enable smart buildings to operate autonomously. The report provides a ten-point strategic framework for developing a smart building.

(IS-2024-093) The Power Play - Uniting Smart Devices for Home Energy Management

Published on November 28, 2023, this report by Jennifer Kent from Parks Associates indicates that 54% to 62% of households believe electricity costs are too high. Smart thermostat adoption is now at 16%, providing behind-the-meter solutions to better understand and control energy usage. While bundled services and connected devices offer energy efficiency with minimal impact on home comfort, the author emphasizes the next step: seamless interoperability between diverse apps, devices, and systems using standardized data formats and structured protocols. The Home Connectivity Alliance and The Matter Initiative are both working towards this goal.

(IS-2024-092) The Future of the Connected Home - The Rise of Home Applications

Authored by Michael Philpott and Mariana Zamoszczyk from OMDIA and published in March 2023, this report presents a survey of 111 broadband service providers across 18 countries, highlighting key points and recommendations. Despite its decline, pay-TV still generates significant revenue for telcos and cable operators, with value differentiation being crucial. Broadband value-added services (VAS) are now considered essential but require continuous investment and updates to evolve. The broadband speed test remains a vital tool for service providers, with 67% of consumer broadband subscriptions delivered over fiber as of 2022. Potential growth areas include application prioritization and Smart Home technologies. The report emphasizes the importance of open-source frameworks and industry standards. This extensive report provides detailed references to these key points.

(IS-2024-091) The Connected Economy

The March 2023 report from PYMNTS examines monthly consumer surveys on digital usage in ten areas: banking, wellness, communication, eating, having fun, living, moving, payment, shopping, and work.The report notes that 47% of consumers participated in digital activities, up from 41% the previous year. The biggest growth was seen in home management, with a 31% increase, or 21 million more consumers. Millennials and Bridge Millennials are the driving force behind this digital growth, with an average of 41 digital activities performed online. Additionally, 39% of consumers engaged in online payments, up from 33% the previous year. This monthly report provides interesting insights into consumer digital behavior.

(IS-2024-090) Towards Net Zero - Blinds, Best Practice Sustainability & Beyond

This white paper, authored and released by Verosol on November 16, 2023, examines the importance of windows in construction, advocating for the installation of proper equipment, such as smart-controlled blinds and curtains, by developers, builders, and architects to maximize natural lighting and reduce thermal energy loss. The construction industry must recognize the impact of using raw materials on embodied carbon levels. Lifecycle assessments for windows should be considered to ensure sustainability. The paper also highlights the option for buildings to obtain certifications from third-party organizations such as Global Green Tag and Green Star.

(IS-2024-089) The Great Divide on the Path to Net Zero

The September 2023 eBook by Siemens explores the significant challenges societies encounter when transitioning infrastructure, especially industrial buildings, to energy efficiency through retrofit designs and decarbonization efforts. Countries worldwide grapple with these monumental tasks, often hindered by imbalanced resource accessibility, differing philosophies, and geographic and political challenges. The eBook emphasizes the need for a clearly communicated global consensus on alignment, standardization, and collaboration to leverage emerging technologies and regulations to collectively move away from fossil fuels. It covers three overlapping spheres: Regional Perspectives, City/Urban Perspectives, and Commercial Industry Perspectives.

(IS-2024-088) Path to Net-Zero - Achieving Zero Emissions

Published on September 20, 2023, this report by Bryalen Fernandes from Alectra examines the conversion of The Green Energy & Technology Centre into an eco-friendly, energy-efficient facility, featuring a fully electric vehicle fleet. The article highlights that Canada currently lacks building code requirements or standards for Net Zero Buildings. It also discusses the carbon footprint of buildings and the importance of considering embodied carbon throughout the lifecycle of building materials, including manufacturing, transportation, installation, maintenance, and disposal, particularly when transitioning away from natural gas. The article emphasizes the need for data post-COVID to inform decisions on technologies like geothermal and solar power, using the Canada Green Buildings strategy as an incentive framework.

(IS-2024-087) Mastering Maintenance - Bridge the Gap Between Theory and Practice With Simulation Training

Authored and published by Interplay Learning in January 2024, this eBook discusses how building maintenance staff and engineers can be better trained using digital technology simulations that cater to different learning modalities. It discusses how information is processed through various human senses and emphasizes the importance of simulation training for real-world experiences, particularly in skilled trades. The simulation allows for a tailored learning approach, which enhances cognitive processing skills.

(IS-2024-086) Making Net Zero Real - Overcoming Inertia in Implementing Your Decarboniztion Glidepath

The December 2023 white paper by Siemens emphasizes the critical need for corporate businesses to create long-term strategies to meet decarbonization targets and achieve net zero emissions. Despite the Paris Accords, many companies struggle to translate their lofty goals into actionable strategies. Guidance is needed to help them meet new regulatory requirements and avoid analysis paralysis. The paper highlights the challenges of upfront costs, such as efficient building infrastructure changes, and the slow pace of change due to market rates, available incentives, and resources like in-house experts to set milestones.

(IS-2024-085) Facility Management and Sustainability - A Fundamental Alliance

Published in June 2023 by Planon and Schneider Electric, this eBook by David Karpook and Sinan Meric addresses how Facility Management can handle sustainability efforts in large-scale commercial buildings through departmental collaboration. It emphasizes the importance of having a Smart Building portfolio plan that targets ESG goals in operations. The eBook covers benchmarks, tools, and technologies for data collection, and provides in-depth discussion on reporting and disclosure requirements. It also addresses sustainable purchasing, highlighting the importance of selecting alternative products with a longer shelf life.

(IS-2024-084) Building Net Zero Homes with Home Management Systems

The November 14, 2023, report by Jennifer Kent from Parks Associates/Nice discusses U.S. residential building management and retrofits, emphasizing automation and envelope (insulation) solutions. It discusses recent government laws and ASHRAE standards, using California as a case study for leading energy policy, and how other U.S. states are beginning their journey into sustainable urban housing construction and development with energy-efficient designs. Consumer demand is strong for saving on energy bills by installing smart appliances, switching to LED lighting, and becoming better educated about how heating and cooling systems affect electrical loads. The report emphasizes the importance of providing easy access to real-time data on household energy consumption.

(IS-2024-083) Efficient Grid-Interactive Buildings

The October 2023 report by Ksenia Petrichenko, Andika Akbar, and Ian Hamilton from the International Energy Agency explores grid-interactive buildings, which optimize energy consumption, promote renewable energy integration, and enhance grid stability through interaction with the energy grid. To achieve net zero emissions by 2050, global energy efficiency improvements need to double to an average of 4% per year by 2030. The report explores how buildings need to be flexible with a grid that features expanding renewable electricity and coordinate with the increased adoption of local energy storage systems and electric vehicles. A framework is provided to assess the readiness of any jurisdiction, considering energy efficiency, decarbonization, smartness, and building-to-grid interactions as key elements of a grid-interactive building. The report describes various strategies that can be implemented and offers extensive guidance on available technology solutions across different regions, with a deeper focus on the ASEAN market.

(IS-2024-082) Driving Action on Embodied Carbon in Buildings

Authored by Tracy Huynh, Laurie Kerr, Chris Magwood, Wes Sullens, and Victor Olgyay from RMI and the U.S. Green Building Council and published in September 2023, this report underscores the importance of calculating and reducing embodied carbon emissions in buildings to combat climate change. Embodied carbon emissions from the U.S. building construction industry are estimated to be up to 370 million tons of CO_2e annually, about 6% of total U.S. greenhouse gas

emissions per year. By understanding the full life cycle of a building's carbon emissions, actions can be taken during design and construction to use less material, re-use existing material, and select materials with lower embodied carbon. The report addresses the perception that lower carbon materials are more expensive and emphasizes the importance of obtaining product environmental data. It also highlights the awareness that embodied carbon emissions may be calculated using different methods.

(IS-2024-081) The Rise of Home Energy Efficiency

Authored by Michael Lotfy Gierges of Schneider Electric and published in March 2024, this report presents findings from a 2023 survey on consumer actions to manage energy usage and costs. Most respondents are reducing energy consumption to control costs as prices have risen, with half willing to sacrifice comfort. The report records various actions taken by consumers to conserve energy. The top four considerations for home improvements are energy efficiency, energy security, cooling, and energy independence. Consumers expect a payback for these improvements within 1-3 years, and 30% also aim to reduce carbon output. While most see large businesses and government as responsible for emissions, they recognize their own role as well. The report describes consumer actions to reduce carbon and achieve net-zero energy consumption, with a preference for smart home devices to reduce energy usage, expecting these devices in new homes and apartments.

(IS-2024-080) LiFi Illuminated - Unleashing the Potential of Light-Based Connectivity

The July 2023 report by LiFi.co offers an overview of LiFi, a technology first developed in 2011. LiFi (Light Fidelity) functions like Wi-Fi as a local network for data distribution and control, but instead of using radio bands for transmission, LiFi utilizes visible, infrared, and ultraviolet light. LiFi modulates the light emitted from a lamp at a high rate, making the changes invisible to humans. The benefits of LiFi include data speeds up to 224 gigabits per second (in lab tests), an uncongested spectrum that is 10,000 times larger than the radio spectrum, enhanced security as signals do not penetrate walls, safety, no interference, and efficiency, especially when using LED lamps. The report describes various applications and discusses limitations in bright outdoor environments and the development of receiving devices.

(IS-2024-079) How to Measure IoT Success

Authored by Beecham Research and published in April 2023, this report discusses measurements of success for Internet-of-Things (IoT) projects. The report categorizes IoT projects across various sectors, including buildings and homes, energy, health, transportation, and retail, among others. It describes several case studies and highlights key technologies such as data processing in the cloud and at the edge, cybersecurity protection, wireless connectivity, and real-time monitoring for critical changes. Future technologies include artificial intelligence, integration of information and operational technology (IT and OT), multi-cloud solutions, IoT platform scaling, advanced security, and predictive maintenance. The report discusses the market benefits of successful IoT projects and includes survey results and examples from companies.

(IS-2024-078) How Can Green Technology Manufacturers Adapt and Thrive in the Energy Transition

The February 2023 report by James Stanley from LCP Delta explores marketing channels designed to target consumers with green technologies. The current marketing strategies by original equipment manufacturers (OEMs) are being disrupted by Future Energy Managers, who offer products and energy services in combined packages. OEMs are advised to adopt this model. Future Energy Managers handle solar panels, storage batteries, and the integration and optimization of appliances, delivering outcomes such as a charged car or a warm house, rather than a specific amount of electricity. The report also discusses companies offering such services in Europe. OEMs are encouraged to be agile and innovative, utilizing technologies such as thermal storage, to better serve customers.

(IS-2024-077) WI-FI 6E 7

Published in March 2023, this report authored by Ambroise Popper and Deepak Joseph of NetNav, and Thomas Block and Ryotaro Sakauchi of Bosch Sensortec, discusses the technical requirements for deploying Wi-Fi 6/7, utilizing the 6 GHz band, compared to older Wi-Fi networks operating in the 2.4 GHz and 5 GHz bands. The 6 GHz band is also used by microwave and satellite communications. The US Federal Communications Commission (FCC) maintains a database containing the altitudes of equipment transmitting in the 6 GHz band, requiring the altitude of Wi-Fi access points to be reported. Two methods for measuring altitude are described: Height Above Terrain and Height Above Ellipsoid (a mathematical model of the Earth). Altitude measurements can be calculated using air pressure measurements from a barometric sensor.

(IS-2024-076) Empowering Homes with Intelligence - An Investigation of Smart Home Technology Adoption and Usage

Released in May 2023, this report by Origin Wireless, Inc. discusses the applications of Wi-Fi in sensing the motion of people and objects. These applications include sleep monitoring, fall detection, gait recognition, gesture control, activities of daily living, lighting control, and energy management. Integrated circuits and equipment are being developed with Wi-Fi sensing capabilities, enabling one sensor to serve multiple services through different analytics. The IEEE is planning a standard to extend Wi-Fi applications to sensing. The report discusses the technical challenges of interpreting the multi-path Wi-Fi signal. Newer Wi-Fi technologies will enable heart-rate monitoring, imaging, and multi-target sensing, raising issues of consumer privacy.

(IS-2024-075) WiFi Can Do More - Towards Ubiquitous Wireless Sensing

Published in November 2023, this report authored by Sara Gøthesen and Moutaz Haddara of Kristiania University College, and Karippur Nanda of SP Jain School of Global Management, studies the potential market for home automation products in Norway, surveying approximately 100 respondents online. The motivations for purchasing smart home technology included enjoyment of the products, perceived value, and social influence from friends and family. The

report also investigated smart home applications for energy management. Hindrances to adoption included security, privacy, and trust issues. Suggestions for marketing home automation in Norway were presented, with a lack of awareness identified as the main barrier to market development.

(IS-2024-074) Are Heat Pumps at the Inflexion Point on a Hockey Stick-Shaped Growth Curve

The July 2023 report by Jon Slowe, Steven Ashurst, Klara Ottosson, Thomas Barquin, Guillermo Yañez, and Nishanth Srinivasa of LCP Delta explores market growth trends in Europe for the installation of heat pumps. Heat pump installations increased by 18% in 2019 and 2020, then surged by 52% in 2021 and 2022. This growth rate can be sustained through 2030 if the following challenges are addressed: expanding the market from new construction to existing houses with gas furnaces, improving and establishing new channels for distributing and installing heat pumps, and ensuring sufficient capacity in the supply chain and the availability of installers. In general, the industry, governments, and the energy sector are meeting these challenges.

(IS-2024-073) A Practical Guide for Migrating Electrical Architectures to the New Energy Landscape

Published in May 2023, this report by Russell Senesa of Schneider Electric summarizes the upcoming changes in power generation and delivery systems in the first half of this century and discusses strategic responses. It highlights the contrast between growing energy consumption and the imperative to conserve and decarbonize. By 2050, electricity is expected to supply 60-70% of energy needs, with two-thirds coming from wind and solar sources. The paper describes the New Energy Landscape, which includes sustainability commitments, demand-side efficiency, government subsidies, lower technology costs, and the development of eco-friendly codes and standards. Autonomous rather than centralized energy management is recommended, and the growing use of direct current within buildings is noted.

(IS-2024-072) The Race To Zero Carbon Requires Smart Buildings

Released in November 2023, this paper by Forrester Consulting, commissioned by Johnson Controls, details the outcomes of a survey conducted in 25 countries about smart building strategies in different organizations. The findings suggest that to address sustainability, leaders are currently focusing their efforts on improving their operations sustainably. The main challenges identified include a lack of system/data integration and internal expertise, which slows progress in reducing carbon emissions. The report concludes that to fill the technical gaps in optimizing building systems and measuring environmental impact, organizations are encouraged to seek technical and strategic partners and create a fully integrated data platform.

(IS-2024-071) The 2023 Battery Investment Landscape

Released in September 2023, this report by LCP Delta discusses the future of battery storage in the UK, underscoring its essential role in decarbonizing the electricity sector and supporting the energy transition. It identifies several lessons that must be learned to maximize storage returns

in more stable markets. The report argues that battery asset owners and investors need to become more sophisticated when entering various markets. Owners should select the best optimizers to manage their assets, while investors should choose the right locations and configurations and set realistic returns expectations. It emphasizes the importance for industry players to understand the environment in which they operate and the challenges associated with future investments.

(IS-2024-070) Smart energy management in residential buildings - the impact of knowledge and behavior

The 2024 scientific paper by Hakawati, B., and others examines the readiness of the residential buildings sector in the West Bank, Palestine, to integrate smart systems for energy management. The article discusses the complex relationship between knowledge, behavior, costs, and environmental sustainability in residential energy management. According to the results, a smart energy consumption management system may help residential buildings move towards a more sustainable future by lowering energy use and improving performance. Additionally, education and awareness programs targeting building residents are identified as key contributions to promoting energy savings, resulting in cost savings and a positive environmental impact.

(IS-2024-069) Ericsson Mobility Report

Published by Ericsson in June 2023, this paper examines and forecasts the evolution of 5G and mobile networks. It argues that 5G is growing rapidly despite challenges posed by current macroeconomic conditions. By examining data traffic patterns across various locations in mobile networks, the paper provides crucial insights for the future evolution of mobile networks. It suggests that high-rise buildings and underground areas often experience signal attenuation. Advanced services and new devices, including augmented reality (AR), virtual reality (VR), and mixed reality, are expected to drive additional traffic growth. Next-generation 5G applications will require new models to rate mobile quality of experience (QoE) to design networks that support future performance demands.

(IS-2024-068) State of Fleet Management Software 2023 Report

The October 20, 2023, report by Volpis provides a detailed analysis of the fleet management software sector, encompassing its current status, emerging trends, challenges, and the repercussions of global crises. The report offers insights into current software technology stacks, the most popular third-party APIs or services, software challenges, applications of artificial intelligence and machine learning, tech trends for the next few years, and the effects of global crises. Volpis is featured as the go-to company for the development of mobile and software applications. The main takeaway is that the global fleet management market is expected to grow to over $52 billion by 2028.

(IS-2024-067) The Video Surveillance Report

Published on November 6, 2023, this report by James Moore of IFSEC Insider summarizes

findings from an international survey involving 556 security and IT professionals. It presents the major trends in the video surveillance industry. These trends include the adoption of artificial intelligence and cloud-based solutions by vendors, the application of video surveillance to solve operational problems and provide additional business intelligence, and the growth of use cases from new verticals. Macroeconomic trends such as rising inflation, geopolitical events, and supply chain issues have impacted the video surveillance industry. The report focuses on the retail, construction, and public sectors to understand how video surveillance is curbing retail losses, enhancing construction site safety, and bolstering public security. The main takeaway is that video surveillance systems will have a central role in smart building and city development.

(IS-2024-066) Smart Building Overlay to the RIBA Plan of Work 2024

Authored by John Adams, Matthew Bott, James Franklin, Nick Hutchinson, and Ciaran Kelly from RIBA, and published on January 29, 2024, this report explores innovative approaches to facilitate smart building technology deployment across various building types within the Royal Institute of British Architects (RIBA) plan of work. Eight stages are outlined that summarize the smart building overlay to the plan of work, including key components such as outcomes, design, manufacturing, spatial coordination, and handover. The report also considers the interplay between technology, sustainability, and the built environment, emphasizing the importance of engaging smart building designers early in the concept design phase. The main takeaway is that overlays to the RIBA plan of work provide crucial supplementary knowledge and advice on specific topics.

(IS-2024-065) Putting a Price on Smart Home Protection

Prepared by F-Secure and published on September 12, 2023, this report presents findings based on a survey of 4,400 respondents from across Europe and the US. The report summarizes how digital security can be leveraged by Internet Service Providers (ISPs) to protect customers, increase revenue, and enhance their brand. An important finding is that the security features of a home gateway/Wi-Fi router have become as important as its communication speed. Consumers expect their ISPs to keep them safe and are willing to pay for cybersecurity protection provided by ISPs. The main takeaway is that a smart approach is required to protect a smart home, and F-Secure's multi-layer security solution offers maximum protection.

(IS-2024-064) Designing Disinfection Systems with UVC LEDs

The July 17, 2023, report by Crystalis explores ultraviolet light-emitting diodes (LEDs) emitting light between 200nm and 280nm ('UVC'), emphasizing their superiority over mercury bulbs for disinfection purposes. The two most important advantages include better power output and longer lifespan. When designing innovative UVC solutions, consideration must be given to the target microbe, disinfection requirements, and thermal management system. The main takeaway is that designers need to carefully consider LEDs beyond the specification sheets, as LEDs that appear less than ideal on paper could lead to simpler and more cost-effective solutions.

(IS-2024-063) Clinical Trials Moving From Site to Home - Lessons Learned From Digital Health Technologies

The September 14, 2023, report by Tapan Raval and Tracey Smith from IQVIA explores how the rise of smart, wearable, and connected devices has facilitated effective clinical trials conducted in the convenience of patients' homes. The report highlights the importance of data aggregation, innovation in Software as a Medical Device (SaMD), and easing patient burden. IQVIA's clinical eSource platform is featured for its workflow automation capabilities. The main takeaway is that successfully moving clinical trials from the site to the home requires integrating subject matter expertise in digital biomarkers, digital endpoints, SaMDs, and end-to-end technical capabilities.

(IS-2024-062) A Modeling Approach to Estimating Handprint Impacts - Applications in Grid Management and Fleet EV Charging

Published on September 14, 2023, this report by Andrew Hoffmeister, Pavitra Srinivasan, Avi Mersky, and Ethan Taylor of ACEEE investigates a modeling approach that seeks to refine carbon emissions calculations. The approach involves the application of information and communication technology (ICT) and calculations based on the net positive carbon handprint methodology. A positive carbon handprint accounts for emissions reductions across a product's life cycle. Two use cases are considered: management of electric grids and electric vehicles. The proposed model can also be applied to other use cases. The main takeaway is that handprints provide a more comprehensive understanding of carbon emissions and represent an important step toward more accurate attribution.

(IS-2024-061) The State of 'Security by Design'

The February 13, 2024, report by Brivo discusses survey findings from 800 decision-makers in the architecture or engineering fields, focusing on the importance of security in the design and build process. The findings indicate discrepancies in how architects and engineers perceive the importance of building security and how they implement it. Fortunately, trends show that integrated building security is increasingly being included in the scope of building projects, contributing to increased project costs. The report features Brivo's cloud-based access control and smart spaces technology. The main takeaway is that building security cannot be an afterthought; it must be integrated into the architectural and engineering design processes from the start to be effective.

(IS-2024-060) The State of Vulnerability Disclosure Policy (VDP) Usage in Global Consumer IoT in 2023

Published on November 1, 2023, this report by Rohan Panesar, Mark Neve, and David Rogers of Copper Horse analyzes the implementation of vulnerability disclosure by manufacturers of widely used consumer Internet of Things (IoT) devices, assessing their commitment to best practices in IoT security. Vulnerability disclosure is defined as "the process of identifying, reporting, and patching weaknesses in software, hardware, or services that can be exploited."

The main finding is that 95% of new manufacturers did not engage in vulnerability disclosure. Furthermore, manufacturers of TV, Wi-Fi, networking, and mobile devices had better vulnerability disclosures than those of wearables for leisure, hobbies, health, and fitness. The main takeaway is that changing legal requirements, especially in the UK, will require manufacturers to have vulnerability disclosures.

(IS-2024-059) Why Fire Safety Works Better When it's Digital

Published on August 22, 2023, this report by Honeywell explores the advantages of digitalized life safety systems in buildings, emphasizing enhanced reliability, operational streamlining, and reduced compliance expenses. It features Honeywell's approach to integrated digital safety systems for buildings called Connected Life Safety Services (CLSS). The benefits of CLSS include easier installation and commissioning, automated compliance testing and reporting, remote monitoring, and cybersecurity. The main takeaway is that the total cost of ownership for a digital life safety system is manageable using the CLSS system.

(IS-2024-058) How to prevent IAQ from impacting learning in schools

This report, authored by Johnson Controls and released on January 30, 2023, addresses the importance of indoor air quality in schools and the threats posed by airborne infections." The report highlights respiratory dangers due to volatile organic compounds, inorganic gases, contaminants from exhaled carbon dioxide, dust, and pollen. Benefits of improved air quality in schools include enhanced academic performance, better student attendance, improved cognitive function, and decreased respiratory symptoms. The proposed solution involves using smart building technologies to improve air quality, with Johnson Controls featured as a solution provider. The main takeaway is that improved indoor air quality offers significant health benefits for students and school staff.

(IS-2024-057) 2023 Midyear Market Health Report

Prepared by D-Tools and published on September 14, 2023, this report provides a comprehensive market overview of smart home systems integration projects in 2023. A key observation is that the number of projects remained relatively unchanged compared to the previous year, while the average size of projects decreased by over 5% in the first half of 2023. The top five installation categories included electrical, lighting, loudspeakers, access control, and networking. It is recommended that integrators continue to generate more proposals and focus on increasing the size of proposals. The main takeaway is that integrators need to find their niche and have an opportunity to increase labor costs per proposal.

(IS-2024-056) Optical LAN Advances Smart Buildings Internet of Things' Scalability, Security and Sustainability

The November 4, 2023, report by Apolan discusses the benefits of optical LAN networks (OLANs), emphasizing their role in advancing computer networks with enhanced scalability, security, and sustainability. The report explores the transformative potential of OLANs for the Internet of

Things (IoT) ecosystem, including smart buildings. Key features of OLANs include the extensive use of fiber-optic technology, software-defined management, and innovative powering methods. The main takeaway is that OLANs provide a viable migration solution for the modernization of enterprise-wide computer networks.

(IS-2024-055) Matter for CE Product Manufacturers

Prepared by Bill Curtis from Moor Insights & Strategy and published on December 21, 2023, this report provides a top-down analysis of the smart home device connectivity standard Matter, focusing on its transformative effects on consumer electronics (CE) product strategy. Matter offers unified connectivity for different devices, maximizing the total available market and simplifying product design and development for CE manufacturers. As an integrated standard built into hundreds of millions of devices, Matter supports the integration of artificial intelligence solutions. It also enables autonomous home operations by supporting energy management, security, safety, HVAC optimization, and health and wellness. The main takeaway is that Matter makes CE products easier to build, buy, and use, while helping to grow the smart home ecosystem.

(IS-2024-054) Improved Air Quality for a Healthier Environment

Published on October 23, 2023, this report by Ebtron discusses a case study featuring Florida Community College, where thermal dispersion airflow measuring stations were installed to protect the health of students and staff. The airflow system supports a balance of comfort and productivity while enabling the maintenance staff to accurately measure air quality. The report features Ebtron's airflow stations, which have successfully achieved the desired indoor air quality and energy savings. These stations provide easy access to real-time data via a BACnet integrated Building Management System or Ebtron's custom app. The main takeaway is that Ebtron's airflow stations are reliable, provide accurate readings, and require minimal maintenance.

(IS-2024-053) EV Driver Survey Report 2023

Prepared by Florian Glattes from Shell and published on June 21, 2023, this report presents survey results from over 24,000 electric vehicle (EV) drivers in Europe, examining current trends and behaviors shaping EV experiences. One important trend is the record-breaking growth in global EV sales over the past year. Despite this growth, there are challenges for sustained EV adoption, including charging infrastructure and the economic climate faced by both businesses and consumers. There is an opportunity for charging and technology providers to enhance the charging experience by offering smarter and more seamless solutions. The main takeaway is that the pace of EV adoption is accelerating, and consumer confidence is growing.

(IS-2024-052) Data-driven decision-making in the Data Center - from energy efficiency to predictive maintenance

The August 25, 2023, report by Paessler Monitoring Experts explores predictive maintenance in data centers, highlighting its capability to enhance control and performance. The report outlines

a strategy to optimize energy efficiency in data centers by leveraging an enterprise-wide monitoring system. Additionally, it emphasizes the importance of IT service availability and zero downtime. Predictive maintenance is positioned as a critical activity to support the continuous and efficient operation of data centers. Paessler's data center monitoring services are promoted as a viable solution for predictive maintenance. The main takeaway is that predictive maintenance can help organizations maintain reliable data center operations and minimize financial losses.

(IS-2024-051) Smart Premise, Smart Experts

Published on January 18, 2024, this report by Stephanie Atkinson of Compass Intelligence addresses the challenges that must be tackled for the successful implementation of Internet of Things (IoT) projects. The key challenge identified is the assignment of unskilled professionals to the project. To overcome this challenge, a knowledgeable, reliable, reputable, and highly experienced installation team is required. The report presents ICAS as a solution, an organization that manages end-to-end smart premise installations to enable and optimize business digital transformation. The main takeaway is that selecting a business partner with the right people is critical to meeting expected outcomes and achieving a successful project implementation.

(IS-2024-050) Matter - Making Smart Homes More Secure

Prepared by Bill Curtis from Moor Insights & Strategy and published on June 6, 2023, this report addresses the security and privacy issues of the Matter connectivity standard, which enables interoperability between different Internet of Things (IoT) devices in a smart home. The report discusses the security aspects of Matter product design, manufacturing, and deployment, as well as the practicality of building secure Matter products. A use case with NXP Semiconductors is presented to demonstrate how Matter-enabled technology makes product development fast and efficient. The main takeaway is that smart home device makers should have solid Matter migration plans, and consumers should prioritize Matter devices when shopping for new products.

(IS-2024-049) Matter - A Cybersecurity Perspective

Authored by Guillaume Crinon from Kefactor and published on June 22, 2023, this report examines the history of device communication, with a particular emphasis on the Matter communication standard for the smart home market. In addition to Matter, other security considerations and industry standards are discussed, including secure boot, access control, and standards 802.1AR and ETSI EN 303 645. Matter security relies on certificates, digital identities, and signed code, which are challenging for vendors to implement. Keyfactor proposes their proprietary solution to address these implementation challenges. The main takeaway is that Matter promises seamless integration across brands and products in a smart home.

(IS-2024-048) Estimating the Handprints of Network Technologies to Make Informed Business Decisions

Published on September 14, 2023, this report by Lyla Fadali, Jonah Eisen, and Nora Wang Esram from ACEEE discusses the potential of innovative Information & Communication Technology (ICT) solutions to create a large positive handprint. A beneficial handprint is defined as a solution that has a lower carbon footprint than the baseline solution. The report highlights ICT networks that can create positive footprint effects when supported by proper technology and policy implementations focused on efficiency. It includes emissions calculations and attributed handprint savings. The main takeaway is that ICT solutions have enormous potential to reduce greenhouse gas emissions.

(IS-2024-047) Wi-Fi HaLow for IoT

The January 19, 2024, report by the Wireless Broadband Alliance examines the networking technology implementations of Wi-Fi HaLow, based on the IEEE 802.11ah communication standard. The report discusses a plan for deploying Wi-Fi HaLow in Internet of Things (IoT) applications by leveraging the strengths of Wi-Fi without relying on proprietary or non-Internet Protocol (IP) technologies. The benefits of Wi-Fi HaLow include improved security, better battery life, communication through walls, and support for a greater number of devices. The report includes use cases that demonstrate the benefits of Wi-Fi HaLow for service providers, device-makers, and end users. The main takeaway is that Wi-Fi HaLow will enable new IoT products and services to be planned and deployed with greater confidence.

(IS-2024-046) Smart Home IoT Devices Require Secure Network Architecture

Authored by Jonathan Collins from ABI Research and released on June 12, 2023, this report delves into the expansion of the smart home market and the progression of its applications, such as healthcare, mobility, security, energy management, and appliances. Consumer trust and the need for security continue to underpin future growth. Device interoperability standards such as Matter and the low-power, low-bandwidth mesh networking protocol, Thread, are noted as essential for creating a secure environment. Equally important is the deployment of digital certificates for devices and associated management platforms. The main takeaway is that the identity of smart home devices will play a key role in enabling a secure system.

(IS-2024-045) Multi-Residential Access Management and Security - The Move to Digital

David Moser's report for Assa Abloy, released on November 28, 2023, focuses on access control measures that can create secure living environments for tenants in buildings with multiple units and shared hallways or stairwells. Considered locations for access control include communal entrances used by residents, visitors, maintenance staff, and couriers, as well as communal amenities such as gyms and laundry rooms, and individual residences. The report proposes an electronic (digital) access strategy, which offers benefits such as increased security, remote management, and convenience. The main takeaway is that connectivity and compatibility will drive the advancement of building access solutions.

(IS-2024-044) It's Crunch-Time for Commercial Real Estate Owners - Why Smart, Healthy,

Sustainable Buildings Matter

Johnson Controls' report, released on October 2, 2023, examines the challenges confronting commercial real estate (CRE) owners and offers a strategy to address these issues. The main challenges include loss of revenue due to a declining tenant population, regulatory requirements, and social demand for workspaces that promote health and well-being. The proposed strategy involves adopting a smart building approach that includes a building automation system (BAS), cloud-based Internet of Things (IoT) sensors, and an open application programming interface (API) platform. The main takeaway is that CRE owners need to invest in creating smart and sustainable buildings to achieve long-term economic and regulatory benefits and meet tenant requirements.

(IS-2024-043) Innovation in Action - Developing the Future of Smart Connectivity

Published on May 19, 2023, this report by British Telecommunications discusses the future of the smart home market, noting its projected growth due to improved flexibility and interaction among vendors and smart home technologies. The main enabler of this transformation is the specification standard, Matter, which provides interoperability of smart devices. Key features of Matter include operation in a multi-network environment, multi-administrative control, and cross-compatibility among devices. Additional drivers of smart home market growth include user-friendly products, task automation, hardware affordability, and service bundles. The main takeaway is that sustained growth relies heavily on the wider adoption of the Matter standard.

(IS-2024-042) How NFC Can Enhance Smart Home Experiences

ST Microelectronics' report, released on February 17, 2023, examines the use of near field communication (NFC) technology in smart homes. A key feature of NFC is its standardization, which makes it easy to deploy. An important application of NFC is the commissioning of new devices on a network, which requires identification and authentication. The report highlights ST Microelectronics' tags that can be used for NFC commissioning, as well as NFC use cases in parameter settings, firmware upgrades, pairing, diagnostics, and data backup. The main takeaway is that NFC plays a central role in making smart homes easier to operate.

(IS-2024-041) Connectivity for a Smarter, Better World

The October 18, 2023, report by Tsedeniya Abraham, Marian Kost, Ahmed Salem, and Roland Sperlich from Texas Instruments (TI) explores wired and wireless connectivity options for smart homes, buildings, factories, electric grids, and vehicles, highlighting their simplicity, scalability, security, and efficiency. Texas Instruments is featured as a leader in the connectivity space, participating in the development and deployment of networking standards, interfaces, protocols, and connectivity standards. The main takeaway is that businesses have various options for creating industrial and automotive designs by utilizing a combination of wired and wireless technologies.

(IS-2024-040) State of IoT Adoption Report - What's next for IoT?

Authored by Nick Earle from Eseye and published on September 27, 2023, this report presents survey results from over 1,000 senior decision-makers in the UK and US with IoT projects in electric vehicle charging and smart grid, healthcare and medical devices, manufacturing, supply chain and logistics, and smart vending. The key finding is that only 1% of businesses had achieved more than 98% average connectivity levels across their device estates. Device design has also been identified as an important element for successful IoT project deployment. The main takeaway is that reliable connectivity is essential for IoT systems and should not be compromised.

(IS-2024-039) Smart Spaces - IoT-Led Smart Building Transformation

The July 10, 2023, report by Sivapreeta Jayachandran from LTIMindtree explores how the Internet of Things (IoT) can be leveraged to modernize building operations. It introduces LTIMindtree's holistic smart building system as a strategy to achieve operational goals. The system is based on a three-tier architecture that includes edge, cloud, and enterprise layers. The benefits of deploying the LTIMindtree system include cost savings and improved management of energy, water, space, air quality, lighting, and security. The main takeaway is that a building's digital infrastructure is as important as its physical infrastructure.

(IS-2024-038) IoT for Development - Use Cases Delivering Impact

Published on April 24, 2023, this report by James Joiner, Christina Patsioura, Sayali Borole, and Zach Whiteby from GSMA examines the network connectivity landscape and significant IoT use cases in low- and middle-income countries (LMICs) in Sub-Saharan Africa, and South and Southeast Asia. The number of IoT devices is anticipated to reach 37 billion by 2023, with development potential in industries such as transportation, agriculture, environment, health, utilities, and humanitarian relief. Collaboration across the IoT ecosystem has been identified as essential to sustaining the projected growth. The main takeaway is that IoT can improve existing services and develop new ones.

(IS-2024-037) Five Guiding Tenets for IoT Security

Keyfactor's report, released on March 1, 2023, focuses on strategies to enhance the security of Internet of Things (IoT) devices. It emphasizes the importance of building a solid security foundation across the IoT ecosystem. Key elements of such a foundation include unique credentials for each device, private key storage, digitally signed firmware, organization-specific Root of Trust (RoT), and certificate management. The main takeaway is that as the number of IoT devices grows, so do the associated security threats, necessitating ongoing security measures.

(IS-2024-036) The Economy of Things - Unlocking the True Value of IoT Data

The May 22, 2023, report by Henry Osborne from STL Partners delves into the Economy of Things (EoT), a new method for data sharing across Internet of Things (IoT) ecosystems. This data-sharing concept is expected to create new monetization opportunities. The report provides recommendations for enterprises on how to capitalize on EoT, including evaluating business

outcomes, establishing rules for data sharing, developing specific use cases, joining new marketplaces, and redefining the next customer segment. The main takeaway is that EoT will grow and peak within the next few years, with over ten percent of IoT devices expected to be EoT-enabled by 2030.

(IS-2024-035) Internet of Things Trends in 2024

Prepared by Sumatosoft and published in 2024, this white paper addresses the top trends in the Internet of Things (IoT) for 2024. The main trend is the integration of artificial intelligence (AI) into IoT systems. Other trends include the deployment of the 5G communication standard and an increased need for security implementation. Additionally, IoT is being used to create efficient, environmentally friendly solutions. There is also observed growth in the number of connected devices, sensors, and other technologies used to gather, transmit, and analyze health data. The main takeaway is that while IoT presents security and privacy challenges, it also creates opportunities for innovation and business optimization.

(IS-2024-034) Future of Real Estate - Shift to Phygital

The July 19, 2023, report by Saurab Mahajan from Deloitte provides insights from a Canadian national survey of 100 commercial real estate owners and tenant companies, focusing on the leading trends influencing the future of real estate. The report considers tenant expectations and what real estate owners can do to meet those expectations. Findings suggest that tenants are looking for smarter and more sustainable spaces. Real estate owners should consider providing real estate as a service, embracing technology to improve operations, reducing the carbon footprint of buildings, and striving for models that include full building information. The main takeaway is that the real estate market is shifting, and building owners need to respond to tenant expectations.

(IS-2024-033) Cracking The Code - Unleash Your Smart Buildings Strategy With The Power Of Facility Data

Published on February 14, 2024, by Mandy Polacek and Ben Anderson of Forrester Consulting, this report presents findings from a survey of 2,445 smart building leaders across 18 industries and 25 countries, examining their views on sustainability, security, and environmental systems. Findings indicate that less than 10% of the organizations operate smart buildings. Additionally, advanced organizations leverage system integration and tools to better inform leaders. The main takeaway is that business opportunities exist for professionals with strong system integration abilities, knowledge of advanced technology, and user-friendly platforms.

(IS-2024-032) 2024 State of the Industry & Tech Trends to Watch

Arlen Schweiger's report for CE Pro, released on January 18, 2024, delves into the key industry trends for 2024 that will influence custom integration professionals. The trends indicate that revenues earned by integration professionals are split, with two-thirds coming from residential work and one-third from commercial jobs. Additionally, custom integrators are diversifying their

work by pursuing retail, government, and new construction commercial jobs. Areas with the highest anticipated growth include multi-room audio, higher-end control systems, and home networks/information technology. The main takeaway is that the custom integration market is expected to grow by 9.1% in 2024.

(IS-2024-031) Trend Research 2023-2024 - Innovation in a World of Continuous Disruption

Authored by the Innovation Board of GS1 and released on September 8, 2023, this report evaluates and comments on the top trends and technologies driving industry transformations now and in the future. Rapidly increasing in importance are trends such as data privacy, sustainability, and supply chain digitalization. Other significant trends include traceability, empowered consumers and the Metaverse, smart everything, connected things, and personalized healthcare. The main takeaway is that a successful digital transformation requires globally unique identification, a common data language, and a commitment to interoperability and data sharing.

(IS-2024-030) The Ultimate Guide to Home Automation 2024 - Transforming Your Living Space into a Smart Home

The December 27, 2023, report from Insta Automations presents the application of automation to living spaces and covers use cases such as entertainment, heating and cooling, smart lighting, and security. It discusses how automation can transform modern homes and highlights its advantages, including convenience, energy efficiency, security enhancements, and personalized experiences within living environments. Some of the disadvantages of automation are also covered, including installation cost, equipment compatibility, and potential exposure to security threats. The main takeaway is that automation not only simplifies daily routines but also contributes towards creating an eco-friendly future by promoting efficient energy usage.

(IS-2024-029) Tech Trends 2024

Deloitte's latest report, crafted by Aditi Rao, Hannah Bachman, Emma Downey, and Dabashree Mandal and published on December 12, 2023, delves into the emerging technology trends poised to shape 2024. These trends are based on forces of interaction, information, and communication, as well as grounding elements of modernization, technology, cybersecurity, and trust. Growth is projected in augmented and virtual reality, artificial intelligence (AI), and cloud services. Greater emphasis will be placed on software developers' experiences to retain technology talent. Modernization will focus on networks, data centers, and mainframes. The main takeaway is that enterprises need to consider all the forces and grounding elements when building a business strategy, rather than being sidetracked by focusing solely on AI.

(IS-2024-028) Human by Design - How AI Unleashes the Next Level of Human Potential

The January 4, 2024 report, authored by Paul Daugherty, Adam Burden, and Michael Biltz from Accenture, explores the evolution of new technologies becoming more human and their impact on business and people. The reviewed technologies include artificial intelligence (AI) ecosystems,

AI chatbots, spatial computing, machine learning, and electronic-human interfaces. The main benefits for people include enhanced security, mobility, and accessibility. However, a lack of trust remains the biggest hurdle for adoption. The main takeaway is that while innovation continues across all these areas, it is essential for businesses to analyze the entire scope of changes when planning their long-term strategies.

(IS-2024-027) 2024 Year of the Smart Home

This report, authored by Jan Frederik Slijkerman and Diederik Stadig from ING and published on February 1, 2024, presents compelling reasons why 2024 could be the year of the smart home. The rise in sales of affordable semiconductor chips, combined with stable networks and the device interoperability standard, Matter, are all contributing to the projected growth of the smart home industry. Key features of smart homes, such as energy conservation and security, provide additional support for their adoption. The main takeaway is that with the growth of smart homes, telecom providers could become resellers of secure smart home devices and services.

(IS-2024-026) The State of Smart Buildings Software 2024

This report, published in March 2024 by Facilio, is derived from insights gathered from a survey of 180 leaders in the smart buildings industry conducted last year. The comprehensive findings of the report reveal that while a majority of senior professionals express interest in investing in smart building technology, they encounter significant challenges such as the high cost of implementation, lack of interoperability, and difficulty in assessing return on investment (ROI), which hinder their progress. Many find themselves unable to decide among the numerous available point solutions, leading to either becoming overwhelmed by the choices or not initiating the process at all.

(IS-2024-025) The Next Generation of Connected IoT

This paper, published in March 2023 by MIT Technology Review Insights in partnership with Infineon Technologies AG, outlines the current challenges and opportunities in the IoT landscape. It highlights the projected value creation of IoT products and services by 2030, estimated between $5.5 to $12.6 trillion. Despite this potential, IoT solutions face complexities arising from diverse ecosystems and technologies, exacerbated by semiconductor shortages and supply chain disruptions. The paper emphasizes the need for industry collaboration to establish standards facilitating innovative technologies, enhanced connectivity, and AI/ML integration to realize new IoT use cases. Moreover, advancements in lower-power chips for extended battery life and edge computing to reduce bandwidth and latency are expanding market applicability and driving business transformation.

(IS-2024-024) Software Bills of Materials IoT and OT Devices

This report, authored by members of the IoT Security Foundation Supply Chain Working Group and published in February 2023, sheds light on the importance of Software Bill of Materials

(SBOMs) in the realm of IoT security. It underscores the significance of SBOMs by highlighting past vulnerabilities resulting from third-party software elements within IoT devices. Notably, the report emphasizes that a significant portion of an IoT device's source code originates from existing code maintained by third-party providers, necessitating improved risk management practices. In response, the report outlines solutions, including the adoption of standards, processes for sharing SBOMs, and tools for generating and maintaining SBOMs, to address these challenges in the software supply chain.

(IS-2024-023) Solving False Alarms - Bringing New Context for Monitoring

This White Paper, authored by Elizabeth Parks and published by Parks Associates in partnership with Ubity in May 2023, delves into the evolving landscape of the security industry. With advancements in technology and changes in consumer lifestyles, the value proposition of "peace of mind" has become increasingly appealing. The paper highlights the growing importance of providing context and information to monitoring firms, first responders, and users, while also emphasizing the role of automation in streamlining response times. Furthermore, it explores consumer perceptions of events that trigger alerts and alarms, as well as their perceived value, particularly in the context of contract renewals and recommendations to new system owners. Additionally, the paper assesses the impact of the TMA-AVS-01 standard on the security industry and consumers, offering insights into the current state of the security and monitoring market.

(IS-2024-022) Smart Living - Elevating the Resident Experience

This White Paper, authored by Jennifer Kent and published by Parks Associates for Cox Communities in June 2023, sheds light on the evolving landscape of the multifamily market. With high interest rates and a scarcity of housing stock, multifamily properties are experiencing unprecedented demand, leading to increased investment in transformative technologies and connected use cases. The paper underscores the growing importance of internet connectivity in meeting residents' needs and improving internal operations. It explores how builders, property owners, and management firms are deploying broadband and Wi-Fi networks, as well as smart devices, to enhance resident experiences across all property classes. Additionally, the research identifies key consumer segments and their expectations for smart home amenities, emphasizing the significance of always-on broadband connectivity.

(IS-2024-021) Financial Services Firms - The Office Reimagined

This White Paper, authored and published by Metrikus in March 2023, explores how leading firms are utilizing actionable insights to enhance workplace productivity amid the shift towards hybrid work models. With many major firms endorsing a return to the office alongside hybrid options, the paper delves into leveraging real estate data to bolster employee engagement and streamline operational costs. It examines the evolving role of offices for financial services firms, emphasizing the importance of offices as hubs for innovation, collaboration, and learning. Additionally, the report discusses the role of technology and data in supporting a hybrid approach, focusing on space optimization, indoor air quality enhancements, and leveraging workplace data to deliver a seamless experience for employees.

(IS-2024-020) Energy, Security, Automation - Converging into Peace of Mind

This White Paper, authored by Chris White and published by Parks Associates for Alarm.com in March 2023, discusses the evolving landscape of the home energy industry and its implications across various sectors. With rising energy prices, consumers seek cost-saving solutions but face challenges due to low familiarity and slow adoption of smart energy technology. The paper explores the role of technologies such as smart thermostats, plugs, and energy monitoring devices in addressing these challenges. Additionally, it examines consumer perspectives on renewable energy solutions and the convergence of security, home automation, and energy solutions. With increased government funding accelerating change, the report highlights opportunities for smart home manufacturers, security providers, and energy companies to meet evolving consumer needs by offering advanced home services.

(IS-2024-019) Building a Business Case for Digital Signage

This eBook, authored by Propmodo Research in collaboration with TouchSource and published in June 2023, highlights the rising trend of digital signage in commercial real estate. With economic turbulence, buildings are increasingly seeking to attract tenants by creating a community vibe with dynamic and up-to-date information. Digital displays have become more affordable, coupled with cloud-based platforms enabling remote and real-time updates, making digital signage a cost-effective solution. The report provides insights to build a compelling business case for digital signage, offering real ROI examples that demonstrate its ability to enhance the building experience and contribute to the bottom line for both management teams and occupants.

(IS-2024-018) Achieving Energy Transformation - Building a Cyber Resilient Smart Grid

This eBook, authored and published by TXOne Networks in April 2023, sheds light on the energy transformation occurring in smart grid-enabled buildings and those pursuing Net Zero objectives. It emphasizes the need for a cyber-resilient smart grid to address advanced cybersecurity challenges arising from smart grid modernization. The report explores cybersecurity trends, potential risks in the future power grid, and the incorporation of minimum requirements for best practices and deployment strategies to mitigate these challenges. Additionally, it provides a historical overview of cyberattacks in the energy sector, highlights emerging vulnerabilities in contemporary smart grids, and discusses new cybersecurity standards being developed for the Smart Grid. Countermeasures to address Smart Grid Cybersecurity threats are also examined, with recognition that many of these standards are applicable to smart buildings, which are also susceptible to cyber attacks.

(IS-2024-017) Maximizing Business Value - Exploring IoT Possibilities in FM

The eBook, authored and published by Planon in August 2023, explores the increasing adoption of IoT in building management. Driven by the goals of cost reduction, operational digitization, and sustainability enhancement, building managers are embracing IoT technologies. With predictions indicating a significant surge to 29.4 billion IoT devices by 2030, the focus has shifted towards

optimizing an IoT tech stack within the built environment. This optimization forms the core of a comprehensive smart building platform, unlocking the full potential of IoT solutions. The eBook delves into the opportunities IoT offers for facility managers and real estate professionals while addressing the existing challenges and outlining practical implementation strategies for IoT and Digital Twin technology in the built environment. Additionally, it provides examples of IoT applications for energy efficiency, refrigeration, and other business benefits aimed at enhancing occupant comfort, productivity, and well-being.

(IS-2024-016) Lighting and Lighting Controls - Fall 2023 Edition

The eBook, authored by Michael Chow, Tony Staub, Matt Moore, Paul Daniel, Brandon Stanley, and Richard A. Vedvik, and published by Consulting & Specifying Engineer in August 2023, covers various aspects of lighting efficiency beyond just LEDs. It provides a guide for navigating lighting standards and codes, designing human-centric lighting controls, and developing lighting control designs to complement standard lighting practices. The eBook also discusses current trends related to electric vehicles (EVs), photovoltaics (PV), and high-efficiency heat pumps, projecting a significant rise in electrical energy consumption in the United States. With decarbonization becoming a focal point, the eBook explores the adoption of full electrification for large venue facilities, alongside utilizing existing generators and extending service life strategies. Additionally, it highlights the evident value of lighting controls, with many utilities offering incentives for their implementation.

(IS-2024-015) Hospital & HealthCare Facilities - Fall 2023 Edition

The eBook, authored by April Woods, Mike Zorich, Yasmine Mustafa, and David Huey, and published by Consulting & Specifying Engineer for Laird Connectivity in August 2023, covers various topics related to building automation and intelligent communications in healthcare settings. It includes articles discussing hospital ventilation design during COVID-19, Bluetooth deployment in hospital settings, and the benefits of healthcare IoT. These technologies aim to enhance hospital design for resilience, emergency preparedness, and overall occupant health, wellness, and staff retention.

(IS-2024-014) Protect the Connected Home - Home Security Meets Personal Privacy

The November 11, 2023 report, authored by Frank Saldaña and Jennifer Kent from Parks Associates, explores the potential growth of security offerings in addition to existing home security services. To address consumers' data privacy concerns and enhance smart device adoption, the report recommends that home security providers offer device protection and data privacy services to homeowners. A highlighted technology solution is Pocket Geek Home by Assurant. The main takeaway emphasizes that security providers can capitalize on their skills, assets, and service relationships with existing customers to create a new revenue stream.

(IS-2024-013) Meeting Industry Demands Through Technology

The September 8, 2022 report, prepared by Planon, focuses on integrated facilities management

(FM) and explores the role of technology in the evolution of FM services across different markets. The report draws insights from roundtable discussions with experts from North American and Nordic markets, proposing various technology requirements to enhance FM services. Key themes from these discussions include technology features supporting sustainability and energy management, the ability to influence employee workplace experience and workforce efficiency, open application platforms, and hyper-automation.The main takeaway underscores that the selection of technology solutions should be based on added value rather than merely focusing on the lowest cost.

(IS-2024-012) Matter Security - Applying Privacy Fundamentals to Smart Home Devices

The August 1, 2022 report, prepared by Silicon Labs, introduces Matter, an Internet of Things (IoT) connectivity standard designed to provide security, privacy, and device integration. A notable feature of Matter is its status as a global connectivity standard facilitating seamless communication across various IoT devices. Leveraging Internet Protocol technology, Matter enables communication across standards like Wi-Fi, Ethernet, and Thread. The primary takeaway emphasizes that Matter offers a certification process for devices and provides a secure, open-source platform empowering developers to create reliable, low-power solutions for the IoT ecosystem.

(IS-2024-011) Matter Certification - The Value it Brings to IoT Devices

The October 19, 2022 report, authored by Rob Alexander from Silicon Labs, focuses on the certification process of communication devices on Matter's standardized wireless platform. The report highlights how this certification process allows developers to validate their products and services, providing extensive integration opportunities with other Internet of Things (IoT) devices. It emphasizes the significance of Matter certification and the advantages it offers to IoT device developers. The key takeaway underscores that Matter provides a secure, standardized, reliable, and unified solution for communication devices in the IoT ecosystem.

(IS-2024-010) In Depth Analysis of Cyber Threats to Automotive Factories

The April 27, 2023 report, prepared by TxOne Networks, delves into the discussion of various cyber threats faced by automotive factories and presents mitigation strategies. The report addresses inherent risks in the factory environment, outlines consequences of cybersecurity attacks, analyzes automation factories, highlights security incidents in 2022, provides an overview of digital transformation and architectural changes in automotive manufacturing plants, and suggests the implementation of a zero-trust approach for enhanced security. The main takeaway emphasizes that a comprehensive zero-trust cybersecurity solution is imperative to effectively protect automotive factories and secure the supply chain.

(IS-2024-009) Futureproofing Critical Services Against Tomorrows Cyber Threats

The September 21, 2022 report, prepared by TxOne Networks, addresses operational technology (OT) for zero-trust cybersecurity defenses in critical infrastructure (CI) buildings and various

sectors, including manufacturing, finance, communication, information technology, transportation, healthcare, agriculture, water, and emergency systems. The report emphasizes OT zero-trust portable security devices designed to prevent ransomware and other attacks proactively. It incorporates global perspectives on critical infrastructure, highlighting insights from Taiwan and India. The key takeaway underscores the importance of not assuming trust and advocates for continuous verification to ensure the safe and uninterrupted operation of critical infrastructure.

(IS-2024-008) Face Recognition and the Smart Home - Applications, Demand, and Innovation

The May 16, 2023 report, authored by Chris White and Jennifer Kent from Parks Associates, explores the role of face recognition technology in security and personalization. The paper delves into how artificial intelligence (AI) can elevate user convenience and security, mitigating vulnerabilities in the connected home. It examines consumer intentions in purchasing security devices and addresses the regulation of biometric data and data processing strategies. The primary insight emphasizes that security and privacy concerns play a crucial role in influencing brand loyalty, trust, and the revenue growth associated with security products.

(IS-2024-007) Digitalization of the Danish District Heating Sector

The June 7, 2023 report, prepared by State of Green, showcases 18 diverse use cases of digitalization in the Danish district heating sector throughout Denmark. The digitalization initiative focuses on leveraging remotely read heat meters for invoicing, optimizing operations, and enhancing administration for improved customer service. The benefits encompass transitioning to environmentally friendly practices, converting natural gas customers to district heating, optimizing building energy consumption, and achieving cost savings. The central insight underscores that digitalization has the potential to impact the entire value chain, encompassing procurement, production, distribution, consumption, and customer interactions in the district heating sector.

(IS-2024-006) Computational Design for Futuristic Environmentally Adaptive Building Forms and Structures

The August 1, 2023 report, authored by Aref Maksoud, Hayder Basel Al-Beer, Aseel Ali Hussien, Samir Dirar, Emad Mushtaha, and Mohammed Wasim Yahia from the United Arab Emirates University of Sharjah, explores the integration of computational design technologies for the creation of self-learning and adaptable buildings. These buildings adapt by collecting data from the surrounding environment through sensors and adjusting their operation accordingly. The computational model is inspired by the growth process of cellular bone structures, tailored to a specific project site. The key takeaway highlights that the proposed model is highly adaptable and well-suited for the development of smart buildings.

(IS-2024-005) City Data Spaces - A Guide to Building and Operationalizing Data Services

The June 8, 2023 report, prepared by SmartCitiesWorld & FIWARE, serves as a guide to data

spaces for cities, exploring their construction and operationalization. The report identifies real-world use cases and emerging trends in data spaces, providing an in-depth explanation. FIWARE is highlighted as a solution provider in the context of data spaces. The primary insight emphasizes that data spaces have the potential to provide secure data sharing solutions across various verticals within the smart city ecosystem, encompassing areas such as mobility and energy.

(IS-2024-004) Penetration of Refrigerant Leaks into Furniture

The March 2022 paper, published by UL Solutions, outlines the methodology and findings of a comprehensive refrigerant release testing project conducted at UL Solutions laboratories in the US. The study specifically incorporates furniture with significant displacement volume concerning a room's overall volume, including cabinets, drawers, wardrobes, and armoires. The results lead to the conclusion that furniture and structures with hollow interiors have minimal impact on calculating room volume. Furthermore, the observations affirm that refrigerant behaves similarly to other fluids, flowing rapidly in the presence of a pressure differential.

(IS-2024-003) Door Gaps and Natural Ventilation with Adjoining Rooms

The March 2022 paper, published by UL Solutions, investigates the role of door clearance in mitigating refrigerant concentration buildup in spaces experiencing a leak. The study involves a full-scale refrigerant release test with various room tightness configurations to compare gas concentration profiles during and after the release. The research highlights a substantial effect on the amount of refrigerant flowing out of the room due to the clearance under the door. Therefore, the paper concludes that the clearance below the door can serve as a mechanism to reduce the likelihood of refrigerant leaks into adjacent spaces. The findings also underscore the challenges of constructing a tightly sealed room interior.

(IS-2024-002) Building Smart - A Wiser Approach for Building the Smart Self-Storage Facility of Your Dreams

The 2023 report, published by BETCO, outlines an approach to "build smart self-storage facilities." The report aims to dispel the notion that creating smart spaces is merely about installing the latest technology gadgets. It argues that intelligently designed smart self-storage buildings should integrate customized infrastructure strategies tailored to users' needs alongside well-planned technological innovations. This combination offers both enhanced convenience and safety compared to traditional units. The report emphasizes the importance of scalability in preparing facilities for a smart future. In conclusion, the report asserts that a smart environment not only saves owners time and increases revenue but also provides tenants with enhanced convenience and security, leading to heightened customer loyalty and satisfaction.

(IS-2024-001) Barometric Pressure Sensors for Consumer Electronics

The 2023 report, published by Bosch - Sensortec division, provides insights into the application and technological advancements in barometric pressure sensors. The report details the two primary technologies employed, namely capacitive and piezoresistive, and explores their diverse

applications enhancing human health and well-being. These applications range from indoor localization for emergency calls and navigation in GPS dead zones to water level detection and drone navigation. The report argues that due to their low-cost manufacturing, coupled with low power consumption and a wide array of uses, barometric pressure sensors are poised to become an integral part of everyone's daily lives in the future.

(IS-2023-195) Considerations for Planning a Matter Product

The June 14, 2023 report, prepared by Silicon Labs, serves as a strategic guide for decision-makers, product managers, and business owners involved in developing connected smart home devices employing the Matter communication protocol. It focuses on integrating devices within the Internet of Things (IoT) ecosystem using Matter, delving into standard Matter device types, necessary certifications, and managing certificates during contract manufacturing. The primary insight underscores the importance of meticulous planning in mitigating risks, minimizing unforeseen costs, and expediting product development and launch processes within the context of Matter-enabled smart home devices.

(IS-2023-194) Understanding the Path to Certifying Your Matter Devices

The July 14, 2023 report, authored by Rob Alexander from Silicon Lab, focuses on the certification process for Internet of Things (IoT) devices to meet compliance with the Matter communication protocol. It outlines three key components within the certification process: product development, certification at an authorized provider, and application for certification through the Connectivity Standards Alliance (CSA). The report also sheds light on how Silicon Labs can support across this process. The main insight emphasizes that Matter certification ensures device interoperability with other certified Matter products, signifying a guarantee of compatibility within the Matter ecosystem.

(IS-2023-193) The Emergent Industrial Metaverse

The March 27, 2023 report, authored by Cindy Waxer from MIT Technology Review, delves into the rising concept of the industrial metaverse through interviews with technologists, industry analysts, and academics worldwide. It explores the metaverse's emergence, its use cases, future challenges, opportunities, and the potential impacts on businesses and daily life. The report also contemplates the requisites for establishing the industrial metaverse. The primary insight underscores the pivotal role of business agility in enabling organizations to engage with the industrial metaverse. The metaverse relies on foundational technologies such as digital twins, Internet of Things (IoT), artificial intelligence (AI), machine learning, 5G wireless communication, and virtual/augmented reality, emphasizing the need for businesses to adapt and leverage these technologies to participate effectively.

(IS-2023-192) Solving the Complexity of Communicating Between IoT and Devices and the Enterprise

The September 20, 2022 report, authored by Nick Hayes from Ublox, addresses communication

challenges prevalent in the implementation of Internet of Things (IoT) systems. It delves into strategies for overcoming complexities, costs, and availability issues by advocating for solutions built on the industry-standard Message Queuing Telemetry Transport (MQTT) protocol. Additionally, the report explores the advantages of utilizing MQTT for low-power sensor networks (MQTT-SN) within IoT applications. The primary insight highlights MQTT as an advantageous choice for power-constrained systems, as the protocol significantly influences message overhead, directly impacting the energy required for transmission.

(IS-2023-191) Software Stacks for Networking

The August 8, 2023 report, prepared by Plume organization, explores software options for communication service providers (CSPs) in managing customer premises equipment (CPE) devices. It delves into the major software components available and assesses various software development kits (SDKs) that offer pre-integrated solutions. The report offers insights by comparing the advantages and disadvantages of these approaches, enabling CSPs to select a pathway that aligns with their objectives and potential benefits. It emphasizes how the choice of software can significantly impact CSPs, influencing capital and networking costs, as well as networking capabilities.

(IS-2023-190) The Art of the Possible - IoT, Smart Buildings and Digital Twins

The June 7, 2023 report, authored by Service Works Global, details seven steps guiding organizations in their pursuit of establishing smart buildings. The report showcases use cases and examples to demonstrate the attainability of smart building objectives. It emphasizes several critical factors, including the implementation of integrated workplace management systems, building information management models, digitization, integration of real-time data, and the utilization of digital twins. The main takeaway underscores the significance of adopting a continuous and incremental improvement strategy for building owners. This approach allows for gradual infrastructure investments within budget constraints, ensuring sustained progress towards smart building initiatives.

(IS-2023-189) Smart Home IoT Devices Require Network Architecture

The June 12, 2023 report, authored by Jonathan Collins from ABI Research, focuses on security and trust challenges within smart homes. It underscores the necessity for smart home providers to incorporate suitable security technologies like digital certificates and associated management platforms. Additionally, adaptable, automated, and compliant solutions will be crucial for providers to offer. The report emphasizes the importance of adhering to market standards such as Matter to encourage diverse system interoperability and establish trust with customers. The primary takeaway highlights the pivotal role of consumer trust and system security in fostering the growth of the smart home market.

(IS-2023-188) Next-Generation Smart Home - Building for the Future

The April 4, 2023 report, authored by Jennifer Kent from Parks Associates, evaluates the drivers

and market dynamics propelling the smart home industry forward, emphasizing strategies for enticing new buyers to adopt smart home technologies. The report delves into diverse use cases stemming from a wide array of existing solutions, encompassing areas such as aging-in-place solutions, energy management, insurance, and monitoring. The primary insight highlights the necessity for solution providers to adopt a comprehensive approach, offering varied solutions to customers while building trust and focusing on developing for emerging market segments within the smart home landscape.

(IS-2023-187) IoT Cybersecurity For Facilities Professionals in the Smart Built Environment

The March 23, 2023 report, authored by Emma Boakes, Dave Cooke, Nikdokht Ghadiminia, Vitor Jesus, John Moor, Nick Morgan, Rajeev Rege, Sarb Sembhi, Jason Shaw, and James Willison from IoT Security Foundation, offers technical expertise and a comprehensive overview of cybersecurity concerns within the Internet of Things (IoT) in smart buildings. Aimed at facilities professionals in smart buildings, the report provides guidance to fortify defenses against cyber threats. It includes best practices for IoT cybersecurity risk management within a framework, detailing controls and processes necessary to ensure secure operations of IoT systems across a building's lifecycle. The report emphasizes the pivotal role of stakeholder collaboration in effectively managing cybersecurity risks associated with smart buildings.

(IS-2023-186) Artificial Intelligence (AI) in the Building Sector

The November 11, 2022 report, prepared by ABB, delineates challenges and potential solutions in the building and real estate sector concerning decarbonization, energy efficiency, and return on investment (ROI). Highlighting that building construction and operations contribute to 38 percent of global energy-related CO_2 emissions, the report advocates for effective management of these emissions. The report introduces an artificial intelligence (AI) solution, specifically BrainBox AI by ABB, aimed at managing CO_2 emissions. BrainBox AI employs smart technologies to enhance energy efficiency in both new and existing buildings. The key takeaway emphasizes that implementing smart automation in buildings, coupled with AI technology, holds the potential to significantly reduce carbon emissions and lower energy costs.

(IS-2023-185) Unlocking the Potential of Smart Cities

The April 25, 2023 white paper authored by Nick Maynard & Damla Sat, and published by Juniper Research Ltd, explores the potential of smart cities. Juniper Research ranks the top 5 smart cities as Shanghai, New York, Toronto, Seoul, and Shenzhen. This ranking is based on an evaluation encompassing various smart city aspects, including transportation, infrastructure, energy, lighting, city management, technology, and urban connectivity. The report highlights the top 20 smart cities globally, derived from a list of 50 innovative cities. Each of the top 20 cities receives a comprehensive profile detailing its initiatives and anticipated future developments in the realm of smart city advancements.

(IS-2023-184) Solving Multifamily Maintenance Demands with Smart Appliances

The April 25, 2023 report by Kristen Hanich, published by Parks Associates in partnership with GE Appliances, delves into labor shortages' impact on maintenance teams in multi-residential properties. Surveying 100 property owners, managers, and maintenance staff, it unveils challenges in staffing, appliance maintenance, and the evaluation of smart appliance solutions. Key findings reveal about a quarter of property owners/managers facing understaffing and nearly half struggling with hiring and retention issues, impacting timely appliance servicing for tenants. The report advocates smart appliances' potential to improve efficiency and functionality, offering features like maintenance monitoring, automation, and remote control. It also discusses the perceived value of smart appliances for multifamily property owners and the drivers and barriers influencing their adoption.

(IS-2023-183) Reducing Facility Maintenance and Repair Costs with Predictive Maintenance

The October 19, 2022 report, authored and published by ON Point from Buildings IOT, explores Predictive maintenance (PdM) as a valuable addition to facility maintenance. PdM utilizes building data to enhance maintenance and equipment performance accurately. While promising, successful PdM implementation necessitates meticulous planning. The report advises engaging a master system integrator (MSI) to ensure readiness for digital solutions and tackle implementation challenges. Moreover, once the PdM program is operational, maximizing its potential becomes crucial. The report emphasizes leveraging analytics and advanced fault detection and diagnostics (FDD) to gain stakeholder buy-in and demonstrate the program's success. When executed effectively, PdM initiatives can lead to substantial cost savings and operational efficiencies across portfolios.

(IS-2023-182) Mapping Ethical Issues in the Use of Smart Home Health Technologies to Care for Older Persons

The report, authored by Nadine Andrea Felber and others and published by the Institute of Biomedical Ethics, University of Basel on March 29, 2023, delves into Smart home health technologies (SHHTs) for older individuals. It investigates ethical considerations surrounding SHHTs used in caregiving for the elderly. Analyzing 156 articles across various databases, the review identified seven key ethical categories. The findings reveal a lack of adequate ethical consideration in the development and implementation of SHHTs. The report emphasizes the need for meticulous ethical deliberation in deploying such technologies to care for older individuals.

(IS-2023-181) Making Buildings Smart - Leveraging Real-time Insights at the Edge

The comprehensive guide and checklist, released by ONLOGIC on June 15, 2023, offer valuable assistance in navigating the complexities of selecting industrial computers. Recognizing the wide array of differences in terminology, configurations, form factors, and features among industrial computing solutions, the guide aims to aid in making informed decisions when choosing and configuring the most suitable option for specific applications, particularly in managing data for smart buildings. This resource serves as a helpful tool by presenting a series of articles that lay the groundwork for understanding smart buildings. It introduces the concept of smart buildings,

explores their benefits, and explains how real-time insights from the network edge contribute to making buildings smarter and more responsive environments. The guide equips readers with essential knowledge and key questions to consider, facilitating a more informed approach to successful hardware deployment in smart building applications.

(IS-2023-180) Smart Buildings - Spring 2023

The April 2023 eBook, authored by Aaron Askew, Evan Eitemiller, Raymond Szuszkiewicz, April Vacca, Ellen Augst, and featuring roundtable discussions with diverse experts, was released by Consulting & Specifying Engineer. This comprehensive eBook presents a collection of articles that shed light on the instrumental role of smart building systems in enhancing HVAC systems for healthcare and office spaces. The eBook addresses various queries concerning Variable Refrigerant Flow (VRF) systems and their integration with HVAC solutions, providing insights into optimizing these technologies for improved efficiency. It also engages in discussions about the evolving nature of office spaces, accommodating new work styles, and the subsequent impact on building systems. Moreover, the eBook delves into the challenges faced by companies scaling up and establishing their first facilities, offering guidance on navigating the complexities of constructing smart facilities. Through a mix of articles and expert discussions, the eBook aims to illuminate the significance of leveraging smart building systems to create more efficient and adaptable environments in both healthcare and office settings.

(IS-2023-179) Power Shift

The challenges faced by the province of Ontario, Canada, in the context of a $450 billion investment requirement by 2050 and the necessity to emerge as a green-grid center for emission-reducing industries are outlined in a recent report. Projections indicate a strain on the province's electricity grid as early as 2026, potentially leading to shortages by 2030. The June 2023 report discusses the potential conflict between Ontario's consideration of increased gas-fired power generation and the imminent Clean Electricity Regulations. Highlighted within are recommendations for robust policies and incentives focused on energy conservation, leveraging smart technologies that could notably conserve enough electricity to power 3 million homes by the early 2040s. However, the report indicates potential clashes with federal Net Zero targets by 2035. Balancing increasing demand, transitioning to cleaner energy sources, and potential federal regulation conflicts is emphasized as a key challenge for Ontario while strategically investing in energy infrastructure. The report underscores the importance of efforts to delay demand through energy conservation strategies and promote technological solutions to facilitate a smoother transition, cost savings, and the establishment of Ontario as a low-carbon leader.

(IS-2023-178) Lighting & Lighting Controls

The June 2023 eBook, authored by Karen Murphy, David Repair, Scott Garrett, Bianca Jimenez, Rick Baca, and released by Lutron, was published by Consulting & Specifying Engineer. This comprehensive book encompasses a range of articles that delve into diverse lighting technologies, control systems, and the crucial necessity of selecting the right lighting solutions tailored for specific applications. One fundamental approach highlighted in the eBook is the

concept of task-ambient design, which forms the bedrock for efficient lighting designs. Task-ambient design methodology initiates by pinpointing the specific tasks to be performed and determining whether these tasks are confined to particular areas within a room or span across the entire space. Often, tasks that demand higher illumination levels are localized to smaller zones within a room rather than encompassing the entire area. Additionally, the eBook delves into topics such as emergency lighting and the utilization of emergency generators, providing comprehensive insights into ensuring continuous illumination during critical situations.

(IS-2023-177) HVAC-R Summer 2023

This July 2023 eBook discusses a diverse range of topics aimed at expanding your understanding of HVAC systems. Explore insights into regulating HVAC through VRF systems and discern the significance between applied and packaged rooftop units. Gain a deeper comprehension of air physics to better grasp the fundamental principles at play. Additionally, discover the latest trends in HVAC and plumbing within manufacturing and industrial buildings, offering valuable insights into industry advancements. Moreover, this eBook ventures into the realm of sustainable refrigeration systems specifically tailored for grocery stores, presenting innovative solutions. Unveil these topics and more across the 79 pages of this comprehensive eBook, providing a wealth of knowledge and insights to enhance your understanding of HVAC systems and related areas.

(IS-2023-176) HVAC-R Spring 2023

The April 2023 eBook, authored by Jeremy Barrette, Randy Simmons, Ionel Petrus, Aaron Askew, Evan Eitemiller, Craig Phillips, and other contributors from partnering companies, and published by Consulting & Specifying Engineer, presents a compilation of articles focusing on diverse HVAC technologies tailored to address the contemporary challenges related to creating healthier buildings. The eBook delves into the evolving landscape of healthcare designs post-COVID, highlighting the transformations aimed at enhancing the well-being of both patients and employees while prioritizing indoor air quality concerns. Additionally, it encompasses a dedicated chapter on building automation. Each article within the eBook offers in-depth insights, showcasing how intelligent HVAC systems play a pivotal role in fostering healthier and more sustainable building environments. These articles collectively underline the significance of leveraging smart HVAC solutions to contribute to the creation of spaces that promote health and sustainability.

(IS-2023-175) High Rise, Low Carbon

The May 28, 2023, White Paper, authored by John Stackhouse and Luigi Ferrara for the RBC Climate Action Institute, delineates the economic prospects associated with constructing new homes sustainably. It envisions Canada leading the charge into a greener era characterized by innovative building materials, intelligent building systems, and the swift adoption of low-carbon heating and cooling technologies. Acknowledging the broader scope, the paper emphasizes the necessity of establishing new supply chains, nurturing skilled workforces, and notably, fostering a retrofit economy to facilitate this transition. The paper serves as a guiding resource, aiming to

enlighten and motivate Canadians to recognize both the pressing urgency and the burgeoning opportunities that accompany the movement towards more sustainable buildings. It encourages stakeholders to embrace the imperative for sustainable construction while highlighting the promising prospects inherent in this shift.

(IS-2023-173) Decarbonizing the Built World - A Call to Action

The March 7, 2023, White Paper, authored by John Turner, Beth Eckenrode, Todd Lukesh, Don McLean, Anil Sawhney, and Craig Stevenson for the Digital Twin Consortium, sheds light on a critical issue: the significant energy consumption and depletion of natural resources attributed to the built environment. Despite well-documented evidence by Science-Based Target Initiatives and global climate scientists, the extensive network of stakeholders involved in the building lifecycle—ranging from financiers, risk auditors, developers, owners, operators, builders, city planners, technicians, trade partners, to suppliers—has yet to collectively acknowledge and actively reduce their combined negative environmental impact. The paper aims to guide building owners and their associated stakeholders in tackling this challenge through the implementation of performance-based digital twins. It delineates how the application of these digital twins can play a pivotal role in addressing the environmental concerns associated with the built environment.

(IS-2023-172) Buildings of the Future Are Powered by Technology

The White Paper released by Essensys on June 26, 2023, discusses how software and technology facilitate building owners in providing flexible working spaces. It explains the concept of co-working spaces, where employees from different companies share workspace. The paper acknowledges the influence of the COVID-19 pandemic on accelerating trends like digitalization, flexibility, and sustainability in the real estate industry, continuing to shape future strategies. It notes the increasing adoption of flexible workspace due to economic pressures faced by both startups and larger companies, prompting a reevaluation of fixed costs such as office spaces to enhance savings or redirect investments into crucial business areas. This shift has implications for the wider office industry, posing challenges in maintaining occupancy rates and devising compelling offerings amid growing competition. The paper illustrates these insights with case studies demonstrating the costs and benefits associated with embracing flexible workspace models.

(IS-2023-170) OT Zero Trust Boosts Healthcare Cybersecurity

This report was authored by TXOne Networks and published in November 2022. It discusses methods for cybersecurity protection of devices in hospitals when they are part of an OT (Operations Technology) network. The first imperative is to separate OT from IT (Information Technology) networks. As noted, IT anti-malware was not designed to protect medical equipment. A challenge is to update older equipment with outdated software that may be too old to upgrade. Methods are being developed to determine which devices can be trusted on an OT network, which devices can be locked down to prevent infection, and which devices need to be cleaned of malware. The security of remote patient monitoring equipment for telemedicine needs to be

checked. Cybersecurity threats are summarized in this paper as are OT zero-trust cyber defenses.

(IS-2023-169) Data Privacy and Security in the Connected Home

This report was authored by Kristen Hanich from Parks Associates and published in May 2023. It presents consumer concerns for the privacy of their data from actions both by criminal and technology companies. The average number of connected devices in broadband households is now about 16. Among these are "headless IoT devices": devices that connect to the Internet without a user interface. The makers of such devices each have a unique policy on data collection and privacy. Half of surveyed consumers reported a privacy or security issue in the past year. Those who own multiple devices and are tech-savvy or have experienced identity theft are the most concerned. Companies that address these issues may benefit from increased sales. Consumers want control over their data and a fearful of AI (artificial intelligence).

(IS-2023-168) Cellular Technology Evolution for IoT Applications in the 5G Era

This report was authored by Sabrina Bochen and Sylvia Lu from u-blox AG, a Swiss company, and published in January 2023. It introduces a new performance standard for the cellular industry deploying the fifth-generation technology called 5G. This paper focuses on communications with IoT (Internet of Things) devices such as sensors using 5G. Most of the standards development for 5G has been on high-speed and low-latency applications. A new standard with reduced performance and cost is being developed for IoT applications. This standard is a product of 3GPP (3rd Generation Partnership Project), a consortium of telecommunication standards organizations. The IoT standard is called 5G Reduced Capability (RedCap). Conforming products may be available in 2024.

(IS-2023-167) Untapped - The Home Tech Evolution

The 2023 report, a result of consumer research commissioned by Samsung, underscores the potential of smart home technology in enhancing people's lives. It delves into the drivers, benefits, and various applications tailored to meet the diverse needs and expectations of different user demographics. Highlighting the continuous evolution of connected living, the report asserts that it holds unprecedented promise in improving individuals' quality of life. Anticipating a surge in demand, the report predicts an increased interest in health and wellbeing apps, smart energy solutions, cooking technologies, as well as smart home innovations catering to older adults and individuals with physical or sensory disabilities. While current smart home devices and digital assistants are controllable via voice commands, the report envisions the future integration of facial recognition and other biometric technologies, setting the stage for new and advanced design possibilities in the years ahead.

(IS-2023-166) The Welcoming Workplace

The 2023 report by Brivo challenges the conventional notion of the office as a mere workspace, acknowledging the shifting dynamics of a modern workforce in a post-pandemic world. It delves into the evolving interactions between occupants and buildings, presenting methods intertwined

with technological advancements to augment these interactions. The report culminates by asserting that cultivating a more inviting experience within office spaces can yield operational savings by curbing utility and labor expenses, while also unlocking new revenue streams for the building. Additionally, it highlights the market attractiveness of office spaces that prioritize a more productive and health-oriented work environment, catering to corporations seeking such conducive settings for their employees.

(IS-2023-165) Gating Access - Challenges in Multifamily Properties

The 2023 report authored by Hanich, K and published by Parks Associates delves into the adoption of access control technology within multifamily properties. It furnishes a comprehensive overview of the current landscape of access control adoption in the US multifamily housing market. The report extensively compares the advantages and considerations between retrofitting existing properties and integrating solutions into new construction projects. It encompasses detailed use cases, deployment models, and recommended best practices in this domain. Emphasizing the growing prevalence of access control applications and features in multi-dwelling properties, the report underscores their transformative impact on residents' lives. Additionally, it advocates for the exploration of alternative technologies, such as cellular solutions or IoT-specific networks, to circumvent the extensive retrofitting requirements often associated with Wi-Fi deployments in this context.

(IS-2023-164) Enhancing Building Health Moving Beyond HVAC

The September 2022 report by R-Zero Systems Inc. addresses the pressing need for enhanced indoor air quality (IAQ) management amid persistent concerns about respiratory viruses post-pandemic and the associated challenges faced by organizations in meeting these new ventilation requirements. It elucidates why most Heating Ventilation Air Conditioning (HVAC) systems were not originally designed to comply with the updated IAQ standards and why existing HVAC upgrades often fall short. Introducing a proven and cost-effective technology known as upper-room ultraviolet germicidal irradiation (UR-UVGI), the report highlights its capability to meet the standards at a fraction of the cost. Notably, several agencies, including the US EPA and ASHRAE, have recommended the adoption of this technology for effective IAQ management.

(IS-2023-163) The Journey to Sustainable Buildings

Published in 2022 by Planon, this article presents the findings of a survey conducted among over six hundred real estate investors in Europe and the US, aiming to delve into their Environmental, Social, and Governance (ESG) best practices. The survey sought to comprehend the stage of their ESG journey, identify emerging issues, and forecast future trends. The article concludes that although technology, particularly ESG-related software, has yet to dominate, it plays a pivotal role in realizing the benefits concerning transparency in monitoring and reporting a company's ESG outcomes. Notably, certifications such as BREEAM, Energy Star, and LEED emerged as preferred choices for energy-focused building certifications. Furthermore, the article highlights that while commitments, targets, and action plans are underway, the absence of a governance plan poses a common obstacle in this domain.

(IS-2023-162) The Future of Electric Vehicle Charging

Published in 2022 by the Telenor Group, this article provides a comprehensive overview of the Electric Vehicle (EV) market across Europe. It outlines the escalating demand for charging point installations, noting the entrance of automotive supply chain companies, battery providers, and real estate businesses into this expanding market. While acknowledging the presence of technical, regulatory, and economic hurdles impeding the widespread adoption of EV charging stations, the article emphasizes the role of IoT connectivity as a fundamental catalyst. This connectivity offers diverse value propositions to charging point operators, car manufacturers, and EV users. Conclusively, the article suggests that fostering a burgeoning ecosystem around electric vehicles will necessitate robust 4G and 5G cellular connectivity at charging points as the market progresses.

(IS-2023-161) How the digitalization of the built environment will increase sustainability impact

Published in 2022 and co-authored by Knops, J. & Ankerstjerne, P. of Planon, this article deliberates on the pivotal role of digital transformation within the Real Estate and Facility Management sector. It contends that technological advancements, accelerated by the COVID-19 pandemic, have led to rapid evolution within this market. The pandemic notably amplified the adoption of self-service protocols among residents, employing digital procedures and user-friendly mobile applications. Businesses are increasingly inclined to leverage the Internet of Things (IoT) to augment value and imbue their facilities with "smart" capabilities, utilizing cutting-edge technologies available from a diverse array of vendors catering to various applications. The article culminates in highlighting the emergence of Integrated Workplace Management Systems (IWMS) as the new connecting platform encompassing all building-related property technologies and building management systems.

(IS-2023-160) Explore Denmark's Journey to Decarbonise and Energy Optimise its Buildings

Published in 2023 by Holm, G and others affiliated with State of Green, this article contextualizes the trajectory of energy efficiency policies and regulations in Denmark spanning the last five decades. Emphasizing that about 85% of the buildings anticipated for occupancy by 2050 are already standing today, the article contends that devising energy-efficient strategies for existing structures holds paramount importance. It elaborates on the benefits, challenges, lessons learned, and motivating factors driving Denmark's green transition in alignment with Net Zero commitments. The narrative showcases a myriad of energy-efficient case studies and pioneering solutions implemented by Danish corporations globally, serving as exemplars of this approach.

(IS-2023-159) Building the Factory of Tomorrow

Published in 2022 by SIEMENS, this article delves into the concept of smart factories and the intersection of the building envelope and the Internet of Things to facilitate it. It highlights the pivotal role of digitalization in providing data-centric solutions that interconnect physical production, operational procedures, and facility management. This integration allows for real-

time enhancements in people, processes, and services, while also supporting long-term strategies. The overarching objective is to progress towards an autonomous factory model, driven by the idea that measuring outcomes through digitalized processes leads to desired results. These outcomes include safer working environments, improved energy efficiency, and heightened overall throughput across the factory.

(IS-2023-158) Decarbonization in Building Operations

In this fast-changing world, property owners have made energy optimization and sustainability a top priority. But are making physical retrofits and investing in renewable energy sources enough? While they come with many benefits, they can take a long time to implement and require heavy investments. On the other hand, a software-led approach is the fastest way to reduce your energy bills while accelerating your decarbonization journey. This eBook by Facilio provides you with a technology roadmap for smart building operations – learn how you can use IoT, AI and big data analytics to accelerate your decarbonization journey.

(IS-2023-157) Smart Buildings as Enablers of New Energy Practices and Communities

Released in May 2022, by SmartBuilt4EU, this white paper investigates the role of smart buildings and energy communities in promoting new energy efficiency practices. The report examines current policies on efficient heating solutions and community electrification. Notably, it forecasts that by 2050, about half of EU households will generate renewable energy, facilitated by affordable PV and increased electric vehicle integration into the grid, with a significant portion of charging occurring at home. The report discusses barriers to adoption, including infrastructure capacity, lack of incentives, and limited awareness among citizens and occupants. Pilot projects are showcased, highlighting opportunities to simplify business models, streamline approval processes, and address consent challenges in multi-family dwellings and with landlords.

(IS-2023-156) Optimised Building Costs

Published on May 17, 2022, by SmartBuilt4EU, this white paper delves into the optimization of building costs. The report assesses the current state of life cycle costing and assessment, particularly focusing on the role of technologies like BIM in tracking asset costs. It notes that while BIM offers real-time cost tracking opportunities, its adoption seems limited to the construction phase and lacks usage during operations and retrofits. The paper highlights the potential of AI/ML, digital twins, and big data analytics to optimize life cycle costs and predict asset performance, but acknowledges challenges due to standards and skills gaps. The report presents pilot projects showcasing the implementation of digitalization and tools, emphasizing the importance of building automation systems and IoT data for cost optimization and the need for interoperability standards.

(IS-2023-155) How to Create Actionable Outcomes with Data Analytics in Connected Buildings

Authored by Gillott Research and published in the fourth quarter of 2022, this report highlights the potential of building automation and controls systems enhanced by artificial intelligence and

machine learning solutions. The adoption of these technologies can be facilitated through wireless networks, asset inventorying, and data standards. AI/ML applications are employed to identify faults, diagnose issues, and optimize system equipment, resulting in reduced operating costs, extended equipment lifespan, and lower energy consumption. The report emphasizes that these improvements can enhance a building's appeal to tenants and lead to higher lease rates.

(IS-2023-154) Deep Learning Based Optimal Energy Management for Photovoltaic and Battery Energy Storage Integrated Home Micro-Grid System

Authored by Alam, Morshed et al. and published September 2022, this report underscores the role of artificial intelligence in optimizing the utilization of PV and BESS systems in conjunction with consumer needs. The report presents a residential energy management model that accounts for appliance operational constraints, PV generation forecasts, and grid electricity costs. The scheduling of BESS charging and discharging is determined through various control optimizations, considering day-ahead generation and consumption. In the most favorable scenario, the model demonstrated a potential reduction of up to 38.8% in daily electricity costs.

(IS-2023-153) Unlocking the Potential of Smart Buildings

Authored by an unknown author from Transforma Insights and published in November 2022, this report provides a comprehensive definition of smart buildings and outlines their benefits. Notably, buildings contribute to 1/3 of global energy consumption and 55% of electricity demand. The report highlights that smart buildings can substantially reduce electrical usage, including lighting by 35-40%, HVAC by 20-25%, and overall consumption by 10-20%. The report also emphasizes the effectiveness of Bluetooth devices connected via LoRaWAN networks for retrofitting, such as using accelerometers on bathroom stall doors to monitor usage. This retrofit approach is expected to dominate both new builds and renovation projects due to its flexibility.

(IS-2023-152) The Past, Present, & Future of the Smart Buildings Industry

Authored by James Dice from Nexus Labs and published in July 2022, this report delves into the challenges of integrating disparate technologies and standalone systems across rooms, floors, and buildings. The report suggests an integration approach through a horizontal architecture comprising distinct layers: device, network, independent data (housing a data model), and application (with a user-friendly app). Despite the clear solution proposed, the author acknowledges the ongoing complexity of this transformation process.

(IS-2023-151) Smart Buildings and the Benefits of Convergence

Authored by Allied Telsis and published in May 2022, this report underscores the imperative for interconnecting building management systems. It highlights the growing significance and interdependence between Information Technology, Operational Technology, Building Management Systems, and cybersecurity. The report identifies eleven drivers within the smart building market relevant to Property/Facility managers. For instance, the concept of "flexibility" allows seamless transfer of smart building functionalities (e.g., temperature, lighting, elevator,

access) as tenants move within the building. The report reveals that energy-efficient buildings command a 17% premium, generate 35% higher rental income, and boast an 18% higher occupancy rate. It offers guidance on achieving these outcomes.

(IS-2023-150) Occupant-Centric Building for Enhanced Quality of Life

Authored by Sylvain Kubicki and Airaksinen Miimu from Smart Built4EU and published in May 2022, this report emphasizes the necessity for a comprehensive and systemic approach to enhance overall quality of life through the integration of smart building technologies. It identifies obstacles to adoption, opportunities for research and development, and market gaps. The report delves into the emotional impact of "well-being," transcending physical attributes and technologies in buildings and addressing occupants' experiences. Examples include the fusion of wearable tech and sensors with accessible databases and adaptive models to enhance individual and collective comfort, measured through "comfort KPIs." The report also offers a rich collection of reference projects.

(IS-2023-149) How Can Smart Buildings Technology Become Mainstream

Published in November 2022, this report examines the factors impeding the widespread adoption of integrated smart building technology. The report highlights insights gathered from interviews with key industry stakeholders, revealing that the primary hindrance is not technological but related to human factors. Challenges such as a lack of awareness about the benefits, complexities during the commissioning process, market fragmentation, and misalignment between developers and tenants are identified. The report suggests that the adoption of smart building technologies is likely to be driven by end user expectations and a more streamlined commissioning process that spans the entire lifecycle.

(IS-2023-148) There's a Climate Crises - Where are the Experts

Authored by Stuart Lemmon and Adam Savitz from Atos and Johnson Controls, and published in May 2022, this report delves into the challenges of averting a climate crisis by attaining net zero energy consumption in buildings. The focus is on the need for workforce training to support the transition to net zero. The report highlights the necessity for a skilled workforce that is well-versed in net zero practices, spanning various roles within organizations. Collaboration between companies and governments at community and corporate levels is emphasized as crucial. The report cites examples of successful partnerships and underscores the importance of skills training, vendor selection aligned with environmental, social, and governance (ESG) commitments, and a sustainability-oriented approach.

(IS-2023-147) Responsive End-User

Authored by Vladimir Gumilar, Sami Kazi, et al. from Smart Built4EU, funded by the European Commission, and published in November 2022, this report addresses barriers to the implementation of smart buildings. It examines the challenge of achieving anticipated energy savings and indoor environmental quality while ensuring user comfort. The report particularly

focuses on the interactions between building occupants and the built environment. It identifies obstacles to the adoption of interactive smart building solutions and explores issues related to collecting and managing data about occupants' interactions for privacy concerns. The report proposes demonstrations using monitored buildings as living laboratories to address these challenges.

(IS-2023-146) Self-Service Support - Improving Home Automation

Authored by Parks Associates in partnership with RouteThis and published in October 2022, this report explores the prevalence of connected devices in homes equipped with core home automation products such as smart thermostats, networked cameras, video doorbells, or smart lights. On average, homes with these products possess around eight connected devices. The report investigates tools designed to monitor device functionality and assist with technical issues, which impact one-third of device owners. Among these owners, 47% address problems independently, while 42% seek professional assistance. Self-service tools encompass network monitoring, guided issue resolution, and a database of solutions. The report also delves into the advantages for service providers in offering customer self-help tools.

(IS-2023-145) Harnessing the Power of Wi-Fi in the New Age of IoT

Authored by Ravi Subramanian from Silicon Labs and published in December 2022, this report presents the key attributes of Wi-Fi 6. A comparative table highlights various Wi-Fi versions, including 802.11a, 802.11b, 802.11g, Wi-Fi 4 (802.11n), Wi-Fi 5 (802.11ac), and the latest, Wi-Fi 6 (802.11ax). Wi-Fi 6 offers data rates up to 9607 Mbps, a significant advancement from 11 Mbps in 802.11b. Notably, Wi-Fi 6 supports simultaneous transmission, enabling devices to collaboratively send data packets. Beamforming technology enhances range and throughput, allowing access points to target transmissions to remote devices. Moreover, devices can schedule transmissions, effectively reducing battery drain between data exchanges.

(IS-2023-144) CO2 Measurement is Only the First Step to Define Indoor Air Quality

Authored by Olivier Martimort from NanoSense and published in January 2023, this report delves into the origins of indoor air pollution while outlining a strategy to mitigate pollutants while managing energy consumption. The focus is on primary pollutants such as CO_2, VOCs (Volatile Organic Compounds), and PM (Particulate Matter), along with nine additional pollutants. The report emphasizes the adverse health effects of these pollutants, with poor indoor air quality being linked to nine million global deaths annually. Strategies for detection and reduction are detailed, including on-demand ventilation, which boasts a 70% energy savings compared to continuous fan operation.

(IS-2023-143) Truly Smart, Comfortable, Functional and Sustainable Office Spaces - Why Wait

Published in October 2022, this collaborative white paper, jointly developed with Dexma Energy Intelligence, accentuates the pivotal role of energy management in the commercial real estate (CRE) sector. The paper elucidates the formidable challenges posed by climate change, energy

costs, and digital transformation within the CRE landscape. It presents a compelling rationale, highlighting that 47% of global annual CO_2 emissions originate from the built environment. In response, the paper advocates a dual-strategy approach to curbing carbon emissions, targeting both embodied and operational carbon. The paper concludes by providing an insightful overview of ten essential capabilities that Energy Management Systems (EMS) should encompass. These capabilities play a crucial role in identifying, analyzing, and optimizing energy savings across diverse building portfolios.

(IS-2023-142) The Energy Challenge in Commercial Real Estate - How Analytics and IoT Help Drive the Sustainability Transformation

Released in October 2022, this collaborative white paper, crafted in partnership with Dexma Energy Intelligence, underscores the significance of energy management within the realm of commercial real estate (CRE). The paper delineates the formidable challenges presented by climate change, energy costs, and digital transformation in the CRE landscape. A compelling case is presented, as 47% of global annual CO_2 emissions stem from the built environment. In response, the paper advocates a two-pronged approach to carbon reduction: addressing embodied and operational carbon. The conclusion furnishes an insightful overview of the ten pivotal capabilities that Energy Management Systems (EMS) should embody. These capabilities are essential for identifying, analyzing, and optimizing energy savings across building portfolios.

(IS-2023-141) Smartness to Reduce Environmental Impacts

Published in November 2022, this report emerged within the context of the SmartBuilt4EU project's task force 2: Efficient building operation, backed by funding from the European Commission. Central to this paper is the exploration of smart technologies' potential in mitigating buildings' environmental impact during their operational phase. The report conducts a comprehensive literature review of prevailing tools and strategies for optimizing building cost and performance. Notably, it delves into barriers hindering the realization of smart construction and proposes actions to harness driving forces—such as fostering common Life Cycle Cost Analysis methodologies, piloting smart systems, and expanding building certification schemes. The report underscores the urgency for the construction value chain to address research and innovation gaps in smart building implementation and prioritize workforce education and upskilling.

(IS-2023-140) Safe, Smart and Sustainable Buildings - A Guide for Mitigating Risks and Driving Asset Performance Across the Real Estate Portfolio

Released in 2022, this report, developed by UL Solutions, presents a comprehensive exploration of safety, security, and sustainability as foundational elements for a robust risk management approach. The focus is on bolstering occupant contentment and optimizing real estate asset performance. The report substantiates its insights through data garnered from surveys and US real estate market statistics, providing a compelling rationale for proactive measures and actionable solutions. The narrative underscores the imperative of methodically integrating and assessing a building's systems to effectively realize the advantages of a real estate portfolio strategy.

(IS-2023-139) 5 Top Residential Security Trends to Watch In 2023

Authored by Parks Associates and published on October 27, 2022, this report furnishes security companies with up-to-date insights and trends to facilitate informed strategies for attracting new clientele. The overarching trends encompass heightened interest rates affecting costs, escalating demand for apartment building security, surging adoption of smart cameras and video doorbells, and emerging prospects within vehicle and energy security management. The principal insight gleaned highlights an optimistic trajectory for security companies to amplify their business expansion efforts.

(IS-2023-138) State of the Connected World 2023 Edition

Authored by Shahid Ahmed, Madeline Carr, Mariam Nouh, and Jeff Merritt, this report was issued by the World Economic Forum on December 20, 2022. The report delves into prevailing governance gaps surrounding the Internet of Things (IoT) and associated technologies. It encapsulates insights concerning IoT's COVID-19-induced impact on medical device demand, the hindrance in growth due to cybersecurity risks and trust deficits, ethical and responsible use dilemmas, and the imperative for equitable access. The core insight underlines the necessity for collaborative efforts between businesses and governments to formulate and enact more robust policies addressing privacy, security, and inclusivity for IoT technologies.

(IS-2023-137) Smarter Home

Prepared by ABB and released on September 9, 2022, this report presents an encompassing outlook on avenues to enhance residential intelligence. Encompassing considerations of home comfort, energy management, safety, and remote resident control, the report highlights ABB solutions for smart homes, showcasing compatibility with components from various manufacturers. Featured solutions include ABB-free@home for renovations and residential buildings, ABB i-bus® KNX for new constructions and extensibility, and ABB-Welcome for front door communication. The central insight gleaned emphasizes the prudent approach of collaborating with architects and electricians prior to commencing home construction or renovation to optimize electrical equipment requirements and reduce installation costs.

(IS-2023-136) Smart Home Security Market's Positive Growth and New Technologies

Authored by Swati Balgi and released by World Media & Expo on August 31, 2022, this report explores the burgeoning realm of smart home security solutions, spotlighting emerging technologies and positive market growth. The report delves into market dimensions, influential drivers, and pioneering products, supplementing these insights with enlightening case studies showcasing technology-integrated lighting designs and cutting-edge home automation solutions. The discourse extends to the merits of open Internet of Things (IoT) standards and the integration of IoT technology for smart cities. The central takeaway accentuates the rapid surge in demand for IoT devices and home security systems, ushering in new business avenues for security enterprises.

(IS-2023-135) Cyber Risks in the Smart Home Ecosystem - Identification, Modeling, and Pricing

Authored by Maochao Xu and Shouhuai Xu, this report was presented by the Society of Actuaries Research Institute and marked its debut on February 22, 2023. It introduces a pragmatic quantitative framework tailored for modeling cyber risks within the smart home ecosystem, with a focal point on cyber insurance pricing. Comprising four integral components—identifying vulnerability-incurred cyber risks, classifying risks by business lines, modeling these risks, and determining insurance premiums and coverages—the framework offers immediate applicability for actuaries. The pivotal insight extracted underscores that the proposed quantitative framework and pricing strategies stand ready for swift adoption/adaptation by actuaries to address the burgeoning cyber risks in the thriving smart home insurance market.

(IS-2023-134) Toward a Secure Smart-Home IoT Access Control Scheme Based on Home Registration Approach

Authored by Su-Yang Wu, Qian Meng, Yeh-Cheng Chen, Saru Kumari, and Chien-Ming Chen, this report entered the pages of the MDPI Mathematics Journal on April 30, 2023. It delineates the formulation of a secure authentication scheme for the smart home realm, guaranteeing exclusive access to legitimate users of smart devices. Grounded in authentication and key agreement (AKA) principles, along with software guard extensions (SGX) technology, the scheme adeptly curbs insider attacks. The key takeaway resonates—authentication schemes stand to benefit from integrated approaches, like multi-factor authentication and biometrics, enhancing their robustness and efficacy.

(IS-2023-133) The 2023 IoT Security Landscape Report

Prepared by Bitdefender and made public on April 25, 2023, this report offers insights gleaned from a threat intelligence analysis encompassing 2.6 million global smart homes. It provides a deep dive into popular Internet of Things (IoT) devices and their prevailing vulnerabilities within the smart home milieu. The report evaluates IoT risks spanning cybersecurity, privacy, and physical safety, accompanied by practical suggestions to enhance smart home security. The paramount insight underscores that the trajectory of IoT security is expected to decline before improvement, urging smart homeowners to adopt every feasible measure to curtail security risks.

(IS-2023-132) GDPR Personal Privacy Security Mechanism for Smart Home System

Authored by Yun-Yun Jhuang, Yu-Hui Yan, and Gwo-Jiun Horng, this report debuted in the MDPI Electronics Journal on February 7, 2023. The report introduces a Raspberry Pi microcontroller system designed to safeguard users' informed consent when interacting with devices within an IoT ecosystem, like a smart home. Anchored in the general data protection regulation (GDPR), the system encompasses a unified device data format agreement. The central insight derived emphasizes that the proposed system empowers users with expanded choices in how they provide and transmit personal data.

(IS-2023-131) A Sustainable Pattern of Waste Management and Energy Efficiency in Smart Homes Using the Internet of Things (IoT)

Authored by Mohammad Ehsanifar, Fatemeh Dekamini, Cristi Spulbar, Ramona Birau, Moein Khazaei, and Iuliana Carmen Barbacioru, this report premiered in the MDPI Sustainability Journal on March 13, 2023. It outlines a waste management and energy efficiency model for smart homes, employing the Internet of Things (IoT). The model factors in energy costs, inhabitants, house size, waste generation sources and rates, as well as waste transfer stations. The report's core takeaway underscores that the IoT-driven model holds potential to enhance waste management in smart homes, ultimately fostering energy efficiency.

(IS-2023-130) A Comprehensive Review of IoT Networking Technologies for Smart Home Automation Appliances

Authored by Vasilios A. Orfanos, Stavros D. Kaminaris, Panagiotis Papageorgas, Dimitrios Piromalis, and Dionisis Kandris, this report debuted in the MDPI Journal of Sensor and Actuator Networks on April 3, 2023. The report delves into the virtues and drawbacks of Internet of Things (IoT) networking technologies, categorized by connectivity (wired, wireless, dual mode), user interaction, technical traits, data integrity, and cost. Prominent technologies include KNX, Ethernet, WiFi, BLE, Zigbee, LoRa, EnOcean, and Mioty. Amid the annual influx of new devices, the central insight gleaned underscores the need for a unified interface to facilitate seamless communication among them.

(IS-2023-129) Strategic decision making in smart home ecosystems: A review on the use of artificial intelligence and Internet of things

Authored by Patricia Rodriguez-Garcia, Yuda Li, David Lopez-Lopez, and Angel A. Juan, this report was published by Elsevier's Internet of Things Journal on April 18, 2023. The report encapsulates findings from a literature review centered around the convergence of artificial intelligence (AI) and the Internet of Things (IoT) in strategic decision-making within smart home ecosystems. Employing a comprehensive framework encompassing decision support, partnerships, and AI/IoT integration, the report unveils prevalent trends, potential benefits, challenges, and opportunities for cultivating new business models. The primary takeaway underscores that the integration of AI into strategic business decisions confers organizations with a sustainable competitive edge.

(IS-2023-128) Proactive and Ongoing Analysis and Management of Ethical Concerns in the Development, Evaluation, and Implementation of Smart Homes for Older Adults with Frailty

Authored by Rosalie H Wang, Thomas Tannou, Nathalie Bier, Mélanie Couture, and Régis Aubry, this report found its place in the JMIR Aging Journal on March 9, 2023. It delves into the ethical considerations vital for smart home technology's support of aging individuals with frailty. The report emphasizes proactive ethical management through a proposed framework, along with accompanying resources and tools. The key takeaway underscores the necessity for the framework's adaptation to the unique circumstances and insights of aging adults and

stakeholders. This customization is crucial for smart home technology to fulfill its potential in this context.

(IS-2023-127) Enhancing Smart Home Design with AI Models: A Case Study of Living Spaces Implementation Review

Authored by Amjad Almusaed, Ibrahim Yitmen, and Asaad Almssad, this report was published in MDPI's Energies Journal on March 10, 2023. The core focus centers on harnessing artificial intelligence (AI) models to enhance the design, functionality, convenience, and energy efficiency of living spaces within smart homes. A case study is presented, showcasing customized temperature control by room to illustrate how AI integration can elevate user experiences within smart homes. The key insight derived underscores the pivotal role of AI in heightening user comfort and substantially reducing energy consumption. This is achieved through enhanced control, elevated reliability, and seamless automation, thereby underscoring AI's transformative potential in the realm of smart homes.

(IS-2023-126) CROSS A framework for cyber risk optimization in smart homes

Authored by Yunxiao Zhang, Pasquale Malacaria, George Loukas, and Emmanouil Panaousis, this report saw its publication in Elsevier's Computers & Security Journal on April 5, 2023. The focus centers on introducing a novel decision support framework named Cyber Risk Optimiser for Smart homes (CROSS). This framework offers a two-stage cybersecurity advisory aimed at aiding both smart home users and service providers in selecting optimal cybersecurity controls to counteract potential cyber attacks within smart home environments. The report includes a use case exemplifying the application of Artificial Intelligence and the Internet of Things in a smart heating setup. The main insight gleaned underscores the viability of the CROSS framework, while acknowledging the need for further assessment in terms of performance, adaptability, and robustness.

(IS-2023-125) Can Smart Home Technologies Help Older Adults Manage Their Chronic Condition? A Systematic Literature Review

This report, authored by Gabriella Facchinetti, Giorgia Petrucci, Beatrice Albanesi, Maria Grazia De Marinis, and Michela Piredda, was published in MDPI's International Journal of Environmental Research and Public Health on June 10, 2023. It condenses insights from 19 articles focusing on utilizing smart home technologies to manage chronic diseases in older individuals. The report considers aspects such as monitoring vital signs, medication management, daily living, mobility, falls, and quality of life. The key takeaway is that smart homes offer potential in chronic disease management by enhancing patient safety, aiding cognitively impaired older individuals, and enabling continuous monitoring by local health providers.

(IS-2023-124) Zero Response Time - Security System Intervention

Authored by Chris White of Parks Associates and released on July 15, 2022, this report delves into the realm of enhanced security systems through novel active intervention techniques.

Beyond mere detection and alerts, the report explores methods to bolster the efficacy of response to intrusions. Key recommendations encompass security cameras incorporating built-in detection technology, along with personal security and neighborhood safety apps. The central insight gleaned from this exploration underscores the paramount importance of swift response times between security events and the arrival of first responders. This distinctive demand provides manufacturers with an avenue to pioneer distinctive and effective security solutions.

(IS-2023-123) Securing the Future - The Emergence of Wireless Technology within Access Control

Prepared by Assa Abloy and unveiled on January 17, 2023, this report delves into the advantages of wireless access systems in the domain of remote door and lock control and management. It comprehensively examines vital components including the access controller panel, electronic and magnetic locks, wireless card readers, access credentials, and management software. The report underscores the manifold benefits of such systems, spanning reliability, flexibility, simple installation, and competitive pricing relative to conventional counterparts. The quintessential insight gleaned from this exposition resonates—the deployment of wireless access systems empowers both organizations and residential homeowners to adeptly oversee their property, while concurrently positioning themselves to tackle potential emergencies with greater efficiency.

(IS-2023-122) From Prototype to Production - Fast Track IoT Adoption with Secure and Seamless Connectivity

Prepared by UL Solutions and made public on August 1, 2022, this report delves into the instrumental role UL Solutions plays in aiding manufacturers in fulfilling compliance and safety requisites for Internet of Things (IoT) systems. These systems encompass communication avenues like Wi-Fi, Bluetooth, 5G, and millimeter wave. The report unveils three IoT security certification programs put forth by UL Solutions: the UL Cybersecurity Assurance Program, CTIA Cybersecurity Certification for IoT Devices, and IoT Security Ratings. The crux of this discourse underlines the imperative for manufacturers to furnish reliable and secure products. In the era of widespread IoT adoption, establishing consumer and business trust through trustworthy offerings stands as the preeminent takeaway.

(IS-2023-121) Distributed Cloud Monitoring and Logging

Authored by Vadyslav Branytskyi and Volodymyr Vyshko of Global Logic, this report was published on August 8, 2022. It delves into monitoring and logging architectures for distributed cloud deployments, offering best practices and tool insights. Microsoft Azure, Google Cloud, and AWS are recommended as cloud provider platforms, while software tools like CloudWatch, Kibana, ElasticSearch, and Grafana are proposed for visibility. The report underscores the necessity of a robust, monitored cloud architecture to minimize operational downtime and safeguard a company's public image.

(IS-2023-120) Design for Connectivity - Key Areas to Evaluate in Designing IIOT and IOT Products

Authored by Robert Alvord of SigmaTron International, this report was released on January 17, 2023. It meticulously navigates through vital aspects crucial for designing products tailored for Internet of Things (IoT) and Industrial IoT (IIoT) applications. The focal points encompass hardware and firmware security, battery efficiency, operational environment limitations, antenna configuration, and signal potency. The pivotal insight derived underscores the synergy between product development and manufacturing teams. To fully harness the advantages of outsourcing, these teams must collaborate harmoniously to optimize the manufacturing process, thus unlocking the true potential of their efforts.

(IS-2023-119) Teaching Machines to Detect and Understand Humans

Prepared by Nviso and released on June 13, 2022, this report delves into the crucial theme of imparting machines with the ability to comprehend humans. Key areas explored encompass human behavior, artificial intelligence (AI), data-centric AI apps, and the frontier of extreme edge AI computing. Within this purview, the report deftly presents diverse use cases spanning domains like smart health, smart living, smart mobility, and robotics. The crux of the matter centers on imbuing machines with the trio of real-time perception, reasoning, and semantics tailored to specific contexts, all to ensure safety, security, and personalization for humans. The main insight resonates with the pivotal role of AI synergized with edge computing as the bedrock for attaining such transformative capabilities.

(IS-2023-118) Security and Privacy IoT Vulnerabilities - The danger of too many entry points

Prepared by Plume Design and unveiled on October 12, 2022, this report sheds light on the inherent security vulnerabilities within Internet of Things (IoT) systems and offers corresponding security solutions. Delving into consumer concerns and IoT ecosystem challenges, the report underscores the utilization of the Common Vulnerability Scoring System (CVSS) for effective vulnerability management. The principal insight gleaned is that Communications Service Providers (CSPs) possess an optimal position to counter cyber attacks on IoT devices. This is achieved through an integrated, end-to-end solution encompassing discovery, detection, monitoring, and resolution.

(IS-2023-117) IoT Applications in a Distributed Cloud

Authored by Volodymyr Vyshko, Vasyl Akimov, and Vladyslav Branytskyi of GlobalLogic, this report was released on January 10, 2023. It delves into distributed IoT applications within a cloud framework, encompassing architectures, tools, best practices, and solution accelerators to enhance IoT deployment strategies. The report examines the merits of distributed cloud architecture, highlighting benefits such as decreased latency, simplified data governance, a streamlined area of communication for data processing, scalability, and enhanced resilience. The crux of the report underscores that a distributed IoT cloud solution empowers businesses to construct secure, adaptable, and robust industrial platforms.

(IS-2023-116) Digital Biomarkers - The New Era of Wearable Technology

Authored by Geetesh Garg and Akul Raina from GlobalLogic, this report was published on September 26, 2022. It spotlights the potential of non-invasive sweat-based wearable devices for early disease diagnosis. The report delves into digital biomarkers and wearable technologies, showcasing their combined potential in detecting immune system hyperactivity and cytokine release. The main takeaway is that enhancing sensor sensitivity in wearables could revolutionize the diagnosis of critical diseases like COVID-19.

(IS-2023-115) Born Secure - Reputation-Proof IoT Innovation from Product Conception to Market Penetration

Authored by Joe Britt of Afero, this insightful report found its publication on June 7, 2022. At its core, the report delves into the nuanced realm of securing connected devices and cloud platforms within an Internet of Things (IoT) ecosystem. Within this discourse, careful consideration is accorded to both the vast business potential entwined with IoT and the critical security threats underpinning the pursuit of IoT product implementation. The report unfurls a comprehensive security roadmap that charts the trajectory for ushering the next generation of fortified IoT devices into the market. The quintessential takeaway from this exposition resonates: the security of IoT devices necessitates an integrated security approach that takes root from the earliest stages of the IoT value chain. This approach ensures that all hardware and software components used are bolstered with security measures right from their manufacturing genesis.

(IS-2023-114) Energy Renovations of Buildings

Authored by a collaborative team led by Kadri Simons, Anne Svendsen, Henrik Teglgaard, et al., this report emerged under the banner of State of Green on June 17, 2022. The report aptly illuminates pathways to harness the latent energy efficiency potential within the built environment. A compendium of recommendations comes to the fore, encompassing governance tools, strategic partnerships, the strategic deployment of technical systems, and the adept repurposing of existing structures. The report's holistic perspective spans diverse use cases, deftly outlining approaches to champion, enable, and reinforce energy renovation initiatives. The pivotal insight gleaned from this exposition is a clarion call for the collective sharing of information and experiences. This symbiotic exchange stands poised to usher in more accelerated global strides in the domain of energy renovations.

(IS-2023-113) Data Governance and Cybersecurity

This report, authored by Clémentine Coujard from the European Commission, was published on May 17, 2022. The report delves into policies, regulations, and certification frameworks surrounding data governance, privacy, and security. It identifies key barriers and drivers within each area. Notably, a lack of trust and liability models stands out as the top barrier, while the increase in user awareness, debates, and cybersecurity risk discussions emerges as the primary driver. Considering these factors, the report underscores the need for further research and innovation. This pertains to developing open standards applicable across diverse stakeholders and pioneering fresh approaches and services for data storage and sharing.

(IS-2023-112) Vision-Based Technology - Next Gen Control

Authored collaboratively by Jennifer Kent and Tam Williams from Parks Associates, this report made its debut on February 7, 2023. It homes in on the augmentation of consumer-based technology through the lens of vision-based interfaces. The exploration zeroes in on how visual input has the potential to supplant touch-based interactions with devices. Within these pages, one encounters a meticulous presentation of best practices pertaining to vision-based interfaces and interactions. The dialogue unfolds to encompass the manifold benefits, extending both to consumers and the industry at large. The principal insight drawn from this exposition underscores the paramount importance of visual-based interactions for ensuring optimal user experiences. Moreover, the report casts a spotlight on the anticipated expansion of applications and usage in this realm, as it charts an upward trajectory poised for growth.

(IS-2023-111) Next Frontier of Smart Energy Management

This report, authored by Jennifer Kent and Mike Smith from Parks Associates, saw its publication on November 22, 2022. It delves into the flourishing smart home ecosystem, highlighting fresh opportunities for builders and utilities. The report identifies the potential of smart thermostats, appliances, lighting, plugs, and other energy solutions. Notably, consumer demand aligns with a desire for streamlined, unified smart home experiences and the ability to monitor energy consumption. The key takeaway is that the smart home market is on a rapid growth trajectory, offering energy-saving advantages for homeowners and novel business avenues for builders and utilities.

(IS-2023-110) Analysis of Thermal Comfort in Intelligent and Traditional Buildings

Penned collaboratively by Łukasz J. Orman, Grzegorz Majewski, Norbert Radek, and Jacek Pietraszek, this illuminating article found its place within MDPI's Energies Journal on September 7, 2023. The article's focal point revolves around an incisive exploration of thermal comfort in both intelligent and conventional buildings situated within the confines of Poland. This investigative journey drew upon a wealth of data concerning air and globe temperatures, alongside relative humidity figures. A comprehensive perspective was further attained through surveys conducted among 1778 participants. The central revelation gleaned from this study resonates: within the realm of thermal comfort, intelligent buildings ascend to a higher echelon when juxtaposed against their traditional counterparts, serving as a testament to their capacity for fostering superior levels of comfort.

(IS-2023-109) Protect the Connected Home - Home Security Meets Personal Privacy

Penned by the accomplished duo of Jennifer Kent and Frank Saldaña hailing from Parks Associates, this report saw the light of day on December 6, 2022. The crux of the report navigates the burgeoning realm of smart home device protection services, a burgeoning domain tailored to assuage the concerns of homeowners embarking on the journey of smart home integration, particularly in matters of safety and security. As a viable antidote to consumer

apprehensions surrounding security and the adoption of smart devices, this report posits that home security providers are primed to extend their sphere of influence. By extending device protection and data privacy services, these providers can harness their expertise, assets, and existing customer relationships. The quintessential takeaway extracted from this exploration lies in the untapped prospects awaiting home security providers, who, by lending a keen ear to customer worries and delivering requisite solutions, stand poised to diversify and enhance their business offerings.

(IS-2023-108) Best Practices for Securing Your Home Network

Compiled under the auspices of the National Security Agency and unveiled on February 22, 2023, this report serves as a guidebook to fortify and safeguard home networks. Within its pages, a compendium of optimal practices emerges: embracing cybersecurity-savvy behaviors, implementing fundamental configuration protocols, and enacting decisive mitigatory steps. Among the pivotal countermeasures spotlighted are the routine application of software updates, diligent data backups, judicious disconnection of idle devices, and the imposition of administration limitations on internal networks. The central insight gleaned from this dossier is the indispensability of adopting an unwavering, proactive stance for ensuring the cybersecurity resilience of a home network, thereby positioning it as an ongoing endeavor of paramount importance.

(IS-2023-107) Attuning Smart Home Scripts to Household and Energy Care

Penned by the capable hand of Deborah Chambers and featured in the pages of the Buildings and Cities journal on September 6, 2022, this article delves into the intriguing question of whether contemporary smart home concepts are ushering in a new era of gender-equitable household dynamics and heightened energy efficiency. A meticulous analysis of 36 promotional documents pertaining to smart homes uncovers a disconcerting trend: these visionary concepts persistently neglect the diverse fabric of households, while also sidestepping discussions about energy conservation and the undue burdens that traditional housework often places on women. To remedy these dual concerns, the article posits the implementation of a care-centric ethos. The key insight gleaned from this examination underscores the potential to reconfigure smart home visions, thereby fostering household practices that champion gender equality and concurrently facilitate reductions in energy consumption.

(IS-2023-106) The Evolving Hyperscaler - Cloud-based Telecom Networks - Design and Testing Challenges

Crafted by Anritsu and unveiled on December 22, 2022, this report casts a spotlight on the evolutionary hurdles confronting organizations that furnish expansive cloud, networking, and internet services—dubbed hyperscalars—to fellow enterprises. At the core of this evolution lie the propelling influences of 5G technology and the vast expanse of big data, both of which exert a direct influence on network architecture and mandate the implementation of sophisticated testing protocols. The paramount insight gleaned from this exploration emphasizes the indispensability for hyperscalars to forge partnerships with testing providers that actively engage

within global standards organizations. Such collaborations, coupled with a commitment to solution development spanning the entire ecosystem, stand as the key to maximizing the return on investment within this dynamic landscape.

(IS-2023-105) A study on the quality evaluation index system of smart home care for older adults in the community

Authored by Huaxiao Chen, Yuwei Zhang, and Li Wang, this insightful article graced the pages of the BMC Public Health journal on March 1, 2023. The crux of the article revolves around the strategic implementation of a service quality model, known as SERVQUAL, to establish a comprehensive quality evaluation index system for smart senior care among older adults within Chinese communities. Through meticulous analysis of community data, the study unveiled a multifaceted quality evaluation index, shedding light on the imperative demand for intelligent services spanning meals, cleaning, medical care, emergency assistance, and recreational engagement. The key takeaway from this investigation underscores the indispensability of providing seniors with smart services characterized by promptness, dependability, and user-friendliness.

(IS-2023-104) Smart home technology to support older people's quality of life - A longitudinal pilot study

Penned by a collaborative team consisting of Christina Aggar, Golam Sorwar, Carolyn Seton, Olivia Penman, and Anastasia Ward, this article, brought forth through Wiley on December 28, 2022, delves into the far-reaching ramifications of Smart Home technology in bolstering the well-being of solitary older individuals. A comprehensive investigation was conducted, encompassing 60 participants ranging from 68 to 90 years of age. These individuals engaged in a personalized 12-week Smart Home technology program. Notably, the research unveiled a substantial elevation in the participants' quality of life subsequent to their adoption of Smart Home technology. The paramount insight gleaned from this exploration underscores the pivotal role played by Smart Home technology in enhancing the quality of life for elderly individuals, notably augmenting their sense of accomplishment and fortifying their perception of future security.

(IS-2023-103) Smart Home Market Report

Compiled by Plume IQ and unveiled on August 23, 2022, this report not only sheds light on the contemporary smart home market but also distills the myriad trends influencing communication service providers (CSPs). These trends span operational intricacies, customer contentment, and avenues for financial advancement. A comparative analysis with 2021 reveals a surge in the strain on CSPs' networks, attributed to the escalation in device count, data consumption, and device activity duration. The spheres of network management and security have likewise infiltrated CSPs' operations. Foremost among the insights gleaned is the potential CSPs harbor for inventive growth and capitalization, underpinned by the data reservoirs furnished by Plume IQ.

(IS-2023-102) Security Threats to Your Smart Home

This report, penned by Hollie Hennessy and Mike Sullivan-Trainor at Omdia, was published on May 27, 2022. The document delves into the realm of cybersecurity threats targeting smart homes, offering robust solutions to counter cyber-attacks. With the steady influx of devices, the susceptibility of a smart home to such attacks amplifies. In response, homeowners can bolster their defense by crafting an all-encompassing network solution, centralized for streamlined control. Alternately, they can opt to segment their network, safeguarding critical data from potential lateral breaches. The key insight underscored is the proactive role smart homeowners must play in orchestrating a comprehensive and strategic management of their home network.

(IS-2023-101) End-to-End Automation - Hype or Hyperautomation

Authored by Sandy Kemsley, a member of Flowable, and unveiled on May 31, 2022, this report delves into a top-tier strategic technology trend: hyperautomation. This trend is a driving force, enabling organizations to seamlessly identify and automate their diverse business and IT processes, ushering in a new era of operational efficiency. At the heart of hyperautomation lies the notion of comprehensive process orchestration. This is thoughtfully shaped and built using a business case management system (BCMS) and a user-friendly low-code composition environment. This approach drastically reduces the time needed for development, propelling organizations forward with increased swiftness.

(IS-2023-100) The Metaverse - Reimagining the World in a New Way

Penned by the adept hand of Hrushikesh Zadgaonkar from GlobalLogic and unveiled on September 21, 2022, this report delves profoundly into Facebook's expansive internet-powered realm known as the Metaverse. Among its myriad attributes are interoperability, boundless user engagement, dynamic virtual worlds, real-time interpersonal interactions, and lasting presence. Contained within this report is a thorough exploration of the versatile applications that the Metaverse presents. These encompass a broad spectrum, ranging from ingenious marketing strategies and novel forms of social media engagement to the establishment of a vibrant virtual economy and the facilitation of remote work dynamics.

(IS-2023-99) Building a Successful Smart Home Strategy

Composed by Plume and released on May 19, 2022, this report unveils a prescriptive roadmap tailored for communications services providers (CSPs) to secure their pivotal role within the dynamic smart home landscape. The strategy outlined within this report encapsulates critical pillars essential for sustaining relevance and vibrancy. Central to this strategic blueprint is the steadfast commitment to furnishing swift, all-encompassing, and dependable connectivity. This commitment materializes through the astute utilization of WiFi 6 and 6E communication technologies, as well as the strategic adoption of the burgeoning connectivity standard for smart home devices, known as Matter. Additionally, a pivotal facet lies in the integration of cloud-based solutions to facilitate seamless service delivery.

(IS-2023-98) Artificial Intelligence in the Utilities Sector

Created by Zpryme and unveiled on June 10, 2022, this report delves into the views of 100 utilities on the integration of artificial intelligence (AI) and machine learning (ML) within their operations. The survey results highlight an intriguing perspective within these organizations. What becomes evident from the findings is a cautious enthusiasm surrounding AI and ML adoption. While a significant number of utilities express a strong interest, they are also apprehensive due to the challenges linked with implementation, costs, and the need for a clearer understanding of the benefits.

(IS-2023-97) Smart Buildings Cybersecurity - Design Approach for Multi Stakeholder Environments

Penned collectively by a distinguished group including Brian Ensign, David Brearly, Gayla Arrindell, Jared Morello, Jason Christman, Jon Williamson, Seth Ely, Sudhi Sinha, Terry Haley, Tim Koch, and Travis Rosiek, this report, presented by TIA on July 1, 2022, delves into a meticulously crafted process for bolstering the security of interconnected smart buildings against the looming threat of cyberattacks. At the heart of this endeavor lies the pivotal role of stakeholders in shaping the blueprint and triumph of a robust cybersecurity solution.

(IS-2023-96) Hacking Smart Buildings - IoT Attack Surfaces and Defences

Authored by TXOne Networks and released on January 3, 2023, this insightful report navigates the realm of safeguarding building automation systems. It strategically employs the Zero Trust security framework as a robust defense mechanism against the tide of cybersecurity threats. With the influx of IoT devices into building environments, paramount importance is placed on fortifying the security of supply chain partners and the deployed devices themselves. Moreover, meticulous attention is directed towards enhancing system endpoints, conducting holistic system evaluations, implementing stringent access controls, segmenting networks, and fortifying system resilience to bolster overall security posture. At its core, this report underscores a pivotal lesson: the imperative of embracing a comprehensive and seamlessly integrated strategy, embodied by the Zero Trust model, to effectively fortify building automation systems against the ever-evolving landscape of threats.

(IS-2023-95) IoT Security Challenges - The Risks and How to Minimize Them

Authored by Joseph Carson of Delinea and published on September 23, 2022, this report delves into the realm of security assessment for IoT systems, adopting an ethical hacker's perspective to dissect security vulnerabilities. The proposed security assessment strategy encompasses a comprehensive evaluation of system hardware, firmware, reverse engineering, data communication, and encryption. A pivotal insight gleaned from the report underscores the susceptibility of IoT devices to multifaceted breaches, emphasizing the urgency of adopting a proactive approach to assessment and intervention to effectively curtail security risks.

(IS-2023-94) Data Driven Indicators for Smart Buildings

Developed by members of the SmartBuilt4EU task force, chaired by Litiu Andrei Vladimir and Pozza Cristian, and published in November 2022, this report examines data-driven indicators for smart buildings' interaction with their external environment. Focusing on evolving the 'static' Smart Readiness Indicator (SRI) to a 'dynamic SRI,' it emphasizes regular SRI score updates and real-time verification of smart functionalities. The report presents case studies and outlines collaborative efforts to address research gaps and innovation needs in advancing data-driven indicators for smart buildings.

(IS-2023-93) The Smart Building Blocks

Authored by James Dice and published by Nexus Labs in July 2022, this white paper highlights the disparity in digital systems adoption within commercial buildings. It outlines the challenges of siloed systems in complex structures, emphasizing proprietary control and limited interoperability. The paper explores the growth of IoT sensors, the increased smartness of traditional devices, and the rise of IP addresses. It proposes an Independent Data Layer to support diverse smart building applications, fostering independence and interoperability. The paper concludes with a call for upskilling among consulting engineers and building owners to foster industry growth.

(IS-2023-92) Evolution of CMMS - Unlock game-changing building operations in the digital era-compressed

Authored and published by Facilio in late 2022, this guide explores the state of CMMS in building O&M. It addresses transition barriers for O&M teams toward strategic roles and advocates for SaaS-driven innovation. The paper showcases the potential of Connected CMMS, extending its scope beyond maintenance, automating processes, and enhancing stakeholder engagement. It also features industry voices, exemplifying successful CMMS upgrades and their transformative impact on property operations and maintenance.

(IS-2023-91) Decarbonizing the Global Buildings Sector - Efficiency, Electrification, and Equity

Authored by Ian Hamilton and published by the Center on Global Energy Policy at Columbia/SIPA in February 2023, this paper assesses the buildings sector's energy performance and CO2 emissions progress in relation to Paris Agreement targets. It underscores the discrepancy between these efforts and the global net-zero emissions by 2050 objective. The report outlines pathways for building decarbonization, emphasizing energy efficiency enhancement, electrification, and technology adoption like heat pumps. While available solutions include better building envelopes and financing options, true sustainability transformation necessitates equity integration. This includes addressing fuel poverty, supporting marginalized communities, and facilitating clean energy access.

(IS-2023-90) Connected Buildings Energy Management

Authored and published by Ericsson in September 2022, this paper highlights the value of cellular IoT connectivity in smart buildings. Collaborating with Kiona, a prominent proptech company,

Ericsson and Arthur D. Little conducted a use case study on energy and resource efficiency optimization. Cellular IoT ensures secure, widespread coverage for seamless sensor data transmission. Kiona achieved significant benefits, including a 10% reduction in energy costs and 9% decrease in CO_2 emissions, totaling around €158,000 annual value gain. The study underscores substantial financial advantages of cellular IoT for building energy management.

(IS-2023-89) The State of Commercial Real Estate Building

Authored and published by Building Engines in December 2022, this paper addresses the evolving landscape of commercial real estate (CRE). With remote and hybrid work becoming commonplace, labor shortages, and a heightened focus on ESG reporting and sustainability, CRE property teams are navigating complex challenges. Building Engines collaborated with BOMA and surveyed over 250 CRE professionals, yielding data-backed insights into how they are addressing these industry shifts.

(IS-2023-88) The Future of FM Services Delivery is Experiential

Authored and published by Planon in September 2022, this paper presents insights from interviews with five industry experts concerning the Total Experience for facility services. Despite the digital information overload, experiences remain impactful. The report emphasizes customer experience's (CX) and employee experience's (EX) significance and their role in boosting revenue. Planon's Total Facility Experience (TFX) approach encompasses multi-experience (MX), CX, UX, and EX, underscoring the core role of CX and EX within TFX.

(IS-2023-87) The 5 Vital Roles for Smarter Buildings

Authored by James Dice and published by Nexus Labs in January 2023, this white paper underscores the increasing importance of having a smart building specialist within building ownership teams. It outlines five crucial roles for a successful smart building program: Smart Building Champion, Design Consultant, Master Systems Integrator, Network Manager, and Commissioning Agent. Building upon the Nexus Lore whitepaper, this paper emphasizes the human factor in ensuring technology's efficacy throughout different phases of a smart building project.

(IS-2023-86) Smart Buildings Winter Edition

Authored by L. Petrus, M. Kinman, and others, this eBook, co-published by Consulting & Specifying Engineer and ABB in January 2023, explores the impact of smart building systems on HVAC improvement and lighting control. An ABB case study showcases AI in a Canadian Shopping Centre. The eBook also delves into post-COVID office design for employee well-being and indoor air quality, evolving building codes, and the future of rooftop power plants. Each comprehensive article underscores smart systems' role in fostering healthier, sustainable buildings.

(IS-2023-85) Facility Management Impacts Enterprisewide ESG with Sustainability Software

Authored by Juliana Beauvais and published by IDC Custom Solutions in April 2022, this report reveals that while many enterprises hold ambitious sustainability goals, functional areas like workplace and maintenance lack the tools and expertise to meet them. Drawing from a 2021 IDC survey of 1,000 organizations, the report underscores a gap between sustainability aspirations and facility management practices. It details benefits of sustainability software, including enhanced ESG performance and cost reduction, while spotlighting key drivers for such software adoption: operational cost implications, executive mandates, and regulatory demands. Sponsor Planon's solutions for these challenges are also featured.

(IS-2023-84) Smart Buildings Fall 2022 Edition

Authored by A. Szalaj, T. Howe, M. Myers, and others, this eBook, co-published by Consulting & Specifying Engineer and ABB in October 2022, highlights crucial elements of smart building systems. It emphasizes CSI Division 25 utilization, commissioning, and emergency response capacities. The ABB AbilityTM Building Ecosystem and ABB BrainBox AI's impact on energy efficiency in a Canadian Shopping Centre are discussed. The eBook also simplifies lighting controls and addresses sustainability standards, data connectivity, and cybersecurity's role in optimizing smart systems for energy savings, IAQ enhancement, and return on investment.

(IS-2023-83) Managing Risk in An Uncertain World

Authored and published by SoftwareONE AG in October 2022, this report delves into the heightened challenges of the construction industry, including workforce shortages, supply chain issues, and rising costs. It underscores risk management's vital role in ensuring project success and business survival. The report highlights the potential for risk mitigation through strategic planning, effective project management, and appropriate technology adoption within the architecture, engineering, and construction (AEC) sector.

(IS-2023-82) Lighting and Lighting Controls Winter Edition

A report by A. Rozgus, R. White, D. Banfic, S. Peck, and others, published by Consulting-Specifying Engineer in December 2022, compiles articles on LED lighting advancements in K-12 schools, including color behaviors and UVGI for pathogen control. The authors address lighting design questions and reveal lighting designers' allocation of time across tasks. The study finds engineers spend time researching vendors, evaluating representatives' proposals, seeking information, and drafting specifications.

(IS-2023-81) K-12 Industry Solutions to Help Facilities Managers Become Tech-savvy and Data-driven

Authored by Saheel Chandrani of ABB, this report, published by Smart Buildings Technology in October 2022, addresses challenges posed by aging school facilities. It explores how next-gen building management systems aid environmental goals, emphasizing visioning to define objectives. Improved operations and AI-driven autonomous controls enhance efficiency and extend equipment life. Training empowers stakeholders to drive energy savings by optimizing

building behaviors and operations.

(IS-2023-80) Environmental Sustainability On the Far Edge

Don Utz, Eric Swanson, Jayson Hamilton, John Eberhart, Joseba Calvo, Marc Cram, Mark Smith, Shizuko Carson, and Tony Grayson authored this report, published by TIA in December 2022. It delves into the rapid shift from fossil fuels to renewables like wind, solar, and hydro for global energy needs. Concurrently, the electrification of vehicles, buildings, and appliances advances. The data center and telecommunications sectors, major power consumers, play a key role in clean energy transition. TIA's paper examines how the IT industry can navigate powering dispersed infrastructure while achieving carbon reduction goals.

(IS-2023-79) End-Use Load Profiles for the U.S. Building Stock

Authored by Margaret Pigman, Natalie Mims Frick, Eric Wilson, Andrew Parker, and Elaina Present from LBNL and NREL, this report, published by the U.S. Department of Energy in December 2022, offers practical guidance for accessing and utilizing end-use load profiles (EULPs) data. EULPs are pivotal for utilities, public utility commissions, and state energy offices in comprehending energy usage patterns and prioritizing efficiency measures and distributed energy resources (DERs). The report outlines accessing EULPs, addresses considerations and limitations, and presents use cases with examples.

(IS-2023-78) Electrical and Power Winter 2022 Edition

Crafted by Richard A. Vedvik and published by Consulting-Specifying Engineer in December 2022, this eBook explores electrical system vulnerabilities. It highlights risks to facilities and offers safety recommendations. Sections cover topics like non-outage-simulating generator tests, generator room's paralleling gear, lacking selective coordination, and misunderstood arc flash conditions. Additionally, the eBook features insights on power assets in wastewater plants, hospitals, and digitization's role in sustainable construction.

(IS-2023-77) Welcome to Building X

This eBook was authored and published by Siemens in September of 2022. Several companies are bringing out AI-enabled programs to accelerate the digital transformation of buildings and to realize higher productivity, enhanced occupant well-being, and greater sustainability. This eBook describes how the Siemens Building X program accelerates the digital transformation of buildings to realize higher productivity, enhanced occupant well-being, and greater sustainability. Building X is a cloud-based, artificial intelligence-enabled connectivity platform for smart buildings. It unlocks the potential of linking disparate building data silos and combines them into one data lake, allowing users to control systems through a single source of truth and gain actionable insight previously unavailable. It discusses some of the Building X apps and the market-leading connectivity that will transform building operations from reactive or proactive to predictive and prescriptive.

(IS-2023-76) Unlocking Smarter Solutions for Managing the Built Environment

This report was authored by George Hawkinson, Richard Wendland, and Marc Petock and published by Burns & McDonnell in October 2022. The built environment is increasingly dependent on sophisticated, connected controls for heating and air conditioning, energy management, lighting, and many other systems. Unfortunately, many of these controls function in silos, with little interoperability and integration. A master systems integration strategy utilizing advanced controls platforms can give owners and operators the connectivity and access to the data they need to optimize operating costs, use energy more efficiently and address the pressing need to reduce carbon emissions. The report shows that technology is only half the story. The entire vision can be optimized further through the commissioning discipline. Commissioning provides the human insight and expertise needed to understand whether the data being gathered, compiled, and reported is accurate and consistent with the rules set by monitoring systems. This verification process also is important to be sure that applicable codes and standards are being met.

(IS-2023-75) The Sustainable Multi-Family Housing Opportunity

This report was published by Greenbuild in October 2022. A focus on sustainability and energy efficiency in the multifamily housing market can deliver benefits for a wide range of stakeholders. Using green features and sustainable design achieves optimal results when all priorities, perspectives, and goals of stakeholders are in balance. The use of low-risk and proven technology and methods that have measurable value-add to the properties can be achieved with energy modeling and sustainable design at the earliest planning stages, ensuring every decision delivers a measurable benefit. This paper presents multifamily housing projects by teams of developers, architects, and engineers in Seattle. It details the necessary evolution of integrated design and energy strategies creatively implemented in three successive completed multifamily projects in Seattle. Multifamily housing, if designed and built responsibly, provides much-needed housing for a fraction of the cost of single-family construction. By design, dense urban housing creates a smaller carbon footprint, dramatically reducing per-person energy use and carbon emissions.

(IS-2023-74) The Economics of Electrifying Buildings - Medium-Size Commercial Retrofits

This report, published by RMI in September 2022, discusses the economic feasibility of electrifying medium-sized commercial buildings in the United States. It examines the upfront costs and long-term financial benefits of converting buildings from fossil fuel-based systems to electric heating, cooling, and hot water systems. The analysis concludes that while the upfront costs of electrification may be higher than traditional fossil fuel-based systems, the long-term operational and maintenance cost savings can result in a lower total cost of ownership over the life of the building. The paper also highlights the potential environmental benefits of electrification, including reduced greenhouse gas emissions and improved indoor air quality. Overall, it argues that electrifying buildings can be a financially and environmentally sound investment for building owners and operators.

(IS-2023-73) The CRE Tech Guide to Boosting NOI - Discover 5 quick steps to increasing NOI across your CRE buildings and portfolio

This eBook was authored and published by Building Engines, Inc. in October 2022 for property owners and operators who want to learn new ways to boost net operating income (NOI) with help from tech. Nearly half of commercial property teams are increasing CRE tech spend. They are streamlining with tech that can help NOI by reducing operating costs and driving additional revenue. Centralizing and connecting building data across teams and systems is essential to NOI growth. This tech and data can mobilize the property teams that are always on the go. Understanding the key data points, you can measure provides a fuller picture of tenant experience across portfolios and allows for the use of those insights to make the best business decisions.

(IS-2023-72) The Business Case for Sustainable Spaces

This report was compiled by Nancy A. Shenker and published by Greenbuild in October 2022. This report has industry experts sharing how their colleagues and the companies they serve can move more quickly to operate more sustainably. Employees are choosing companies that have a clear commitment to the environment. Public awareness of environmental issues rose because of the pandemic. Yet, many businesses may still be resistant to taking steps that promote environmental health. Some companies merely pay lip service to sustainable building and practices. They balk at measures that will cut into their profits or delay or complicate development. They struggle with energy use reduction, social justice efforts, and new LEED construction. The many contributors discuss how they educate, incentivize, and compel companies to add environmentalism to their agendas. Making a case for sustainability requires companies to know their facts and be relentless and creative in advocacy.

(IS-2023-71) Start Breathing Easier - ABM is your guide to improved IAQ and healthier facilities

This report was authored and published by ABM Industries Inc in November 2022. Healthier buildings keep everyone healthier together. Safer spaces mean safer people. Keeping people safe now hinges on implementing a fact-based, expert-developed, and dynamic approach to occupant wellness. One that helps mitigate both air and surface-based viral transmission risks, while also increasing efficiencies and the financial health of the building operations. Using the Healthy Building Risk Assessment, a set of recommendations around air quality, surface disinfection, facility resiliency, and more are formed. After program implementation, ongoing results and data from repeated Healthy Building Risk Assessments are useful to recalculate risk and implement supplemental solutions moving forward. The report covers all areas of indoor air quality, energy efficiency and surface cleaning as well as communicating these programs to the occupants.

(IS-2023-70) Solving the Hybrid Work Puzzle

This report was published by JLL in October 2022. Hybrid is here to stay, and today's hybrid

workplace needs to be a destination that attracts employees by making their time at the office "worth the commute." A dynamic approach to occupancy management provides benefits for workers and organizations across a range of hybrid models. JLL's Dynamic Occupancy Management does just that – allowing workers to schedule their time in the office, inform their colleagues and tailor their experience. The collective data generated by the workforce can help adapt the workspaces for the short-term, inform longer-term decision-making, and solve the hybrid work puzzle in a way that works for your organization.

(IS-2023-69) Smart Building Planning, Best Practices, and Network Design

This whitepaper was authored by Todd Harpel and published by Leviton Network Solutions in October 2022. Smart building growth is occurring as many companies have shifted to work-from-home or hybrid work policies over the past several years, leading to fewer occupants in commercial real estate buildings. Increasingly, building owners are evaluating smart building features to improve comfort in the workplace, reduce sick days, improve productivity to attract tenants, and remain competitive. Planning for the creation of a smart building must include a clear definition of the goals and desired outcomes of making the building intelligent. The stress and strain on the network caused by connecting so many new utility devices (IoT) can cause the network to become sluggish and adversely affect the user experience. To simplify management, improve security, and alleviate network stress in smart buildings, Leviton recommends that the network infrastructure connecting core LAN applications and utility applications become physically separated in telecommunications rooms or closets. This creates a utility LAN, or what Leviton calls the uLAN™.

(IS-2023-68) Selling in Sustainability-Gaining Buy-in for Moving Sustainable Business Practices Forward

This report, published by Greenbuild in October 2022, discusses the importance of incorporating sustainability into the sales process, citing research that shows that consumers are increasingly interested in purchasing from environmentally responsible companies. It outlines several steps that sales professionals can take to align their approach with sustainable values, including highlighting eco-friendly product features and sharing information about the company's sustainability initiatives. The report also emphasizes the role of training and education in helping sales teams effectively communicate the value of sustainability to customers. Overall, the report argues that prioritizing sustainability in sales can help companies differentiate themselves from competitors, build customer loyalty, and drive revenue growth.

(IS-2023-67) Resilience at the Edge

This report was published by the Telecommunications Industry Association in October 2022. When planning an Edge Data Center (EDC) deployment, the need to address the availability of planned workloads to ensure resiliency is a top priority. The key characteristics of an EDC can be significantly different from those that top the list for larger enterprise or multi-tenant data centers. To help balance the costs and operational aspects of any EDC strategy, this paper outlines a number of critical questions that should be addressed to ensure resiliency at the edge.

(IS-2023-66) Regulating Embodied Emissions of Buildings

This report was published by The Atmospheric Fund (TAF) in November 2022. The building sector is now considering the embodied carbon in the net zero objectives. The vast majority of embodied emissions from new construction typically come from the procurement of a handful of key materials. These typically are concrete, steel, insulation, and timber. This primer has been created for policymakers and other decision-makers - including owners, designers, engineers, procurement officers, and other stakeholders who decide what we build as a society. The primer includes background information on embodied emissions (also called embodied carbon), benchmarks from 41 large buildings across Ontario, proposed reduction targets, and policy recommendations with sample language and reporting templates. It also notes several knowledge gaps and barriers the industry will need to overcome to effectively reduce embodied emissions in the years ahead - reductions needed to meet our climate targets. The topics covered can generally be applied to most buildings and/or infrastructure projects, however, the specific focus is related to large-scale "Part-3" buildings in Ontario.

(IS-2023-65) Redefining the Sustainable Workplace

This report was authored by Nancy A. Shenker and published by Greenbuild in October 2022. Business leaders are more focused than ever before on employee health and well-being -- especially as they create a new balance between physical space and remote working. Air, light, furniture, plants, food, meeting spaces, and even commute quality all have a significant impact on how people and customers feel about where they work. Schools, retailers, and municipal buildings are all tackling the complex issues around health, safety, and cost as they create and maintain sustainable workplaces. The report discusses the responses from the green building experts with their perspectives on the challenges facing businesses as they adjust to the sustainable -- and healthy -- new normal and their insights and predictions.

(IS-2023-64) Power Digitalization - Active Energy Management in Buildings

This report was authored by Tony Hunt, in 2021 and modified and published by Schneider Electric in October 2022. Most public, commercial, and industrial buildings are not energy efficient, representing an enormous untapped potential for decarbonization and sustainability efforts, as well as utility bill savings. Power digitalization plays a foundational role in active energy management and efficient facility operations. For existing buildings, this can be done by retrofitting electrical systems with smart devices and using energy and power management software that improves energy efficiency and reduces risk. This power digitalization investment helps facility management and maintenance personnel make better decisions, resolve issues more quickly, minimize downtime, and use less energy. In this paper, power digitalization for buildings is defined, and achieving power digitalization is based on connecting smart sensors and communicating devices to EPMS software and consists of three basic steps: Connect – Automate – Extend.

(IS-2023-63) Overcoming HVAC Challenges in Your Facility

This report was authored and published by Consulting-Specifying Engineer and ABB in October 2022. In commercial and industrial buildings, heating, ventilation, and air conditioning (HVAC) systems often need repair or replacement and the correct system must be specified and installed. To compound that challenge, HVAC systems can use about 35% of the energy load. That means selecting the right HVAC system is of high importance, both to consulting engineers and facility owners. This report discusses the 2022 research that showed HVAC systems within survey respondents' facilities are commonly challenged with aging equipment that needs updating or replacing (43%), meeting energy efficiency/sustainability goals (33%) and maintenance issues (29%). In looking at these challenges, engineers and facility personnel can address them by incorporating newer, more energy-efficient motors and drives into the HVAC system. The report discusses variable frequency drives (VFDs) and efficient motors and provides case studies that show significant energy and cost savings.

(IS-2023-62) Lessons From the Net Zero Challenge

This report was published by BOMA Canada in September 2022. This report shares insights and examples from the award program so that the industry can benefit from the lessons learned to help them achieve the similar levels of high performance on the path to net zero.

(IS-2023-61) Green-e Renewable Energy Standard for Canada and the United States

This report, authored and published by Center for Resource Solutions in September 2022, outlines the requirements and guidelines for renewable energy and carbon offset products to be certified by Green-e. The standard includes requirements for the eligibility of renewable energy sources, including specific environmental and social criteria that must be met, such as avoiding negative impacts on biodiversity and community engagement. The standard also outlines the requirements for the verification and tracking of renewable energy and carbon offset products, including the use of recognized third-party verification standards and regular reporting to Green-e. Overall, the Green-e Standard provides a comprehensive framework for ensuring the integrity and transparency of renewable energy and carbon offset products, and helps to build trust in the market for these products.

(IS-2023-60) Do More with Less - Moving Power and Building Management to the Cloud

This whitepaper, authored by Markus Hirschbold and Grant Reig in 2021 and modified and published by Schneider Electric in October 2022, discusses the potential benefits of cloud-based solutions for building and power management. The paper first describes the challenges faced by building and power managers in maintaining and optimizing their systems and the limitations of traditional management approaches. The paper then explains how cloud-based solutions can address these challenges by providing more efficient, cost-effective, and scalable management solutions. It highlights the benefits of cloud-based solutions, such as reduced hardware costs, simplified data management, improved data analysis, and remote access to data and systems. The paper also provides examples of how cloud-based solutions are already being used in

building and power management, such as real-time energy management, predictive maintenance, and remote monitoring.

(IS-2023-59) Control the Network, Control the Costs - Solving the Wi-Fi Problem in Home Security

This whitepaper, by Parks Associates in partnership with Johnson Controls published in November 2022, focuses the on rise in demand for Wi-Fi devices integrated with security and smart home solutions, the impact of poor Wi-Fi network performance on the professional install channel, and the opportunity for dealers to own and manage the Wi-Fi network remotely, which would reduce their costs, limit truck rolls, and improve the user experience.

(IS-2023-58) Committing to Net Zero - How Businesses Are Meeting Their Carbon Pledge

This eBook, by Honeywell Building Technologies and published in October 2022, highlights the importance of committing to net-zero carbon emissions and provides insights into how businesses are achieving this goal. The eBook begins with an overview of the current state of carbon emissions and the urgent need to reduce them to limit the impacts of climate change. It then discusses the different ways that businesses can commit to net-zero carbon emissions, including setting science-based targets, adopting renewable energy sources, and implementing energy-efficient technologies. The eBook also provides case studies of several businesses that have successfully committed to net-zero carbon emissions, including Microsoft, IKEA, and Schneider Electric. It highlights the strategies that these businesses have implemented to reduce their carbon footprint, including the use of energy-efficient technologies, renewable energy, and carbon offsetting.

(IS-2023-57) Carbon in Buildings - Material Embodied vs Operations Generated

This report was prepared by Greenbuild and GAF roofing and published in October 2022. In new construction, embodied carbon often takes center stage, as it is set by decisions made at the beginning of the building's life cycle and cannot later be altered. Embodied carbon represents emissions from building materials and construction and typically represents 28% of global building sector emissions. The need for resilience doesn't end with initial construction but also with operations. Using Passive Building Design is discussed. Investing in the Building Enclosure and the Impact of Building Codes as well as the cost savings and incentives for High-Performance Buildings are discussed. The challenges, opportunities, and strategies of building sustainability must be embraced as emissions continue to increase, regulatory requirements become increasingly stringent, and economic incentives continue to diversify.

(IS-2023-56) Toronto Part 3 Building Embodied Carbon Benchmarking Report

This report was jointly prepared by contributors at TAF, Mantle, University of Toronto, and the City of Toronto and published in November 2022. The building sector is now considering the embodied carbon in the net zero objectives. This report shows the results of the first attempt to collect and compare embodied carbon results as calculated using whole building life cycle assessments (WBLCA) for Part-3 buildings in Ontario for 41 separate buildings. Methodology

differences make high-quality comparisons between projects difficult. Embodied carbon intensities increase with building height due to increased materials per area and greater subsurface works. Buildings with timber structures seem to have lower embodied carbon (~16% lower). Including sequestration makes this difference significant (~59% lower). Any future policy should provide clear guidance for required life cycle phases, objects of assessment, material quantity data sources, and treatment of carbon sequestration. While there is some 'noise' in the results due to variations in methodology, scope of assessment, and tools used by the teams these results are an important first step in understanding embodied carbon results in the City of Toronto and other Ontario municipalities.

(IS-2023-55) Building Back Better - Key Challenges In Reaching A Net Zero Built Environment

This whitepaper, by KPMG and Planon published in November 2022, informs real estate developers, investors, and occupiers, on what their businesses are up against in reaching their sustainability goals. It specifically outlines: why real estate organisations are central to tackling carbon emissions, the governmental policies in place to accelerate net-zero building initiatives, the challenges of designing and constructing net-zero buildings, the challenges of implementing net-zero principles across real estate investments, and the challenges of developing a net-zero corporate real estate portfolio and operations.

(IS-2023-54) Building Analytics Comparison Guide

This whitepaper, published by Clockwork Analytics in 2020 and modified in November 2022, describes the importance of FDD in HVAC systems and its potential benefits. The paper defines FDD as a process that uses software algorithms to identify faults and diagnose problems in HVAC systems. The paper discusses the challenges faced by building owners and operators in maintaining HVAC systems, and how FDD can help to address these challenges by detecting and diagnosing faults early, reducing energy consumption and costs, and improving the lifespan of the equipment. The paper also discusses the different types of FDD methods available, including rule-based methods and model-based methods, and the advantages and disadvantages of each. It highlights the importance of data collection and management in the FDD process, as well as the importance of working with qualified and experienced FDD service providers.

(IS-2023-53) Building A More Resilient America

This whitepaper was prepared by Tony Cho, CEO and Founder of Future of Cities and published by Greenbuild in October 2022. Solutions to today's sustainability issues must involve a collaborative worldwide community. We must build a country that will stand the test of time and lead the rest of the planet in making fundamental changes. This whitepaper defines how experts in the Greenbuild community on their take on the interconnection between sustainability and resiliency, the difference between sustainability and resiliency, how the U.S. government factors into sustainable development, and the challenges the U.S. faces in reaching a more resilient country

(IS-2023-52) Assuring Trustworthiness in Dynamic Systems Using Digital Twins and Trust Vectors

This paper was authored by A. Budiardjo, J. Geater, F. Hirsch, M. Pfeifer, D. Richter and published by the Digital Twin Consortium on October 25, 2022. The paper provides guidance to help organizations design digital twins securely and safely for digital transformation. It presents an understandable and interoperable model for digital twins' security and safety assurance that satisfies all stakeholders: technical, business, and regulatory.

(IS-2023-51) Accelerating Carbon Neutrality

This report, published by Enerbrain for AI4Cities on November 3, 2022, presents a comprehensive analysis of the potential of AI-based solutions to accelerate carbon neutrality in urban environments. The report first provides an overview of the AI4Cities project and its objectives. It then discusses the challenges faced by cities in achieving carbon neutrality and the role that AI can play in addressing these challenges. The report highlights several AI-based solutions that can contribute to reducing carbon emissions in cities. These include smart building systems, intelligent mobility solutions, and energy management systems. The report also discusses the potential of AI to optimize renewable energy generation and distribution, improve waste management processes, and enhance air quality monitoring

(IS-2023-50) A Guide to Measurement & Verification of Heat Pump Retrofits in Multi-Unit Res Buildings

This report was prepared by Rushby Energy Solutions and published by The Atmospheric Fund on October 12, 2022. TAF commissioned this guide to support their Retrofit Accelerator program, which aims to increase the pace, scale, and ambition of retrofits that include heat pumps which require a large capital investment. This guide is intended for building owners, condo board members, and property managers to ensure heat pump installations are generating the expected energy savings, thus increasing heat pump adoption and encouraging electrification across the multifamily sector. It outlines M&V procedures and recommendations for heat pump retrofits, focusing on space heating retrofits in electrically heated MURBs. However, many of the principles can also be applied to heat pump retrofits in gas-heated buildings. IPMVP Option C is the recommended option for heat pump retrofits in MURBs. However, there are some scenarios when other IPMVP Options are recommended.

(IS-2023-49) The growing role of PPAs in corporate power purchasing

This report was prepared by the PV Magazine Group. The report deals with the growth of European corporate power purchase agreements (cPPAs) in solar, wind, renewables, and biomass. The growth is attributed to cPPA's renewable capacity online, channel private investment into new projects, and support EU climate and energy targets in a cost-effective manner. A case study from Spain is included. The main takeaway is that strong policy support is essential for long-term growth of cPPAs.

(IS-2023-48) Moving the Needle on Comprehensive Commercial Retrofits

This report was authored by Rohini Srivastava and Jasmine Mah from ACEEE and published on May 2, 2022. The report provides an assessment of programs that support and advance comprehensive retrofit projects. A literature review is presented along with interviews of experts in the field. Recommendations and resources are included to help increase the scale and scope of commercial retrofit programs. The main takeaway is that comprehensive retrofits achieve 15–40% energy savings.

(IS-2023-47) Leveraging AMI for the Low Voltage Landscape

This report was by prepared Itron and published on February 16, 2022. The report presents best practices for leveraging multi-purpose networks that support advanced metering infrastructure (AMI) to manage low-voltage applications. Insight is provided regarding plans for managing grid-edge devices as they are deployed at scale, along with the ways in which utilities are prioritizing grid management use cases. The main takeaway is that many utilities across the globe are planning to implement low-voltage applications and are finding opportunities for real-time data from EV charging programs.

(IS-2023-46) Industrial Heat Pumps - Electrifying Industry's Process Heat Supply

This report was authored by Ed Rightor, Paul Scheihing, Andrew Hoffmeister, Riyaz Papar from ACEEE and published on April 13, 2022. The report examines the industrial heat pump (IHP) market, economics, industrial needs, and electrification potential to reduce energy and greenhouse gases. Also included are the enablers of research, development, and deployment of IHPs. The main takeaway is that IHPs can save up to 32% of the source energy for process heat generation.

(IS-2023-45) EnergySage Solar Marketplace Intel Report

This report was authored by Vikram Aggarwal from EnergySage and published in March 2022. The report provides a review of trends in pricing, equipment preference, and marketplace data for residential solar energy. Furthermore, it covers the new dynamics that have emerged in both the solar and storage industries throughout the second half of 2021, impacting solar pricing and consumer preferences for storage. The main takeaway is that financial savings are the main driver for consumers to pursue solar energy storage options.

(IS-2023-44) Progress & Pitfalls on the road to Net-Zero

This report was authored by Lance, Angel and published in February 2022 by National Public Utilities Council. It presents the results of a survey of 70 utility representatives in the US regarding climate change and net-zero plans. It is reported that global policy efforts to combat climate change are considered ineffective, and the new infrastructure law will predominantly drive investments in energy storage and renewables. Although It is expected that incremental change will be seen in an industry that is notoriously slow to change like electric utilities, the cost is seen as the main barrier to becoming net-zero utilities. It concludes that addressing the climate crisis will require investments in key technologies and stakeholder collaboration to

overcome delays in deploying a cleaner electric grid.

(IS-2023-43) Office of the future revisited

The report "Office of the future revisited" by Cushman & Wakefield is a follow-up to their 2016 report on the future of the workplace. The report examines how trends in technology, sustainability, and wellness are impacting the design and use of office space. It argues that technology has transformed the way people work, with increased flexibility and mobility. Additionally, the report highlights the importance of sustainability, with companies using green buildings and renewable energy to meet their climate targets. Finally, the report emphasizes the importance of creating a workplace culture that prioritizes employee wellness, as it has become a key factor in attracting and retaining talent. Overall, the report provides insights into the evolving nature of workspaces and how companies can adapt to meet the changing needs of their employees.

(IS-2023-42) Building Decarbonization Solutions for the Affordable Housing Sector

This report, authored by York, Dan, et al. from ACEEE on April 2022, focuses on the need to decarbonize buildings in the affordable housing sector, which is a key component of achieving greenhouse gas emissions reduction targets. The report discusses the key barriers to decarbonization in this sector, such as financing and lack of technical capacity, and provides a range of potential solutions, including leveraging incentives and financing programs, engaging with stakeholders, and advancing technology and innovation. The report also highlights successful examples of building decarbonization in the affordable housing sector and identifies opportunities for further action and collaboration to drive progress towards decarbonization goals.

(IS-2023-41) Using Software and Other Technologies to Make Renewable Energy a Cost-Effective Reality

This briefing paper, published by Harvard Business Review Analytics Services in January 2022, discusses how software and other technologies can be used to make renewable energy more cost-effective. The authors highlight the challenges of renewable energy project management and how technologies such as SiteTracker and Salesforce can help address these challenges. They also emphasize the importance of data analytics and machine learning in optimizing renewable energy production and reducing costs. The paper provides case studies and examples of companies that have successfully implemented these technologies to improve their renewable energy operations.

(IS-2023-40) Smart Buildings and the Battle for Sustainability

This whitepaper, published in March 2022, discusses the emergence of smart buildings, which are defined as buildings that use technology to enable efficient and economical use of resources while creating a safe and comfortable environment for occupants. The whitepaper explains how smart buildings offer advantages such as reduced costs, space optimization, and minimized

environmental impact. However, concerns about privacy and security need to be addressed. The smart building ecosystem comprises building infrastructure management, security and access management, and energy management. Finally, the paper describes the key vertical markets of smart buildings, which are commercial and industrial buildings, healthcare buildings, and residential buildings.

(IS-2023-39) Empowering Green Hydrogen: Data's key role in sustainable energy generation

This whitepaper on green hydrogen was published by Aveva in May 2022. As the world transitions to sustainable energy sources, the hydrogen economy represents a significant opportunity for energy producers with the right tools and strategies to evolve alongside it. The green hydrogen value chain will be more complex and involve more stakeholders than those of conventional energy sources, and without solid digital tools, companies will find it difficult to take full advantage of all the hydrogen economy has to offer. This whitepaper details the market trends and pressures driving investment in hydrogen, the predicted scale and scope of future hydrogen applications, the benefits of, and challenges to, participating in the hydrogen economy and the tools and strategies companies will need to enter the hydrogen ecosystem.

(IS-2023-38) Smart Locks and Access Control Supply Chain: Scaling Innovation

This report, authored by Jennifer Kent from Parks Associates and published on May 24, 2022, discusses the results of a survey conducted by Parks Associates on the adoption of smart home technology and specifically focuses on the usage of smart locks. The survey found that only a small percentage of households currently have smart locks installed, with concerns over security and price being the main barriers to adoption. The paper suggests that manufacturers can increase adoption by addressing security concerns, improving ease of use, and offering lower-priced options. Additionally, the paper identifies the potential for smart locks to be integrated with other smart home devices, leading to increased convenience and security.

(IS-2023-37) Smart Cities World Trend Report 2022 - Governance and Citizen Engagement

This trend report, by SmartCitiesWorld and published on June 24, 2022, discusses the role of citizens in shaping smart city governance, including the importance of transparency, accountability, and participation in decision-making processes. The report also highlights several case studies from around the world, showcasing how cities are working to engage citizens in the development and implementation of smart city initiatives. The report concludes with recommendations for cities on how to build trust and foster collaboration with citizens, such as creating accessible channels for citizen engagement, utilizing data and technology to improve citizen services, and prioritizing inclusive and equitable outcomes.

(IS-2023-36) Indoor green wall affects health-associated commensal skin microbiota and enhances immune regulation: a randomized trial among urban office workers

This report was authored by L. Soininen, M. I. Roslund, N. Nurminen, R. Puhakka, O. H. Laitinen, H. Hyöty, and A. Sinkkonen from University of Helsinki, and the ADELE research group and

published on April 20, 2022. Discussed in the report is the impact of air-circulating green walls on bacterial abundance and diversity on human skin, and on immune responses determined by blood cytokine measurements. Based on an experiment involving a control group (no exposure to green air-circulating walls) and experimental group (exposed to air-circulating green walls), the main takeaway is that air-circulating green walls may induce beneficial changes in a human microbiome.

(IS-2023-35) The [Connected] Home is Where the Heart is: User Interface Design for Smart Appliances

This report, prepared by The Qt Company and published on October 21, 2021, explores the design trends and considerations for creating user interfaces (UIs) for smart appliances. The paper discusses the importance of creating intuitive and user-friendly interfaces for smart appliances, which are becoming more prevalent in households. The authors also emphasize the need to provide a consistent and cohesive UI experience across all devices and platforms, including mobile and web applications. The whitepaper also covers various design trends and best practices, such as using natural language processing, gesture recognition, and voice control. Additionally, the paper highlights the significance of user testing and feedback in creating effective UI designs.

(IS-2023-34) Smart Home with Batteryless Wireless Technology

This report, prepared by EnOcean Alliance and published on November 19, 2021, provides a comprehensive summary of what constitutes a "Smart Home", with a focus on batteryless wireless technology. The advantages of EnOcean's wireless technology are presented and include product interoperability, flexibility, reduced installation cost, free maintenance, and no reliance on batteries. The main takeaway is that the smart home market is expected to grow significantly and will rely on the integration of open interfaces, different standards, and technologies to enable homeowners to create flexible solutions.

(IS-2023-33) Measurement of CO2 Concentrations in Temperature Changes

This report was prepared by the AsahiKasei Group and published on November 12, 2021. The report deals with a comparison of temperature characteristics between Senseair's CO2 sensor and the competitor's products, all which play an important role in monitoring buildings' air quality. A new evaluation system was constructed that keeps a stable CO2 concentration and constant CO2 temperature. The main takeaway is that only Sensair's CO2 sensor achieved the required accuracy of 75 parts per million as required by the Green Building Certification Program (LEED).

(IS-2023-32) LoRaWAN in building automation

This report was prepared by DEOS.AG and published on May 1, 2022. The report deals with the Long Range Wide Area Network (LoRaWan) energy-efficient wireless technology and how it can be applied for building automation. Key components of LoRaWan are examined from networking

and device perspectives. A practical application of LoRaWan to smart buildings is presented, along with its comparison to Wi-Fi and Bluetooth technologies. The main takeaway is LoRaWan's wide scope of benefits that include long-distance range and deep building penetration, long battery life, low cost of infrastructure, and widespread use in cities and communities.

(IS-2023-31) How the Next Generation of Community Solar Can Unlock New Value Streams and Help Communities Pursue Holistic Decarbonization

This report was authored by Stephen Abbott, Amanda Farthing, Matthew Popkin, and Madeline Tyson from RMI and published on April 11, 2022. The first generation of community solar allowed for greater access to solar energy for residential customers, but equitable access to renewable energy requires deliberate policy and program design. The concept of Community Solar+ introduces the idea of strategically deploying community solar projects to maximize local value streams and advance community-wide sustainability and equity goals. Four core value streams are identified: accelerating investment in EV charging infrastructure, increasing energy resilience for critical assets and vulnerable communities, aligning evolving grid and customer needs for an electrified future, and creating a more equitable energy system. The report offers a hypothetical financial model and case studies demonstrating Community Solar+ strategies already under development in Denver, San Antonio, and Washington, D.C. The report concludes with recommendations for local governments, states, utilities, and other key stakeholders seeking to embrace this emerging practice.

(IS-2023-30) The Truth About Corporate Real Estate Data and Insights

This report was prepared by JLL Technologies and published on September 6, 2022. When it comes to data and insights for corporate real estate (CRE), not all business intelligence (BI) solutions are created equal. Many CRE organizations face challenges that prevent them from effectively using their data to make more informed decisions. But they see the value in it, and research from Forrester Consulting reveals CRE leaders' plans to use data and insights from BI platforms to optimize their portfolios, operations, and workplaces. This white paper examines the challenges around leveraging portfolio data to optimize real estate investments, the challenges of addressing operational processes with data and insights and plans to invest in technology to improve building operations and efficiency.

(IS-2023-29) Why Wi-Fi 6 goes hand-in-hand with cellular to enable the hyper-connected enterprise future

This whitepaper, prepared by Quectel and published on February 16, 2022, discusses the new Wi-Fi 6 standard, which is designed to offer faster speeds, improved reliability, and increased capacity for wireless networks. It explains the key features of Wi-Fi 6, including improved modulation and coding techniques, MU-MIMO, and OFDMA, and how they improve the performance of Wi-Fi networks. The paper also compares Wi-Fi 6 to previous Wi-Fi standards and highlights its benefits for different industries, including healthcare, education, and transportation. Additionally, it provides information on the various applications and use cases of Wi-Fi 6 and discusses the challenges and solutions in implementing this new standard.

(IS-2023-28) Simplifying the IoT Edge - Smart Spaces Best Practices

This whitepaper, from Parks Associates, published on April 29, 2022, discusses the growing complexity of the Internet of Things (IoT) ecosystem and the challenges associated with deploying IoT devices at the network edge. It highlights the importance of simplifying the deployment and management of IoT devices to enable the full potential of the IoT ecosystem. The paper identifies key factors driving the complexity of IoT deployments, including device heterogeneity, data security, and network connectivity. It also proposes a new approach to simplifying IoT deployments, which involves the use of an IoT edge platform that provides a unified management and security framework for IoT devices. The paper discusses the benefits of this approach, including reduced deployment and management costs, improved security, and increased scalability. Finally, it provides recommendations for organizations looking to implement an IoT edge platform, including evaluating platform providers based on their security capabilities and interoperability with existing infrastructure.

(IS-2023-27) Is the Industry - And The World - Ready For 5G Advanced?

This report, by ABI Research, published on July 12, 2022, discusses the readiness of the industry and the world for 5G advanced, the next generation of 5G technology. It highlights the various features and benefits of 5G advanced, including higher data rates, lower latency, and improved energy efficiency. The report also discusses the challenges associated with deploying 5G advanced, such as the need for new infrastructure and the potential impact on existing networks. It provides insights into the current state of the industry and the key trends driving the adoption of 5G advanced, including the growing demand for high-speed data and the increasing use of IoT devices. The report also includes case studies of companies that are leading the way in deploying 5G advanced, as well as recommendations for organizations looking to implement this new technology. Overall, the report suggests that while there are challenges associated with 5G advanced, the benefits it offers make it a promising technology for the future of wireless communications.

(IS-2023-26) Is subscription-based the future of physical security?

This whitepaper was prepared by Siemens and published on February 8, 2022. In the business world, Software as a Service, or SaaS, is nearly fully mature. Largely replacing the on-premises delivery model, SaaS has delivered enormous value to businesses, large and small, in the form of lower costs, faster commissioning, better quality of product, a smoother user experience and cost-efficient scalability. But what are the barriers to entry for Security as a Service? Why is it experiencing this surge in popularity? And what does the future hold for this relatively new offering? Will the trend continue or fade quickly into the technology memory hole? And how should companies evaluate whether to take advantage of this new business model? This whitepaper addresses the barriers to entry for Security as a Service and provides security decision-makers with insights into the risks and opportunities.

(IS-2023-25) Are utilities prepared to prevent and solve cyberattacks?

This whitepaper, by Ericsson published on April 1, 2022, discusses the growing threat of cyberattacks in the telecommunications industry and the potential impact on 5G networks. It highlights the various types of cyber threats that telecommunications companies face, including DDoS attacks, malware, and data breaches. The paper also discusses the unique security challenges associated with 5G networks, such as the increased number of connected devices and the need for real-time data processing. It provides recommendations for telecommunications companies to improve their cybersecurity posture, including implementing a layered security approach, conducting regular security assessments, and investing in security technologies such as AI and machine learning. The paper also highlights the importance of collaboration between industry stakeholders, such as service providers, vendors, and regulators, to address cybersecurity threats and improve overall network security.

(IS-2023-24) Technology Advances Are Changing the Facilities Management Role

This report was authored by Edward Wagoner from JLL Technologies and published on August 2, 2022. Innovative software technologies are automating, streamlining, and disrupting facilities management (FM). Discover the job skills necessary for keeping up with the technologies changing the FM world. This whitepaper addresses how FM job descriptions have changed over the years in response to technological innovations and the knowledge gaps keeping FMs from higher job performance and greater career flexibility.

(IS-2023-23) Introduction to Smart Systems

This report, prepared by Harbor Research and published in May 2022, The article discusses the evolution of "smart systems," which are integrated and interconnected networks of sensors, devices, and applications that work together to collect and analyze data and provide intelligent insights and actions. The article highlights the growing importance of smart systems in various industries, including manufacturing, healthcare, and smart cities. It provides examples of how smart systems are being used to improve efficiency, reduce costs, and enhance customer experiences. The article also discusses the challenges associated with implementing smart systems, such as data privacy and security concerns and the need for skilled professionals to manage and maintain these systems. The article concludes by emphasizing the importance of a holistic approach to smart systems, including a focus on interoperability, scalability, and sustainability.

(IS-2023-22) Doing IoT Right: Top Practices for Multi-Dwelling Units

This whitepaper, authored by Kristen Hanich from Parks Associates and published on May 2, 2022, discusses the growth and potential of the "MDU IoT" market, which refers to smart home technologies and devices installed in multi-dwelling unit (MDU) buildings such as apartments and condominiums. The paper highlights the unique challenges associated with deploying smart home technologies in MDUs, such as limited space and the need to ensure privacy and security for residents. The paper also discusses the opportunities for companies in the MDU IoT market,

including the potential for new revenue streams and improved resident satisfaction. The paper provides examples of successful MDU IoT deployments, such as energy management systems and connected security devices, and offers recommendations for companies looking to enter the MDU IoT market, such as developing scalable and interoperable solutions and building partnerships with MDU property owners and managers. The paper concludes by emphasizing the importance of a resident-centered approach to MDU IoT, with a focus on convenience, ease of use, and privacy and security for residents.

(IS-2023-21) The ROI of Construction Technology

The Procore ROI report, published on April 11, 2022, presents findings on the return on investment (ROI) of using Procore construction management software. The report includes data from interviews with Procore customers who shared their experiences with using the software and the benefits they have gained from it. The report presents several key findings, including that companies using Procore experience increased efficiency, cost savings, and improved collaboration among team members. The report provides specific examples of these benefits, such as reducing change orders and increasing project completion rates. The report also highlights the positive impact of Procore on employee satisfaction and retention. Finally, the report offers a tool for estimating the potential ROI of using Procore based on a company's size and type of construction projects. Overall, the report provides evidence to support the value of using Procore for construction project management.

(IS-2023-20) A Cybersecurity Threat Profile for a Connected Lighting System

The report prepared by the U.S. Department of Energy's Building Technologies Office, in February '2022, provides a cybersecurity threat profile for networked building systems, which includes building automation systems, lighting systems, HVAC systems, and more. The report outlines the potential vulnerabilities and risks associated with such systems, which can lead to data breaches, property damage, and even physical harm to occupants. It also identifies the potential threat actors, such as nation-state actors, hacktivists, and cybercriminals, and their motivations for targeting building systems. The report offers recommendations for securing building systems, such as implementing strong passwords and user authentication processes, conducting regular security assessments, and training employees on cybersecurity best practices. The report also emphasizes the need for collaboration between building owners, manufacturers, and cybersecurity experts to address the evolving threat landscape and to ensure the security and resilience of building systems.

(IS-2023-19) Powering nodes of wireless sensor networks with energy harvesters for intelligent buildings: A review

This paper, published on February 23, 2022 in the Elsevier Energy Journal, discusses the role of intelligent buildings in efficient energy management but also highlights the challenges in their energy use, particularly in powering wireless sensor networks. The paper proposes energy harvesters (EHs) as a solution to power sensor nodes in buildings, complementing the use of batteries and extending their lifetimes. The study reviews various EH technologies currently

under the experimental or development phase that can extract power from environmental sources such as mechanical motion, thermal, light, radio-frequency, and fluid flow. The potential sites and building systems for extracting power through EHs are presented, along with the challenges and opportunities for each technology. The research findings indicate that EHs can generate enough power to partially or completely supply the power demands of sensor nodes in intelligent buildings.

(IS-2023-18) What Are the Building Blocks for Designing Smart Buildings

This paper, published by CFE Media - Consulting-Specifying Engineer on September 8, 2022, discusses the implementation of artificial intelligence (AI) in smart building systems to enhance their efficiency, security, and sustainability. The paper highlights the benefits of AI, such as predictive maintenance, optimized energy consumption, and improved occupant comfort. The paper presents several use cases where AI is being utilized in smart buildings, including energy management, fault detection, and predictive maintenance. It also discusses the challenges of implementing AI in smart buildings, such as data privacy concerns and the need for advanced algorithms and computing infrastructure. The paper emphasizes the importance of integrating AI with other smart building technologies such as IoT sensors and cloud computing platforms to create an interconnected and intelligent building ecosystem. It also highlights the potential for AI to improve building resilience and support disaster response efforts. The paper concludes by calling for further research and development in AI and smart building technology to create more sustainable, efficient, and secure buildings. It also emphasizes the importance of collaboration between industry stakeholders, policymakers, and researchers to address the challenges and opportunities presented by the adoption of AI in smart buildings.

(IS-2023-17) Smart Building Connectivity Network

This whitepaper, published by TIA on September 16, 2022, discusses the importance of connectivity in smart building design, operation, and maintenance. It highlights the benefits of a robust connectivity network, including increased energy efficiency, enhanced occupant comfort, improved safety and security, and reduced operating costs. The document presents several case studies demonstrating how advanced connectivity technologies such as Wi-Fi, 5G, and cellular networks are being used to create intelligent and connected building systems. The paper also identifies the challenges of implementing a reliable connectivity network, including the need for adequate bandwidth, proper network architecture, and security protocols. It emphasizes the importance of selecting the right connectivity technology for a specific building environment, based on factors such as building size, use case, and location. The paper concludes by emphasizing the need for collaboration between building owners, operators, and technology providers to ensure that smart building connectivity solutions meet the evolving needs of building occupants and the larger community.

(IS-2023-16) How to Improve Indoor Air Quality While Minimizing Energy Consumption

This whitepaper, published by Schneider Electric on August 9, 2021, focuses on how building owners and facility managers can meet the new expectations of building occupants by improving

indoor air quality. It also outlines how to control energy use and costs while implementing these return-to-work solutions.

(IS-2023-15) How Does Thermal Comfort Differ in Smart vs Normal Buildings

This report, published by AZoM.com Limited T/A on September 8, 2022, explores how the adoption of smart building technology affects thermal comfort in comparison to traditional buildings. The study involves analyzing data collected from occupants in both types of buildings using thermal comfort surveys and measuring environmental variables such as air temperature, humidity, and air velocity. The results suggest that smart buildings provide more precise and comfortable indoor conditions due to advanced control systems that adjust the environment to suit the occupant's preferences. Additionally, smart building technology provides more flexibility in individualizing the thermal comfort settings for occupants, leading to improved satisfaction levels. However, the study also identifies challenges such as higher energy consumption and costs associated with implementing and maintaining smart building technology. The report concludes that while smart building technology offers benefits for thermal comfort, a balance between energy efficiency and occupant satisfaction should be achieved to ensure sustainable and comfortable indoor environments.

(IS-2023-14) Help Wanted - Tech-Savvy Talent to Lead Smart Buildings Into the Future

This article by Betsy Conroy, published by Smart Building Technologies on September 7. 2022, discusses the growing demand for skilled professionals in the smart building industry and the need for workforce development programs to train individuals for these positions. The article highlights the various job roles that are emerging in the smart building industry, such as building automation engineers, data analysts, and cybersecurity specialists. It also discusses the importance of developing a diverse and inclusive workforce to ensure that the industry can benefit from a range of perspectives and experiences. The article suggests that industry stakeholders should collaborate to create training programs and apprenticeships that can help individuals acquire the skills and knowledge needed to succeed in the smart building industry. Overall, the article emphasizes the importance of investing in workforce development to support the growth of the smart building industry and address the skills gap that currently exists.

(IS-2023-13) The CMMS Solution to Facilities Management

This report, published by JLL Technologies on June 29, 2022, discusses how Computerized Maintenance Management Systems (CMMS) can benefit facilities management by improving maintenance planning, asset management, and overall operational efficiency. The report highlights several key features of a CMMS, including work order management, asset tracking, and preventive maintenance scheduling. It also provides case studies to demonstrate the benefits of implementing a CMMS in various types of facilities, such as hospitals, universities, and commercial office buildings. Overall, the report suggests that a CMMS can help facilities management teams streamline their operations, reduce costs, and improve the overall performance of their assets.

(IS-2023-12) The Business Case for Intelligent Buildings

This report published by Arcadis on June 29, 2022, provides an overview of the benefits of intelligent buildings and how they can help organizations achieve their business goals. It discusses the various technologies and systems that can be integrated into intelligent buildings, such as building automation systems, energy management systems, and smart lighting systems. The report also highlights several case studies to demonstrate the financial benefits of implementing intelligent building solutions. Overall, the report suggests that investing in intelligent buildings can improve the operational efficiency, sustainability, and occupant experience of buildings while also delivering a strong return on investment for businesses.

(IS-2023-11) Comprehensive Approach for Physical and Digital Spaces

This whitepaper, authored by Siemens and published on February 8, 2022, discusses the integration of artificial intelligence (AI) and machine learning (ML) technologies into building automation systems (BAS) and how they can improve building performance, occupant comfort, and energy efficiency. The report emphasizes the importance of data collection and analytics in AI and ML models, which can lead to actionable insights and proactive maintenance, reducing energy waste, and improving indoor air quality. The document also provides examples of AI and ML applications, including fault detection and diagnostics, predictive maintenance, and occupant behavior analysis. Additionally, the report mentions the challenges associated with AI and ML integration, such as data quality, privacy concerns, and the need for skilled personnel.

(IS-2023-10) Commercial Real Estate and Air Quality Safety

This whitepaper authored by Blueair and published on December 8, 2021, discusses the potential health risks of poor indoor air quality and the importance of monitoring and maintaining good air quality in buildings. It emphasizes that air quality can have a significant impact on the health, productivity, and comfort of building occupants. The document also explores various strategies and technologies for monitoring and improving air quality, such as ventilation systems, air filters, and air quality sensors. Overall, the document highlights the importance of prioritizing air quality safety in building design, construction, and maintenance to ensure the well-being of occupants.

(IS-2023-9) Clean Indoor Air - The Guide

The report discusses the impact of the COVID-19 pandemic on the building automation and control systems (BACS) industry. The pandemic has accelerated the adoption of new technologies and approaches, such as the increased use of remote monitoring and control systems, the integration of indoor air quality sensors, and the implementation of touchless systems. The report also highlights the need for building owners and managers to focus on sustainability, resiliency, and flexibility in their buildings to ensure occupant health and safety. Furthermore, the document stresses the importance of cybersecurity measures for BACS systems, given the increased reliance on digital technologies and the potential for cyberattacks.

(IS-2023-8) Zero Carbon Building - Performance Standard

Canada Green Building Council's Zero Carbon Building Standard (ZCB Standard) Version 2 - Performance was published on June 21, 2022. The ZCB Standard sets out the requirements for new and existing buildings to become zero-carbon by 2030. The Performance version of the standard provides a framework for designing and operating buildings to achieve zero carbon performance over time. The document includes requirements for energy efficiency, on-site renewable energy, and carbon offsets. It also provides guidelines for measuring and verifying building performance, as well as a scoring system to evaluate a building's performance against the standard.

(IS-2023-7) Zero Carbon Building - Design Standard

This is the third version of the Zero Carbon Building (ZCB) Design Standard developed by the Canada Green Building Council and published on June 20, 2022. The standard provides guidance on designing and constructing commercial, institutional, and multi-unit residential buildings to achieve zero carbon emissions, with an emphasis on energy efficiency and the use of renewable energy sources. The standard includes three pathways for achieving zero carbon: energy efficiency, on-site renewable energy, and off-site renewable energy. It also sets performance metrics for various building components, including envelope, lighting, HVAC systems, and renewable energy systems, as well as requirements for monitoring and reporting energy consumption and carbon emissions. The standard also includes a section on carbon offsets and the use of renewable natural gas.

(IS-2023-6) The Canada Green Buildings Strategy

The Canada Green Building Strategy Discussion Paper, published by Natural Resources Canada in July 2022, presents a national framework for improving the environmental performance of buildings. The paper outlines the benefits of green buildings, identifies gaps and challenges in the current building industry, and proposes strategies to improve energy efficiency, reduce carbon emissions, and promote sustainable building practices across Canada. The proposed strategies include enhancing building codes, standards and rating systems, improving access to financing and incentives, and increasing education and training for industry professionals and the public. The paper also highlights the importance of collaboration and stakeholder engagement in achieving these goals.

(IS-2023-5) Fuel-Switching Hydronic Systems to Low-Carbon with Air-to-Water Heat Pumps

Mitsubishi Electric published a report on February 8, 2022, highlighting the benefits of using air-to-water heat pumps for year-round heating and cooling, which are extremely efficient and can minimize the need for natural gas. Intertek evaluated the performance of Mitsubishi Electric's air-to-water heat pumps in 3 typical buildings located in Toronto, Vancouver, and Montreal with different climates, and confirmed that energy savings and carbon emission reduction can be achieved with a heat pump in various cold climates. The report also noted that a natural gas boiler was needed to supplement the building's heating needs only on extremely cold days, and

that having an electric heat pump with a supplementary natural gas boiler provides energy diversity and redundancy, ensuring a reliable heating source in case any system goes off grid.

(IS-2023-4) 2022 Migration Patterns - The Ripple Effect

This report, authored by Placer Labs, and published in August 2022 focuses on the ripple effect of recent migration trends. Placer Labs used foot traffic data to show how a small influx of residents can influence a city's office occupancy rates, create commercial opportunities, and impact how retailers serve their communities. The whitepaper answers the following questions:

Where is population growth driving a strong workplace recovery?

Why are national chains now looking to expand in smaller markets?

How does domestic migration impact local retail and dining preferences?

(IS-2023-3) 8 Trends That Will Shape Real Estate And Facility Management By 2027

This whitepaper, authored by Planon and published on June 28, 2022, explores 8 disruptive trends that are currently solidifying and explains the extent of their impact on the CRE & FM domain in the next 5 years. What is happening around the topic of sustainable FM? What technology is there to support? What post-pandemic consequences should be considered?

(IS-2023-2) PoE lighting Benefits and Design Considerations

This whitepaper authored by Panduit Corp. and published on June 10, 2022 discusses the concept of a "digital building," which refers to the convergence of smart devices to manage the day-to-day operations of facilities. It notes that traditionally, buildings have separate networks for various systems, but new technologies are creating the possibility of a single converged digital building network. Power over Ethernet (PoE) lighting is identified as a core component of this digital building revolution, as it merges advances in LED lighting with PoE IP networking, creating a Building Internet of Things (BIoT) component.

(IS-2023-1) How to Achieve Sustainable Indoor Air Quality

A Roadmap to Simultaneously Improving Indoor Air Quality & Meeting Building Decarbonization and Climate Resiliency Goals published by EvVerid on August 5, 2022. The whitepaper discusses the importance of indoor air quality in commercial workspaces, particularly in the context of attracting employees back to the office amid concerns over COVID-19 variants. The whitepaper emphasizes the negative impact of poor indoor air quality on employee productivity and health, and the need for building owners and operators to prioritize improving indoor air quality while also meeting energy conservation and climate resiliency goals. It also presents a four-step Clean First framework for achieving sustainable indoor air quality, which includes defining IAQ goals, cleaning indoor air, optimizing ventilation, and monitoring and controlling IAQ.

(IS-2022-161) The Future of Work Survey 2022

This 2022 Future of Work Survey was authored by Dr. Marie Puybaraud and the JLL's Global research team and published on August 16, 2022. This survey reports on the unprecedented experience of the global public health pandemic. It shows the rapid acceleration of the large-scale adoption of dynamic and flexible working, the growth of workplace technologies to support CRE (corporate real estate) functions in managing these new workstyles, and increased investment to bolster environmental sustainability goals. The power has shifted from the employer to employees, forcing organizations to reimagine workplace and portfolio strategies; and the greater application of technology is becoming crucial to boosting performance levels on all fronts. JLL has surveyed 1,100 strategic decision-makers in businesses around the globe. Offering hybrid working options will be critical to attracting and retaining talent. Without sustained investment in technology and data, it will become more challenging to achieve performance and resilience goals.

(IS-2022-160) The 2022 Tenant Engagement Report

This 2022 Tenant Engagement Report was authored by HqO and published on Jan 14, 2022. The year 2021 was a formative, transitionary period for owners and operators of commercial real estate (CRE) properties. Between growth, consolidation, and significant funding in the PropTech market and evolving workforce needs due to the pandemic, CRE leaders faced an array of new challenges to overcome including how to add value to buildings in ways that support every person who spends time in and around the workplace. HqO surveyed over 100 of the world's leading companies and found that 54% of properties have staff dedicated to tenant experience; 86% of property teams use a building app to communicate with the people in their properties; the many kinds of investments leaders are making to differentiate their assets, attract and retain talent, and achieve financial success; and other critical factors shaping the future of the workplace.

(IS-2022-159) Smart Buildings Balance Efficiency and Tenant Experience

This White paper was authored by Julie Petrone, and published by ABB Building Solutions July 5, 2022. Intelligent buildings open up new possibilities in the building space. As network solutions improve and new IoT services are developed, the buildings industry is leveraging technologies to provide better solutions for energy efficiency and occupant wellness. Digitalization is the driving force behind modern building evolution. Data-driven intelligence and automation have transformed commercial buildings into efficient, sustainable, safe, and comfortable environments that intelligently adapt and respond to people's needs. The networking of a technical building system, which drives efficiency gains, in turn, supports the emergence of new services. The report shows that ABB offers a unified enterprise platform that adds intelligence to buildings and provides a holistic solution for building management, resulting in lower costs and improved ROI over a building's life span, optimized performance and functionality, automated monitoring and control, greater occupant comfort, and enhanced safety and security.

(IS-2022-158) Malls that are Rising to the Top

This White paper authored by Placer Labs, Inc. and published on August 30, 2022, shows how malls are reinventing themselves and staying relevant thanks to experiential offerings, omnichannel options, and strategic tenant selection. Many began to predict the demise and downfall of malls, and that narrative intensified as online shopping grew in popularity. The rise of big-box stores, a focus on "services, not things," and COVID-19 only accelerated these trends. And after two years of isolation and a new, pandemic-induced wave of suburban relocation, malls' potential to bring people together is more prized than ever. Some shopping centers are turning to entertainment to draw crowds into their doors. Others are focusing on offering a full visitor experience that extends beyond simply grabbing a new shirt or a burger at the food court. Top-tier malls are turning to innovative solutions to stay ahead of the game.

(IS-2022-157) Ebook HVAC Summer Edition

This eBook was authored by individual contributors for each topic and published by CFE media on June 30, 2022. The discussions cover the various new methods. technologies and specifications like Divsion 25 and Well V.2 to make the HVAC equipment perform better and also reap the benefits of the digitalization of the new equipment by bringing that data back to a decision-making platform. The topics cover chiller optimization, boilers, and their controls, pumping configurations, and the electrification of our building systems. Each topic covers the issues from the technical capabilities and also the costs and benefits achieved. In many cases, the extra costs up front provide significant operating and energy savings that justify the procurement of better equipment.

(IS-2022-156) Driving Resiliency Through Your Organizations Energy Infrastructure

This report was authored by Ameresco and published on July 26, 2022. In recent years, major weather events, such as hurricanes and wildfires, have exposed vulnerabilities in our energy system that have left many without power for days or weeks, exacting a high cost in terms of lost productivity and quality of life. The price of many distributed energy technologies, such as solar photovoltaic (PV) and energy storage, has dropped precipitously over the last decade, placing them in price parity (or better) with grid-supplied energy. This white paper explores ways in which government agencies, companies, and other organizations can leverage their energy infrastructure to minimize the adverse impacts of major events – in other words, to become more resilient. To date, much of the interest in resiliency has been limited to a few key sectors; however, this white paper, shows that a wide range of organizations are using their energy infrastructure to become more resilient in budget-sensitive ways.

(IS-2022-155) Building Meets Artificial Intelligence

This report was authored by Paul Baumann and published by Siemens on June 20, 2022. The report introduces the many benefits of effective artificial intelligence (AI) in many applications and suggests there are challenges, particularly when connecting and mapping technology within buildings. The topic of AI often causes a split in opinion: making human life easier, and concerns about unethical decisions or the replacement of humans. The subsets of AI in machine learning (ML) using substantial amounts of data from the construction phase and building information

modeling (BIM) are explained. Siemens reports on its Building X, a holistic, open platform of data-driven applications and connectivity solutions for buildings during the operations phase. The platform is based on extendable business services and a common data model that provides a single source of truth for a digital building.

(IS-2022-154) Accelerating Coordinated Utility Programs for Grid-Interactive Efficient Buildings

This report was authored by Kate Strickland & Becca Trietch and published by Smart Electric Power Alliance on July 8, 2022. Grid-interactive efficient buildings (GEBs) are energy- efficient buildings that use smart technologies and on-site distributed energy resources (DERs) to provide demand flexibility while co-optimizing for energy cost, grid services, and occupant needs and preferences in a continuous and integrated way. To help accelerate this GEBs future, building energy programs will need to transition to better integrate conservation and active management of electricity in buildings for the direct or indirect provision of grid services. This study examined the barriers and potential solutions to this building energy program transition with a literature review, survey, focus groups, and one-on-one interviews used to document the industry's current challenges and strategies for success. Solution strategy implementation details, where available, are presented in case studies. By documenting the barriers and key strategies for coordinated EE+DF(+DR) programs, this study aims to support all stakeholders looking to unlock a GEBs future.

(IS-2022-153) The Detailed 5-Step Guide to Ideate Building Performance and Sustainable Design Strategies

This report was authored by COVE.TOOL and published on July 22, 2021. Since each site is different, each project is different, and each client is different, the eBook suggests a consistent way of evaluating building performance across all projects. Developing a decision-making framework is critical for any endeavor and using data-driven design processes solves this problem by using simulations to guide decision-making. In this e-book, they outline 5 key steps design teams can use to simplify building performance and sustainable design analysis and help them implement a repeatable, data-driven process that can be used on hundreds of projects successfully. Site analysis, understanding energy benchmarks, and using a building performance analysis tool, the team can now run through a holistic cost vs energy optimization to test out all the possible combinations for different strategies and pick out the best one.

(IS-2022-152) The Agile and Efficient Digital Building

This report was authored by Panduit Corp and published on June 30, 2022. The report defines the Digital Building as showing the changes to space and amenities as employers are wooing a younger, more collaborative workforce that cares about things like the health and wellness of the workspace and flexible working conditions. The advantages of a digital building go well beyond energy savings and optimized building operations. The report discusses the significant IP network installed by Cisco and the true benefit of a highly connected building. Technology has the potential to transform the operation of buildings. Connecting disparate systems and devices to an IP network allows those systems to share data on occupancy, space usage, temperature,

and more, which makes buildings more responsive and efficient. This also leads to higher employee satisfaction and productivity.

(IS-2022-151) Rethinking Workspaces - Hybrid Workspaces Solutions and Use Cases Outlook

This report was authored by and published by Kontakt.io on March 4, 2022. Occupancy monitoring has become critically important especially as the need for workplace flexibility and safety has grown due to COVID-19 precautions. The report discusses the need to know how many people are in their buildings at any given time, who has been through the building, and what contacts they may have had. It suggests managers rethink the way their space is planned based on utilization data. Accommodating the new trend of hybrid workspaces depends not only on instant access to occupancy levels but historical data on space utilization. The report shows many of the sensors and software applications that provide the data for better occupant usage of the space and additional security and wayfinding capabilities to improve productivity.

(IS-2022-150) Lighting and Lighting Controls - Summer Edition

This eBook was authored by individual contributors for each article from the suppliers and consulting specifying engineers and published by CFE media on June 5, 2022. Each article describes the various ways that lighting control systems contribute to flexible, future-proof buildings. It includes suggestions on upgrading existing lighting systems, addressing cybersecurity, and contributing to energy efficiency. Design features for the health care and school buildings are provided. The eBook contributes to the education on the rapid advancements in lighting and controls from both the engineers' and suppliers' perspectives. Specifying the right system for each job starts with laying out all the design considerations — reliability, responsiveness, security and scalability — asking the right questions about integration, remote system access and system resilience and making sure the manufacturer you choose has a history of service and support that meets your client's needs now and into future.

(IS-2022-149) Lessons from a Heat Pump Retrofit at CityHousing Hamilton

This report was authored by Keith Burrows from The Atmospheric Fund and published on June 14, 2022. The Atmospheric Fund (TAF), working with CityHousing Hamilton (CHH), planned and implemented a pilot project at a three-story multi-family residential building with 40 units. They installed a heat recovery, variable refrigerant flow (VRF) air source heat pump (ASHP) system in three suites to test the performance of the technology under real-world conditions and to provide best practice recommendations. Results showed increased comfort with the addition of colling and while the heating loads were met there were no significant electrical savings when compared to the electric baseboard heaters previously used. This case study provides results, lessons learned, and recommendations. It includes significant detailed information on the measurement and verification methods including the tenant survey results.

(IS-2022-148) IoT for Smart Buildings

The IoT for Smart Buildings authored by Multi-Tech Systems and published June 13, 2022 covers

how wireless sensors, gateways, and analytics leverage the Internet of Things to enable real-time data collection and analysis. It addresses the shared needs of every building that include building security, temperature control, water leakage, and smart restrooms. In this new landscape, facilities managers must evolve to source products, connect devices, and implement processes, which in the past, had been siloed or watched over by a single operator. The report is a summary of key points for facility managers to address, as they look to leverage new advances in their planning and execution of a wide range of Smart Buildings technologies. It contains many case studies showing the benefits of the wireless approach and armed with these new technologies and a better awareness of how they work together, the possibilities are endless.

(IS-2022-147) Green Retrofit Economy Study

The Canadian Green Retrofit Economy Study is a collaboration between The Delphi Group and the Canada Green Building Council (CaGBC) published on June 10, 2022. This report is a summary of findings gained through primary and secondary research between March 2021 and June 2022, building on existing knowledge from thought leaders across Canada and globally. It shows the existing approach to retrofit projects will need to level up and transform into a more systematic ecosystem of aggregated project and investment opportunities. Building owners and managers will need expert support in developing and implementing transition plans to leverage building renewal cycles and market opportunities. It discusses the technologies available today and innovation in training the workforce. Both financing options and policy issues are covered and the different amounts of retrofit potential are shown.

(IS-2022-146) Future-Proof Building Operations to Optimize the Tenant Experience

This eBook was authored by BuildingEngines and published on October 18, 2021. The new normal of tenant experience is very different from pre-pandemic times. Now tenant experience (TeX) is all about cleanliness, air quality, workplace distancing, accurate and consistent communications, information flow, and most importantly—safety. With the average office occupancy rate in the United States currently down to 30 percent, versus normal times at 70 percent occupancy, improving the tenant experience is now a vital component of bringing people back to the office. Property teams and owners can do a lot to make tenants more comfortable and productive once they are back in their building. Occupants need to see a building as a safe space. To achieve this, tenant experience must now be about maximizing the comfort and confidence of occupants' experience in a building. To encourage re-occupancy and lay the groundwork for a successful post-pandemic building, property teams must understand their tenants have changed forever. While flashy amenities, discounts, and events might have won tenant loyalty in the past, tenants now place more value on spaces that promote health, safety, and well-being. This report covers the areas that need improvement.

(IS-2022-145) Energy Efficiency and Savings for Commercial Buildings

This ultimate guide to Energy Efficiency and Savings for commercial buildings was authored by buildingIOT and published on October 14, 2021. The guide explains the significant amount of energy with businesses, government, and commercial sites spending $190 billion every year on

energy-related costs. the EPA suggests that an average of 30% of the energy used in commercial buildings is wasted. Looking at the rising costs and understanding the primary energy-use and waste factors will enable building managers to identify potential areas to target for cost savings. The guide covers many of the areas for improvement. HVAC systems, Lighting, and energy-consuming equipment and devices can have building automation and use fault detection and diagnostics with continuous and actionable analytics that helps to regulate high energy-consuming equipment and devices. Achieving optimal energy consumption requires the collection and organization of essential data for evaluating and addressing energy efficiency over time. With the right analytics partner, you can put in place an analytics system to fulfill this role, enabling you to project future energy usage patterns, and develop goal-oriented energy efficiency and cost savings tactics.

(IS-2022-144) The CRE Playbook for Maximizing ROI on Sustainability

Building Engines, a JLL company, authored this CRE Playbook and published it on May 16, 2022. There is no choice but to face the current and future climate change-induced sustainability challenges for the CRE industry. CRE leaders must begin to do things differently in their buildings. Energy usage must decrease, and efficiency must improve. Tenant demands for healthier and more sustainable workplaces must be met. This playbook for achieving these goals involves technology. Technologies enable property teams to: enhance energy management practices; prioritize health, wellness, and air quality; perform proactive maintenance; prolong equipment lifetimes; measure and evaluate the effectiveness and efficiency of existing systems; plan for capital investments; and achieve key energy certifications.

(IS-2022-143) Smart Solutions - Boosting Revenue in Multifamily Properties

This Smart Solutions eBook was authored by Jennifer Kent at Parks Associates in partnership with SmartRent and published on May 23, 2022. The MDU market is unique for its multiple stakeholders, bulk deployments, and multiple locations for installations. End-user residents, MDU property managers, and building owners benefit directly from proptech. Other ecosystem players are also in a position to capitalize on new demand and value, including smart home solution vendors, ISPs, insurance agencies, security providers, and installers. This whitepaper addresses how connected devices benefit multifamily owners and property managers, from improving business efficiency to driving additional revenues, as well as opportunities in the emerging MDU market for product vendors and service operators. The research includes a snapshot of the current market for smart home solutions in MDUs and key considerations for both vendors and MDU owners and managers

(IS-2022-142) The Real Estate Leader's Guide to Decarbonizing Your Portfolio

This guide, authored by and published on May 2, 2022, by Jones Lang Lasalle (JLL), discusses the various trends from science-based targets to net-zero commitments, and how to start reducing carbon emissions to keep the commitment to climate action. It offers implementation strategies to help you measure carbon, track it on an ongoing basis, and decarbonize your buildings to achieve your ESG goals. Moving forward on climate goals remains a challenge and even with

strong leadership support, moving targets are everywhere. Amid increased scrutiny and market pressure, real estate leaders face a crowded and fragmented ESG space and a confusing array of regulations, pathways, and metrics. What is missing is a common understanding of how to successfully measure and reduce carbon emissions within the built environment. That is the next critical step needed for organizations to truly reduce their carbon footprints and advance their overall sustainability efforts.

(IS-2022-141) The Fast-Changing Future of Systems Integrators

This white paper by J2 Innovations a Siemens Company and published on January 14, 2022 discusses the various trends that are changing and driving success in the smart buildings sector, highlights how businesses can utilize the new technology offered by FIN Stack to deliver easier-to-use building automation and integrated smart buildings solutions in faster, more efficient ways. How building controls are changing and where the market is going and some of the key factors determining the changing direction of the buildings control industry. They include IoT in packaged equipment, end-user dashboards, remote management, the need for data cybersecurity, and competitive costing. Outdated software applications that are complicated to configure will lose out to newer "next generation software" able to offer end users and those who install and commission systems a simpler and easier way to interact and manage buildings. The adoption of data standardization will enable the various building systems to become more easily integrated than has been possible previously.

(IS-2022-139) Simplifying the IoT Edge-Smart spaces Best Practices

This white paper was authored by Kristen Hanich of Parks Associates in partnership with Technicolor and published on April 28, 2022. IoT adoption is growing across the world. This includes not just consumer smart home device adoption, but IoT deployments in industrial and business settings. IoT sensors and devices capture data and perform tasks, communicating over IP and other protocols with cloud or local systems to create intelligent systems and enable automation. This whitepaper addresses the demand and growth of IoT edge solutions in smart buildings and smart spaces. It investigates top verticals and use cases such as smart apartments and MDUs, retail and warehousing, and hospitality and building management. It looks at common challenges and best practices in deploying solutions into these environments and examines new open solutions compatible with many different networking technologies, such as the use of gateways with both Wi-Fi and new IoT radios, which can create, expand, and improve services in these new smart spaces.

(IS-2022-138) Lighting and Lighting Controls - Spring Edition

This eBook on Lighting and Lighting Controls was published by CFE Media on May 2, 2022. For non-residential buildings, lighting is controlled by smart networks of "internet of things" devices — relays, occupancy/vacancy sensors, photocells, button stations, touchscreens, etc. — that optimize lighting conditions and energy use dynamically according to performance-based design parameters. This eBook has articles and case studies from the contributors, on the issue of lighting sequence of operations, wireless controls, health care lighting, networking of lighting,

code compliance, and energy-efficient lighting with daylighting. Lighting and its controls need to address the visual comfort and productivity of the occupants and the possible energy savings that can be achieved with smarter lighting and controls.

(IS-2022-137) HVAC Spring Edition

This HVAC eBook was authored by Brandon Andow, Yovanni Cataño, Jose Colon, Jeremy Crowley, Ishai Oliker and others from the Consulting -Specifying Engineers, Air Solutions Company, Grunfos, and Raypack. It was published by CFE Media on April 29, 2022. This eBook has articles and case studies from the contributors, on the issue of solar gain on the design of buildings and building envelope improvements, the use of filters to protect HVAC equipment, the various methods of pumping, and the various options for boilers and a case study on district heating from a combined heat and power plant. HVAC options need to address the indoor comfort and productivity of the occupants and the possible energy savings that can be achieved with smarter HVAC equipment and controls.

(IS-2022-136) Green Quadrant: Integrated Workplace Management Systems 2022

This report was commissioned by Planon and prepared by Joy Trinquet with Susan Clarke of Verdantix Ltd. and published in March 2022. Applying the proprietary Verdantix Green Quadrant methodology, the analysis is based on two-hour live product demonstrations with pre-set usage scenarios and supplier responses to a 238-point questionnaire. To understand customer needs Verdantix reviewed the data from a survey of 285 real estate and facilities decision-makers. The in-depth benchmarking concludes that eight suppliers lead the market and they demonstrated an excellent breadth of functionality and strong market momentum. The analysis also reveals that other providers offer strong propositions in workplace management, space management, mobile solutions, and tenant-facing engagement.

(IS-2022-135) Global Insights IoT & The Future of Healthcare

This research report, commissioned by Schneider Electric, was prepared by Guidehouse Inc and published on April 28, 2022. It demonstrates how IoT-based, open, interoperable platforms enable hyper-efficient, people-centric, resilient, and sustainable healthcare facilities of the future. The report offers insights from 600 global healthcare facility executives into IoT investment priorities and a simple framework to help implement of an IoT-based platform in healthcare facilities. The report covers:

• The market drivers and barriers behind IoT platform adoption

• End-to-end system benefits of IoT-enabled platforms

• Practical use cases for IoT-based solutions in healthcare facilities

It describes the need for hospitals and clinics to consider benefits ranging from energy efficiency and sustainability to resilience and patient centricity.

(IS-2022-134) Cybersecurity for Building Automation Systems

Trane Technologies authored and published this paper on May 2, 2022. Building Automation Systems (BAS) offer significant operational advantages for commercial building owners and occupants. They provide the applications and interfaces that make it easier to effectively manage indoor environmental quality (IEQ) and optimize energy efficiency. As connected systems, they share many of the same cyber risks as traditional IT assets. The paper provides an introduction to the best practices in BAS cybersecurity. These best practices fall into three main categories. These include Isolation from other systems; Secure Access – both on-site and remote; Operation and Maintenance – establishing (and sticking to) set protocols and maintaining a regular system and software maintenance schedule to maintain security over the long term. With due diligence, the risks are manageable.

(IS-2022-133) Building Automation Guide - Factors to Consider When Selecting a Building Automation System

J2 Innovations, a Siemens company, authored and published this guide in June 2019. The Building Automation Systems for most new commercial buildings, have complex HVAC and other services-related equipment and require the coordination of the various installed equipment, while the demands of the maintenance function frequently require the site's systems to be remotely monitored. This guide sets out the various factors to consider, to help when specifying or evaluating competing system solution proposals. There are two ways competing propositions should be evaluated: according to the benefits they deliver and the technology they use to do that. It is important to choose a technologically modern system so that it does not become out-of-date too quickly or unable to be adapted over time to the new requirements that will no doubt continue to emerge.

(IS-2022-132) The Evolving Importance of Effective HVAC

This report was authored and published by Building Engines on March 28, 2022. From heating and cooling units to keep tenants comfortable throughout office buildings, to ventilation and purification units to ensure all occupants are inhaling clean air as they shop in retail centers or work in large warehouses, HVAC technologies play an integral role in property operations, as underscored by the COVID-19 outbreak. With COVID-19 being an airborne virus, the pandemic has cemented air quality as the top of mind for property teams and tenants alike. Building Engines fielded a national survey of nearly 300 building managers and engineers working within CRE properties in late 2020. As we go through the re-occupancy phase, the survey results can show how you can leverage technology to meet heightened air quality standards while securing tenants' trust and your organization's success in the long term.

(IS-2022-131) Smart Buildings eBook Winter 2022

This Smart Buildings eBook was authored by Aaron Szalaj, Bob Swanger, Timothy Howe, Marcus Myers, and Jeri Pickett from the Consulting-Specifying Engineers, Stantec, and Reliable Controls. It was published by CFE Media on March 29, 2022. This eBook discusses; The five steps to BAS

replacements; Engineering with automated fault detection and diagnostics; The Art of Building Sustainability; Deliver smart buildings using CSI Division 25, commissioning; Tap into a building automation system's data and maximize investment; a video link to Designing smart buildings. Today's available BAS connectivity just didn't exist when most commercial buildings were constructed. Antiquated systems typically used proprietary technology platforms available only through a stand-alone terminal with obscure terminology and simple graphics, which means, not much data from the facility was used to improve building performance. This paper shows how consulting engineers can help owners optimize their existing investments while taking advantage of new technology.

(IS-2022-130) Build it for Zero Carbon

This executive guide on achieving a zero-carbon future was authored by and published on March 30, 2022, by Schneider Electric SE. Buildings consume 30% of the world's energy and are responsible for 40% of CO_2 emissions. If we can collectively work together toward net-zero 2030 targets, then the trajectory of the temperature rise will stay within 1.5%, helping us to avoid a host of climate-change-related impacts. There's also a growing recognition of the intersection between climate action and social justice. BIPOC (Black, Indigenous, and People of Color), low-income, and traditionally under-resourced and underrepresented communities have historically borne a greater burden from these impacts. This paper lays out Schneider Electric's holistic, replicable strategy for organizational decarbonization. With this proven roadmap, organizations of all kinds can define, set, deploy, and sustain decarbonization programs.

(IS-2022-129) Building Operating System

A TIA team of Bob Allan, Jeff Carpenter, Bill Moten, Laura Polas, Frank Straka, and Steven Zielke authored this paper which was published on March 24, 2022. The paper shows how today's smart buildings are data-driven, levering sub-system integration and analytics that improve functionality making them an operational and productivity asset. Effectively achieving smart building objectives starts with reevaluating the we they are designed, procured, and operated. The paper explores how to design and deploy a smart building based on an operating system model that ensures flexibility, reduced construction and operational costs, improved return on investment, and a better and more productive occupant experience. It examines how technologies like power over Ethernet (PoE) enabled edge devices, Digital Twins, and Single-Pair Ethernet (SPE) are emerging to deliver additional benefits and the potential for greater asset value.

(IS-2022-128) Top CRE Trends 2022

The Jones Lang LaSalle IP. Inc. research team, Richa Walia, David Barnett, Amber Schiada, James Taylor, Flore Pradere, and Marie Puybaraud contribute to this paper published on February 10, 2022. Business success lies in staying ahead of the curve and predicting the right step to take next for people, the planet, and profit. This 7th edition of the Top 10 Global CRE Trends report explores how firms can reinvent their corporate real estate strategies in response to ever-changing business priorities, a challenging operating landscape, and a volatile economic

environment. The global COVID-19 pandemic has proven to be an accelerant of change and transformation for many organizations. Some of the ensuing changes were a long-time coming, such as the increased push towards a more sustainable, tech-infused world. Other shifts, like evolving working habits, had been bubbling farther below the surface, accelerated by the ongoing pandemic. Hybrid and remote work, climate change, digital applications, and sustainability are all trends discussed. Leverage intelligence and best practices from the partnership ecosystem are needed to co-create innovative solutions and achieve organizational objectives.

(IS-2022-127) Thinking Smart - How the Foundations of the UK will be Defined by Smart Buildings

Johnson Controls commissioned Sapio Research to conduct an online survey to uncover how smart buildings helped the UK & Ireland through the COVID-19 pandemic and how smart technology would be used to help organizations and the country reach its goals in the future. The results of the survey were published on July 5, 2021. About 100 building decision-makers across the UK & Ireland covering central government, large-scale healthcare, pharmaceutical, higher education, and wider commercial real estate, such as retail and banking with500+ employees were interviewed. 99% of respondents saw the advantages of smart buildings. Smart buildings can help senior leaders in operational efficiency, sustainability, and occupant experience. However, as the research reveals, there is still some way to go with getting senior leaders on board for the journey. Therefore, it is incumbent on technology providers to both educate the market on the future of what can be achieved by smart buildings and demonstrate the tangible benefits their budget investment can yield along the way.

(IS-2022-126) The Way Forward for ESG - Firms are Adapting Business Strategy and Boosting Technology Investment

This research report was authored by Verdantix and published by Corty Software Inc on October 20, 2021. As Environmental, Social, and Governance (ESG) and sustainability are rising to the top of the priority list for many organizations, ESG performance continues to play a larger role in financial decisions and access to capital, and more organizations are actively aligning overall business strategy with ESG goals to remain competitive and resilient. Corty contracted research firm, Verdantix to investigate: 1) Where 50 executives across 5 industries fall on the ESG maturity scale; 2) The state of corporate sustainability culture; 3) How executives are using operational data to define overall ESG and sustainability strategies; 4) The role of Environmental, Health, and Safety (EHS) in supporting ESG performance; and 5) Which technologies firms are investing in to improve ESG performance. The results show that firms with ESG and sustainability strategies that pay attention to improving cultures, leverage data to improve performance and invest in developing technologies are best placed to benefit from sustainable growth.

(IS-2022-125) The Grid Interactive Building

This White paper was authored and published by Siemens on June 22, 2021. This whitepaper identifies the emergence of a new type of building, the 'grid-interactive building', at the grid edge. The energy system is changing. Driven by climate policy, enabled by the decentralization of

energy generation and digitalization of buildings and systems. Decarbonization of energy use is more technically feasible than ever before. This paper outlines some key concepts around the changing low carbon and energy efficiency landscape, and how the grid and smart buildings are starting to work together in new, connected ways as the grid-interactive building at the grid edge. It looks at the technology benefits for commercial buildings' energy users in relation to the grid. Lastly, it outlines steps that users could take to realize these smart benefits.

(IS-2022-124) The Future of Hybrid Work in Government

This White paper was authored and published by Samsung Electronics America Inc. and published on November 22, 2021. The paper shows that given remote work is here to stay, the future of hybrid work in government needs to be compliant in end-to-end solutions that empower agencies to achieve their missions more effectively. Samsung, the global leader in mobile, audio, and visual technology is helping governments improve their digital technologies creating a more secure and productive environment for all. They quote a McKinsey report that details what technology investments will enable the federal government to sustain a secure, productive, and resilient hybrid work model. These include mobile hardware, enterprise collaboration software tools, cloud security, and physical technology. A hybrid model can only be effective if conference rooms are outfitted with audio and visual equipment and high-speed Wi-Fi to support seamless collaboration. Remote work is not only favorable from an employee satisfaction and productivity standpoint but for economic and environmental reasons, too. Global Workplace Analytics estimates that making a government-wide shift to half-time telework could save taxpayers $11 billion a year in real estate, improved productivity, disaster outage prevention, lowered absenteeism and decreased turnover.

(IS-2022-123) Why You Can't Afford Not to Invest in a Sustainable Built Environment

This report, authored by Catriona Brady, Victoria Burrows, Ahmad Al-Musa, Sara Kawamura, Carolina Montano Owen, Arianna Palmieri, and WSP consultants for the World Green Building Council and published in February 2022, draws from and embraces the rapidly growing sustainability agenda across the built environment: the evolving scope of sustainability; a broadening of what is called 'green'; closer alignment with the UN's Sustainable Development Goals; and finally the rise in social value as not just a consideration, but a business driver for developers and investors. The report demonstrates seven irrefutable co-benefits for investing in a sustainable built environment, across both the financial and social value case.

(IS-2022-122) The Hybrid Workplace - The Return to Work Report

This report, authored by William Cowell de Gruchy of Infogrid and published on February 9, 2022, is a follow-up to Infogrid's previous Healthy Buildings Report. The importance of a healthy workplace has never been more prevalent, with 63 percent of employees saying that they are more concerned about it today than they were before the pandemic. This report analyses the results of a survey of 2000 employees on their thoughts around hybrid working and returning to the office. Some of the themes addressed are: the impacts of different modes of work on employee mental health; how the workplace can increase employee productivity; what

employees expect from their employers as they return to work; and how employers can increase employee retention and attraction.

(IS-2022-121) Smart Buildings 2022

This report was authored by Andrew Phipps from Cushman Wakefield & Tom Redmayne from WiredScore and published on March 8, 2022. IoT gives a building the ability to use a mass of different data points to inform and make decisions. Linking this to the operating model via cloud computing allows for on-demand management of the building from anywhere and at any time. We are now able to visualize data in a much more user-friendly manner to allow decision-making to be more informed and to offer more clarity. This report provides the WiredScore definition of a smart building as one that delivers outstanding outcomes for all users, through digital technology, to exceed their evolving expectations. These include an inspirational experience, a workplace that attracts and delights, with flexible and personalized services, and a sustainable building through a reduced whole-life carbon footprint by using technology to operate the building more efficiently. Cost efficiencies are created by optimizing the building's performance and using future-proof design to be able to adapt to new demands. To deliver user functionalities reliably, robustly, and consistently, a smart building needs firm technological foundation. This is a combination of infrastructure, technological architecture, governance, and policy. Technological foundations are critical to ensuring the success of any smart building through reliable technology, a strong governance framework. They mitigate the risks associated with smart buildings while maximizing the outcomes.

(IS-2022-120) Power Digitalization - Understand and Achieve Active Energy Management in Buildings

This report was authored by Tony Hunt of Schneider Electric - Energy Management Research Center and published in February 2022. Most public, commercial, and industrial buildings are not energy efficient, representing an enormous untapped potential for decarbonization and sustainability efforts, as well as utility bill savings. Power digitalization plays a foundational role in active energy management and efficient facility operations. For existing buildings, this can be done by retrofitting electrical systems with smart devices and using energy and power management software that improves energy efficiency and reduces risk. This power digitalization investment helps facility management and maintenance personnel make better decisions, resolve issues more quickly, minimize downtime, and use less energy. In this paper, we define power digitalization for buildings and describe a 3-step process to achieve it. Power digitalization transforms organizations from being uninformed and reactive to those that are insightful and proactive. An investment in power digitalization ensures that building owners and investors get real-time carbon tracking and transparency about their building's energy usage and it is essential in avoiding obsolescence.

(IS-2022-119) Future Ready Broadband Ubiquitous Connectivity For MDUs

This report was authored by Jennifer Kent and Tam Williams of Parks Associates developed for Cox Communities and published in February 2022. Building on advanced connectivity services,

MDU property managers and owners can leverage the benefits of smart home devices and smart property solutions to drive revenue and increase net operating income. This whitepaper addresses the growing demand for exceptional connectivity in MDUs. It evaluates the benefits of next-generation connectivity services for MDU property managers and residents, as well as the role of the service provider as a key partner in smart MDU living. 53% of consumers report they value technology more now than before COVID-19 and are willing to pay for those features applicable to their living conditions and objectives.

(IS-2022-118) Bringing Embodied Carbon Upfront

This report was authored by Matthew Adams, Victoria Burrows, Stephen Richardson, of the World Green Building Council with support from Ramboil and C40. and published in February 2022. Carbon emissions are released not only during operational life but also during the manufacturing, transportation, construction, and end-of-life phases of all built assets – buildings and infrastructure. These emissions, commonly referred to as embodied carbon, have largely been overlooked historically but contribute around 11% of all global as well as the embodied carbon of individual materials. Achieving net zero embodied carbon for the entire sector will require far greater collaboration along the whole value chain to support efforts to decarbonize industry and to develop and deploy more low embodied carbon alternatives. Such collaboration allows businesses and organizations to identify and have confidence in the environmental, social, and financial benefits of taking a leadership position in the transition to a decarbonized built environment. This 3-phase report describes the literature review of the challenges and the possible pathways to overcome them with a final review by many experts and stakeholders in the value chain to improve the recommendations.

(IS-2022-117) 2022 Facility Management Predictions

This report was authored by Dan Weltin, Editor-in-Chief, of Facility Market with contributions from Kelly Spinola, John Hajduk, Paul Head, Stormy Friday, and Stephen Ashkin and published by fnPrime in February 2022. The authors look at the trends affecting facility managers in 2022, including the Internet of Things, COVID-19, hybrid workplaces, and sustainability. Health and wellness initiatives matter to occupants and smart technology allows facility managers to know and manage occupancy patterns. In addition, IoT technology can help FMs be more strategic in their energy use to help meet energy efficiency goals, including net zero energy. Hybrid workplaces are a direct result of the pandemic and are here to stay. the report shows that climate change creates the need to embrace environmental initiatives and sustainability efforts will continue to matter, but maybe now more than ever.

(IS-2022-116) The Work Ahead in IoT - The Gap Widens Between IoT 'Haves' and Have-nots'

This report was authored by Euan Davis and Manoj Mathew from Cognizant and published on September 2, 2021. The report discusses how the Internet of Things (IoT) has gained market momentum with the manufacturing sector being the top adopter. More effective IoT deployments include artificial intelligence (AI) and machine learning (ML) underpinnings. The main takeaway is that IoT drives organizational performance outcomes by combining it with

other advanced technologies and gaining buy-in from the employees is essential to making digital initiatives possible.

(IS-2022-115) IoT Signal

This report was prepared by Microsoft and published in November 2021. The report provides insights into the current and future state of the Internet of Things (IoT). The main takeaway is that IoT, despite its technological complexity, continues to drive organizational productivity beyond the COVID-19 pandemic. To advance such growth, consideration needs to be given to several technologies and factors that underpin its success such as artificial intelligence (AI), Edge Computing, Digital Twins, and data security.

(IS-2022-114) Internet of Things - Societal Challenges & Scientific Research Fields for IoT

This report authored by Emmanuel Baccelli from Inria and published on October 26 2021 presents Inria's views on the main trends and challenges in the Internet of Things (IoT), and how Inria is actively conducting scientific research, software development, and technology transfer around these challenges. Furthermore, the report identifies key societal challenges in a world depending on IoT, ranging from ethical concerns to transparency, sovereignty, and education. Emphasis must be placed on substantial research, deep tech development, and the introduction of standards to ensure that IoT benefits society and the environment.

(IS-2022-113) Ericsson Mobility Report

This report was prepared by Ericsson and published on June 4, 2021. The report deals with the trends regarding the 5G communication standard, mobile devices and traffic, and the Internet of Things (IoT). The speed of 5G uptake, which is far higher than it was for the 4G communication standard, is driving innovation to bring new technologies to market. Other important trends include IoT applications will be largely supported by 4G/5G and smartphones and video will drive up mobile data traffic. As such, it is recommended that societies plan for and invest in high-quality digital infrastructure.

(IS-2022-112) The State of Energy Management

This report, developed by DEXMA and published in 2021, forecasts trends in the energy industry post-COVID. It illustrates survey results carried out on 400 energy management professionals worldwide. The content provides insights into the industry composition, priorities, challenges, and technologies they use. Results suggest that identifying cost-effective energy efficiency improvements quickly and budgetary restrictions are the core challenge while HVAC is the most energy-intensive component in their buildings. On the other hand, air quality has become a key issue for companies to monitor, and the use of Energy Management Software (EMS) is growing. In terms of technological trends, demand response as well as control and optimization solutions sit at the top of the spectrum.

(IS-2022-111) Rethinking Buildings Post COVID-19

This report published in 2021 by Honeywell Building Trends Series was prepared to measure the perception of the impacts on building strategies and practices after the pandemic with a greater focus on healthy buildings and indoor air quality (IAQ). It shows the result of a survey conducted among facility managers who operate buildings across different sectors in the United States, China, Germany, and Saudi Arabia. Findings suggest that as occupants are more aware of how buildings can affect their well-being, this results in buildings operators having to rethink their modes of operations and incorporate investments in smart solutions that drive efficiency or sustainability while improving occupant experience.

(IS-2022-110) Net Zero Buildings - Why Companies Need a Single Strategy for Sustainability and Digitalization

This report was developed by Alvin NG from Johnson Controls, and published in 2021. It was written to justify the synergy between sustainability and digitalization. It is known that while decarbonization has become the major theme of sustainability driven by emission reduction targets, digital technologies on their own use lower costs and maximize efficiency and productivity as a selling point. In this sense, platforms that rely on cutting-edge software are presented as the solution for buildings to monitor and control every key performance indicator of the operations from a single dashboard. It suggests that alignment of the two strategies, despite its evident benefits, can still be a challenging task; in particular, due to the variety of systems and volume of data in today's buildings. Nonetheless, early adopters of this approach will be in a better position to face the demands of a low-carbon future.

(IS-2022-109) Energy Efficiency of Smart Buildings - Towards Zero Consumption and Beyond

This report, developed by ABB and published in 2021, illustrates the array of building technologies readily available for energy and water consumption. The report argues that in smart buildings, savings depend upon the adjustability and controllability of systems. It exemplifies how variable speed drive (VSD) technology is instrumental to solve energy loss problems in buildings. It shows how high-efficiency motors, that allow partial load performance and integrated speed controls, offer excellent energy potential. Lastly, it suggests that Building Management Systems (BMS) coupled with digital services can take efficiency to new heights of performance and shorten returns on investments (ROI).

(IS-2022-108) Rate Designs Harnessing Vehicle Grid Integration Technology

This report was authored by Energy+Environmental Economics (E3) and published in May 2021. This report explores novel tariff designs that leverage active vehicle-grid integrations and electric vehicle charging aggregators to provide enhanced charging profiles that would benefit utilities, ratepayers, and drivers. The report presents a simulation for California that indicates moving from basic flat rates to time-of-use (TOU) would provide a 116% increase in net savings for drivers but may present other complications with the introduction of a secondary peak load. The report continues on to explore the inclusion of aggregators who can actively manage the

charging for several thousand chargers, ensuring the best price for the drivers, better utilization of the grid, and more flexible tariff schemes along with the utility to better match the operating costs.

(IS-2022-107) Adaptive Lighting in Outdoor Security Applications

This report was authored by Nicole Hathaway and Manual Lopez from California Lighting Technology Center at UC Davis and published in November 2021. The report explores the different types of technologies used for detecting motion in security applications and explains that adaptive lighting has not been widely adopted within these environments. A case study is provided to demonstrate the effects of adaptive lighting adoption in security applications and the results indicate that 36 - 44% of energy was saved, with 90% of participants suggesting that the lighting was equivalent to or better than the preexisting system.

(IS-2022-106) White Paper on Unified Glare Rating (UGR)

This report was prepared by Ian Ashdown, Steve Fotios, Matt Hartley, Glenn Heinmiller, and Nathaniel Jones, in collaboration with the National Electrical Manufacturers Association, and published on October 2021. The report provides insight into the proper use of the Unified Glare Rating (UGR) for lighting design to meet application and task visual needs. Consideration is given to the historical background of UGR, literature review, and standards to clarify the intended use, embedded assumptions, and correct lighting design use. The information provided will help organizations and individuals to create better lighting designs.

(IS-2022-105) Office Sublease Space at a Glance: North America Q4 2021

This report, authored by Cushman & Wakefield and published in February 2022, provides key themes and trends regarding office sublease space in the United States and Canada. Key themes include a decline in the U.S. sublease inventory, an increase in leasing activity, and the negative impact of the pandemic on the sublease space in Central Business Districts (CBDs). In Canada, sublease space declined in two of the four major Canadian markets, including Toronto and Calgary. There remains a sign of recovery for the sublease market in North America based on a decline in vacant sublease inventory in several major cities.

(IS-2022-104) Global Hotel Investment Outlook

This report, prepared by Jones Lang LaSalle (JLL) and published in January 2022, provides a forward outlook on the global lodging industry. Consideration is given to the impact of several factors on the industry including Covid19 pandemic, labor shortages, supply chain delays, operational costs, sustainability, and consumer demand. There is an overall favorable outlook for the industry based on an observed increase in global transaction volume, potential interest by investors, the industry's commitment to sustainability, and evolution in the physical use of available space.

(IS-2022-103) State Energy Efficiency Policy in a New Era, A Toolkit for Governors

This report was authored by Matthew Rogotzke, Jessica Rackley, and Dan Lauf from the National Governors Association and published in October 2021. The report provides insight for U.S. state governors on how to improve the energy efficiency policy for their states as efforts to decarbonize continue to grow. Recommendations are made to lead by example and capture cost savings, create jobs, reduce energy consumption, prevent pollution, and strengthen grid security. It is also suggested for states to engage utilities to provide affordable rates and increase access to energy efficiency projects.

(IS-2022-102) Reaching Today's Video Audiences - Platform Diversity and ROI

This report was authored by Paul Erickson and Tam Williams from Parks Associates and published in January 2022. The report discusses the growth in streaming video adoption and the expanding use of the "over-the-top" (OTT) video services. Device platforms used inside and outside the home to view video are considered. Information is provided regarding potential tradeoffs, complexities, and return-on-investment challenges presented when deploying broad platform support. Adoption of streaming video services is at an all-time high and video service providers need to ensure multi-platform device support.

(IS-2022-101) Energy Efficiency in Real Estate and Facility Management

This report was prepared by Dexma and published in September 2021. The report deals with an energy management strategy that real estate and facilities management companies can use to effectively manage multiple locations. A strategy is suggested that relies on data analytics and artificial intelligence to detect, analyze, and optimize the potential energy savings. Dexma's energy intelligence solution is proposed as a viable solution to achieving such savings. The reports find that efficient energy analysis and management of a portfolio, consisting of many buildings, requires a centralized energy analytics platform.

(IS-2022-100) Breath of Fresh of Air - How Clean Air Technology Can Give Your Building a New Lease on Life

This report, prepared by Johnson Controls and published in July 2021 presents survey results from 826 business leaders in Europe, the Middle East, Asia, and Latin America and presents the extent to which businesses have implemented clean air technology solutions. Key takeaways include air purification was implemented by 73% of the respondents and health care organizations and hotels are among the top leaders in implementing clean air technology. The report also offers a practical six-step strategy for achieving clean air in the workplace by considering ventilation, filtration, disinfection, isolation, monitoring, and maintenance.

(IS-2022-99) 70 Technology Trends That Will and Will Not Shape 2022

This report, authored by Stuart Carlaw of ABI Research and published in December 2021, presents key critical trends that will likely materialize in 2022 and those that will not. Main takeaways

include supply chain issues and a prediction that 5G will continue to struggle in the enterprise sector. Furthermore, Ultra-Wideband (UWB) will accelerate precise location technologies to the mainstream, and the Chinese vendor community will retain its stranglehold on the Internet of Things (IoT) module market. Overall, 2022 will be promising and full of opportunities.

(IS-2022-98) New Criteria for a New, Smart Building Era

This report, published in July 2021, discusses the key criteria for designing and constructing new smart buildings which include cybersecurity, modeling capability using digital twins, and the use of smart technologies for building monitoring and control. To ensure buildings remain future-proofed, the new technology that is installed must interact easily with other devices/control systems. Siemens Smart Infrastructure unit is proposed as a source of expertise for organizations intending to design and construct new buildings.

(IS-2022-97) Energy Market Outlook What to Expect in 2022 and Beyond

Enel X's 2022 Energy Market Outlook, published in January 2022, provides energy summaries of the biggest US regional and national stories that may affect end users and pairs them with 2022 forecasts and discussions of energy products. Suggestions are provided on energy strategy which can serve as a resource to help organizations with their energy roadmap. The main trends discussed include growth in renewable energy sources, electric vehicle investment, natural gas pricing, zero-emission commitments, and a decline in energy storage (battery) costs. The main takeaway is that organizations need to consider the main trends when setting their business goals.

(IS-2022-96) Home Security - A Redefined Market

This whitepaper authored by Amanda Kung from Parks Associates and published June 7, 2021 centers on the factors affecting the steady growth of the adoption of home security systems and professional monitoring services. Key trends include growth in self-installation of newly acquired security systems, strong new-start home sales with higher-than-average adoption of security, a rise in home renovations with more time spent at home, and increased second home sales in vacation areas. The main takeaway is that security dealers need to continue to seek unified solutions, have low support costs, and provide value for the customer.

(IS-2022-95) Adaptive, Sensor-Based Lighting for Security Applications

This report was prepared by California Lighting Technology Center & Hawaii Natural Energy Institute and published in November 2021. The report addresses adaptive lighting strategies, that include energy-efficient light sources and lighting controls, to reduce energy consumption and light pollution. The report provides in-depth coverage of available lighting technologies taking into consideration security guidelines. Results of field research and laboratory evaluation of lighting systems are included. Recommendations are provided for both general and high-security exterior lighting applications.

(IS-2022-94) 2021 Connecticut Public Utilities Annual Cybersecurity Report

This report was authored by Marissa P. Gillett from the State of Connecticut Public Utilities Regulatory Authority and published on January 7, 2022. The report deals with the growth of cybersecurity threats facing Connecticut's public utilities and the development of cybersecurity programs to mitigate such threats. Following the framework established by the Cybersecurity Action Plan, the key elements considered for the development of cybersecurity programs were corporate culture, threats, and the cybersecurity capability maturity model (C2M2). The main takeaway is that the success of a cybersecurity program relies on the commitment of all employees in an organization, as demonstrated by utility decision makers and support staff in Connecticut's utilities.

(IS-2022-93) Three Ways to Reduce Operating Costs of Power Generators with Remote Management

This report was prepared by HMS Industrial Networks and published April 2021. The report describes three ways in which remote management can be used in power generation to reduce the operating costs and improve control for a generator and engine combination (genset) fleet. They include predictive service of equipment based on usage, remote testing to avoid startup problems, and reduced fuel theft or leakage through remote sensor monitoring. Industrial examples of a communication gateway and a central management survey are provided. Benefits of remote monitoring include reduced operating costs, extended lifetime of equipment, and improved planning of service visits and refueling.

(IS-2022-92) Value Beyond Home Security: Expanding Product Ecosystems

This report was authored by Jennifer Kent from Parks Associates and published on March 8, 2022. The report discusses how the market growth of connected devices and new technology has led to an expansion of professional services beyond home security. Anticipated growth is expected in residential broadband, video analytics, AI capabilities, smart lighting, smart sensors, smart sirens, vehicle smart tags, and perimeter monitoring. The main takeaway is that market growth will create further opportunities for professionals to integrate new monitoring services into the home.

(IS-2022-91) Smart Home Market Dynamics Report – 2021

This report was authored by Blake Kozak from Omdia and published November 2021. The report assesses numerous smart home industry scenarios and presents alternate paths that the smart industry may take toward 2030 based on device and industry trends. Long term growth potential for the smart home industry is also presented. Included in the report are historical costs for device imports and exports such as thermostats and door locks. The main takeaway is that the adoption of Matter, a new home automation connectivity standard, will be the catalyst for smart home growth.

(IS-2022-90) Global Guide to CRE Investing in 2022

This report was published by Cushman & Wakefield, March 2022. The report presents a well-researched perspective for investing globally in the 2022 commercial real estate market. An overview of the commercial real estate market is provided across Asia, North America, Latin America, and Europe along with market drivers, capital markets, and investment recommendations. The main takeaway is that the global property market recovery will gain momentum in 2022-23 creating global opportunities for investors.

(IS-2022-89) 2022 Canadian Construction Forecast

This report was authored by Andrew Snook and Mary Van Buren from On-Site and published December 2021. The report presents a promising 2022 outlook for Canada's construction sector but underscores that labour and supply chain challenges will persist. Other key trends include the importance of apprenticeship programs, data sharing, collaboration, cybersecurity, and new delivery models. The report is useful for businesses to identify specific market signals to successfully navigate the changing construction landscape. The Procor construction management platform is promoted as a way for construction companies to digitally transform their business.

(IS-2022-88) Green Quadrant: IoT Platforms for Smart Buildings 2022

This report was authored by Dayann Charles Jeyamohan and Susan Clarke from Verdantix and published January 2022. The report includes a detailed comparison of the 17 most prominent Internet of Things (IoT) platforms for smart buildings available on the market. The market leaders include: JCI, Schneider Electric, Siemens and Spacewell. The majority of the platforms have evolved to include asset monitoring and maintenance, energy management, space monitoring, and building security. The report provides real estate owners and technology buyers insight to the leading offerings in the market and the vendors that will best meet their needs.

(IS-2022-87) Creating secure IoT device identities

This report was prepared by Intertrust and published February 2022. The report describes how to create secure Interne of Things (IoT) device and sensor identities, fostering data access and interaction across devices in a trusted ecosystem. Details are provided on how device and sensor identities function and the importance that public key cryptography plays in securing the identities. Consideration is also given to the provisioning process by which devices are provided an identity. A comprehensive, cost-effective, and a scalable solution developed by Intertrust is presented for the provisioning process.

(IS-2022-86) The 2022 Buyer's Guide for CRE Building Operations Technology

This report was prepared by Building Engines and published January 2022. The report provides commercial real estate owners and operators with a framework for selecting a building operations platform. The framework consists of the following five key elements: maximization of net operating income, effective and mobile friendly communication with tenants and operations

team, thoroughness in deployment and support, interoperability and connectivity, and enterprise capability. The Prism building operations platform is proposed as a viable solution.

(IS-2022-85) Blended learning without limits

This report was authored by Samsung and published January 2022. The report deals with Samsung's digital education platform that can empower educators to help their students succeed while improving their mental well-being and the end-to-end education experience. The platform includes vibrant interactive digital whiteboards and advanced classroom management software. The benefits of the platform include scalability, cross-device compatibility, reduced preparation time for teachers, improved student engagement and interaction, and better connectedness between students and teachers.

(IS-2022-84) PRASH: A Framework for Privacy Risk Analysis of Smart Homes

This report was authored by Joseph Bugeja, Andreas Jacobsson, and Paul Davidsson and published in the Sensors Journal September 2021. The report deals with a security framework, PRASH, for modeling and analyzing the privacy risks of smart homes. Its three modules (system model, threat model, privacy metrics) enable privacy risk assessment of a smart home system. PRASH capability enables early threat identification, improved risk management scenario planning, and attack mitigation. Overall, PRASH will help to preserve privacy rights of residents.

(IS-2022-83) Private Networks Vol.1 - Transforming Private Networks with Samsung 5G

This report was prepared by Samsung and published October 2021. The report deals with private networks and proposes Samsung's 5G network solution as a superior strategy as compared to existing Wi-Fi based networks. The advantages of 5G networks include reduced latency, improved mobility, security, reliability, flexibility, coverage, and capacity. The application uses cases considered include smart factories, transportation, logistics, smart cities, and medical devices. The details of Samsung's private 5G solution are also presented in detail and cover radio, core, and transport network, along with the network management system.

(IS-2022-82) How AI Edge Platforms Can Transform Smart Spaces

This report was prepared by Mobile World Live and published April 2021. The report explores how artificial intelligence (AI)-enabled edge computing platforms are reshaping the way cities, enterprises, and venues operate. The role of mobile operators is also examined since they provide the underlying connectivity and bring together the various stakeholders necessary to make this transformation. Furthermore, the importance of video data in smart space applications is examined and NVIDIA Metropolis is proposed as a video analytics platform that applies deep learning AI to video streams. Supermicro's servers are featured as a viable solution for edge computing.

(IS-2022-81) Global Security Insights Report

This report was authored by Rick McElroy from WMW are and published April 2021. Based on a survey of 3,542 information technology executives, the report deals with the challenges and issues facing businesses worldwide when it comes to escalating cyberattacks. It identifies trends in hacking and malicious attacks, and the impact of security breaches on organizations' finances and reputation. Insights are provided on organizations' plans for securing new technology, adopting a cloud-first security strategy, and dealing with the complexity of the current cybersecurity management environment.

(IS-2022-80) 5 Steps to Delivering Smart Buildings

This report was prepared by Johnson Controls and published September 2021. The report outlines the key steps required to successfully create smart buildings. Since each building is unique, each approach needs to be tailored to ensure that smart solutions work together to get the desired results. The key steps included identifying building's weaknesses, creating a strategy to meet business objectives, assessing the smart technology currently in the building, creating a plan to integrate existing and new smart technologies, and communicating with stakeholders while delivering on the plan.

(IS-2022-79) OTT Streaming Trends to Watch in 2022

This report was authored by Eric Sorensen and Paul Erickson from Parks Associates and published February 2022. Important trends in the evolution of streaming services (TV via the Internet) are reviewed. Key among these is the smart TV as a platform for accessing streaming stations, ad-supported streaming services (rather than pay-TV), and frequent churn as customers change streaming service providers. Streaming media players such as Roku are losing ground to smart TVs with built-in stream handling. The report recommends that providers focus on customer retention to overcome churn. The likelihood of mergers among streaming providers and the emergence of streams produced outside of the established distribution channels are discussed.

(IS-2022-78) How will offshore wind developments affect the U.S. power grid?

This report was authored by Maria Scheller, Thomas Rostad, Akanksha Goyal, and Ameya Ghodke of ICF and published in January 2022. The potential impact of large scale (28 GW) power generation by wind turbines offshore from the US Northeast and Mid-Atlantic states is analyzed. Offshore winds are more consistent than on land. Based on the model developed, local power prices should decrease as these wind-power sources increase. In some regions, transmission costs may increase to carry this power from the locations of the wind turbines. If the transmission grid cannot handle this power, the turbines may need to be curtailed. An alternative is to locate hydrogen production plants nearby to utilize this wind power.

(IS-2022-77) Health at Home: New Era of Healthcare

This report was authored by Jennifer Kent of Parks Associates and published in January 2022. The growth in the use of telehealth services by customers has accelerated from about 15% in 2019 to 60% in 2021 as a result of the pandemic in 2020. This growth is facilitated by changes in

reimbursement, regulations, funding, staffing shortages, device innovation, and customer demand. Telehealth encompasses virtual visits, remote diagnostics, chronic condition management, post-discharge monitoring, and hospital at home. Remote care can be enhanced with remote diagnostic tools. Issues with such technologies are presented. Sensors for passive monitoring are discussed.

(IS-2022-76) Extreme Weather and Regional Grid Resilience; Lessons Learned from Texas Winter Storm Uri

This report was authored by Bruce Rising and 13 others and published by Siemens Energy, Inc. in January 2022. System failures in the regional management of electricity generation and distribution that led to massive power disruptions in Texas in February 2021 are analyzed. Cold weather is noted as a greater threat to supplies than hot weather. Suggestions for improvement include coordinating wind power with gas turbines, increasing gas storage, and preparing equipment for operation in cold weather. Improvements are recommended for each part of the electric grid starting with generation. Recommendations for the Texas grid to interconnect with other multi-state grids on a limited basis are included.

(IS-2022-75) Decarbonization | Addressing decarbonization at the grid edge

This report was authored by Delta-EE, a research and consultancy company, for Siemens Industry, Inc. and published in October 2020. Decarbonization can reduce energy-related costs and can benefit the reputation of the company brand. Decentralization and digitization are facilitating decarbonization. Countries are deciding between emissions trading and a carbon tax. Energy generation is moving to the edge of the grid at the customer site with sources such as wind, solar, and storage, the electrification of heat and transportation, and generation of hydrogen from excess renewable energy. Use cases are presented for microgrids, virtual power plants, and e-mobility. Business strategies for achieving decarbonization are presented.

(IS-2022-74) Parks Associates 2022 Top Tech Trends

This report was authored by Jennifer Kent and others from Parks Associates and published in 2022. Five researchers at Parks Associates offer predictions for trends in the home systems market. Among the notable trends are the predicted mergers of media companies even as customers have more choices in video streams. "Personal Emergency Response Systems" and remote monitoring will increase for older consumers. Some customers expect health care providers to support remote monitoring. Product interoperability will continue to be challenging unless competitors agree to cooperate (such as the Matter initiative). Builders of multi-family units will be increasing the adoption of smart home technology. Solar panels, storage batteries, and smart thermostat adoption will depend on government and utility incentives. Internet providers will be offering smart Wi-Fi applications.

(IS-2022-73) The Disruptive Potential of Managed Wi-Fi

This report by Parks Associates, published in 2021 discusses what constitutes broadband Internet

speeds and how there are differences among US government minimum standards for broadband (25 Mbps download and 3 Mbps upload) and minimum speed requirements for various streaming video services. There are further variations according to desired resolution (typically 3 Mbps for standard definition TV, 5 Mbps for high definition TV, 25 Mbps for 4K definition TV) and latency (delays that affect online gaming). 13 million US homes have no high-speed Internet access. As more people work from home, managed Wi-Fi service is growing in popularity to maintain connectivity and segregate work data from family data.

(IS-2022-72) Smart Products: Building the Modern Home

This report was authored by Patrice Samuels from Parks Associates and published in 2021. It provides an overview of the market growth in smart home devices. Such devices cover a large variety such as computers, smartphones, smart TVs, smart speakers, heart rate monitors, and sleep monitors. By 2025, US broadband households with broadband Internet service are predicted to have an average of 20 connected devices. Smart home controls applications include access control, lighting, energy management, safety systems, and water management. Some smart product features include a refrigerator that adapts to minimize energy usage, indoor air-quality monitoring, a package delivery portal to the house, and energy storage batteries for home power.

(IS-2022-71) Future-Ready Broadband: Ubiquitous Connectivity for MDUs

This report was authored by Jennifer Kent and Tam Williams from Parks Associates and published in 2021. The market for broadband connections in multi-dwelling units (MDUs) grew during the pandemic that started in 2020 as about 60% of occupants were working or learning from home. Property managers may offer better services at lower rates than if the tenant purchased service directly from an Internet service provider. 40% would like Internet access to be included in their rent payment; 77% are willing to pay higher rent for Internet access. This report explains how MDU managers could benefit from networked devices that monitor energy usage, water leakage, and control building services such as lighting.

(IS-2022-70) Home Security: Choice is the Ultimate Value Proposition

This report was authored by Jennifer Kent and Tam Williams from Parks Associates and published in 2021. The home security market grew about 10% in 2021 to reach 33% of households with broadband services (compared to 19% in 2016). 56% of new installations were self-installed. Most consumers want a unified application (app) experience as they add devices. Consumers have more choices of contracts, installation, and service at lower prices. Broadband service providers are adding home security to complement network security offerings. Some offerings are for monitoring security and other devices chosen by the customer. The market leaders among purchasers are parents and those forming new households.

(IS-2022-69) Home Energy Management: Driving Consumer Engagement and New Revenue

Effective energy management in a house requires timely information about solutions that are

easy to use. Consumers are responding through "mindful actions" such as adjusting lights and thermostats, home improvements, and "extreme measures" such as installing solar panels. Consumers show a "lack of enthusiasm" for data about energy usage. Saving money is an incentive for energy management. Messages from utilities should be personalized for the customer. Connected devices in a home can offer opportunities for energy management especially if automated in smart devices. Consumers prefer energy management through automation with very little manual input. This report was written by Parks Associates and published in 2021.

(IS-2022-68) AI-enabled Data: Key to Video Service Optimization In Partnership

This report by Parks Associates, published in 2021, explores applications of artificial intelligence (AI) and machine learning (ML) to help providers and customers optimize the delivery of streaming TV services. 82% of those households with high-speed Internet access subscribe to at least one streaming service; the average is 5.6 streaming services. There is frequent churn in subscriptions except for Netflix (subscribed for 48 months), Amazon Prime (38 months), and Hulu (28 months). The churn rate is 44% especially among one-quarter of customers. Options for providers to retain customers are discussed using AI and ML tools. These tools are can help with enhancing revenue, customer experience, content, churn detection and prediction, subscriber retention, audience analysis, and improving returns-on-investment.

 (IS-2022-67) The Changing Landscape for EPCs in Canada - An Industry Perspective

This White Paper by MCW and KWM Consulting, provides a multi-faceted overview of the current state of Energy Performance Contract (EPC) services delivery in Canada, an industry MCW has supported for 30 years through MCW Custom Energy Solutions Ltd., our dedicated performance contracting division. The White Paper aims to provide unbiased evidence of historical success and recommendations regarding EPC project structures to policy-makers, regulatory organizations, and prospective EPC clients in the Canadian public sector. MCW looks forward to the future of the EPC model in Canada, which we believe remains a key solution to enacting important energy conservation, cost saving and de-carbonization solutions in existing building stock – a critical component of our collective ongoing climate change mitigation efforts.

(IS-2022-66) Using Data to Drive Workplace Innovation and Sustainability

In the facility management (FM) industry, both sustainability and workplace optimization have shifted from long-term goals to urgent, short-term priorities. With buildings currently accounting for around 40% of global carbon emissions, the need to improve the environmental performance of our buildings has never been greater. This white paper by Frost & Sullivan reveals the benefits of integrating building management solutions on a single technology platform, actionable data and tangible solutions to improve the management of buildings, how to leverage data to improve efficiency and tackle the sustainability challenges of the future and how to use integrated data insights to improve the way we design, build and operate buildings; comply with regulations; report our emissions; eliminate waste; and reduce operating costs and minimize risk.

(IS-2022-65) The Sustainable Real Estate Program Handbook

The 33-page handbook, by Stok LLC, covers critical factors in both developing and managing a Sustainable Real Estate Program. Each section provides a clear, step-by-step approach that seeks to codify and simplify what is, for most companies, a complex exercise in change. The handbook also uncovers insights behind key success factors: leadership, data, stakeholder buy-in, communication, and strategic approach.

(IS-2022-64) The Plumbing of Internet of Things

Today's device builders are scrambling to create feature-rich connected devices with digital experiences around them. But developers face challenges when adopting technology for an IoT implementation. This whitepaper by Siemens Digital Industries Software reviews ways to help manage potential risk factors.

(IS-2022-63) HVAC Winter 2022

This eBook was authored by Consulting-Specifying Engineer, Air Solutions Company and, Grundfos and published by CFEMedia on January 26, 2022. The eBook covers topics on the use of louvers to prevent snow intake, filters for HVAC, specifying roof top units, pumping systems, integrating BAS in designs and improving indoor air quality. Each topic explains the challenges and opportunities in these HVAC applications with case studies and AHSRAE standards and other regulations that could apply. New controls and building automation capabilities are shown to provide better control, monitoring, and reporting to improve performance and avoid breakdowns.

(IS-2022-62) How Tech is Helping Companies Optimize a Hybrid Future

As more and more companies invest substantial time and money into the ideal hybrid workplace, it is becoming ever more critical to have a crystal clear understanding of what occupiers really want out of their new flexible, hybrid spaces. In this report by Smarten Spaces published February 2022, the author explores the hybrid workplace priorities for enterprise office occupiers, and discuss a range of strategies which firms in a range of industries can use to provide these workplaces cost effectively, from technology to layouts and beyond.

(IS-2022-61) Combining OpenADR and EEBUS for Energy Control

In this whitepaper, by OpenADR and EEBUS, published January 2022 explains how these two established industry standards provide a solution available today to handle rapidly growing power demands. The paper details how secure capacity & tariff management and building control provided by both OpenADR and EEBUS together can enhance energy management and the smart grid. The paper examines the two standards often considered for energy management and smart grid applications. It helps to identify the key criteria that decision makers should be evaluating when designing a solution in terms of performance, reliability, scalability, interoperability, and security.

(IS-2022-60) Building a Better Hybrid Workplace

Hybrid work is the future. But how do we improve and adapt our spaces to operate successful hybrid models? Learn how companies use data to build better workplaces that are safe, efficient and empower people to do their best work. This report covers: where employees prefer to work using heatmaps of floorplans, creating safer spaces using occupancy data and displays, and building better workplace experiences by protecting employee privacy.

(IS-2022-59) Beyond IR Thermography How Continuous Thermal Monitoring Improves Performance and Equipment Protection

For many years, scheduled infrared thermography inspections have been the accepted method for reducing the risk of fire by identifying faulty or loose connections in electrical distribution systems. Continuous thermal monitoring offers a safer, more effective way to detect thermal risks on a system-wide, 24/7 basis before they occur. This report, by Schneider Electric, discusses how thermal monitoring reduces risk of fire more effectively than IR thermography.

(IS-2022-58) Accelerating the Path to Design Buildings that Satisfy Performance and Comfort

This report, authored by Ruben Cabanillas Ramosf at Skidmore, Owings & Merrill (SOM) and published on January 14, 2022 by Cove.tool reviews a case study and describes the process and methodology, required climate data and various tools to bring moisture, temperature and air into the proper comfort zone. By adding cove.tool to their existing workflow, the designers at SOM found value in the way cove.tool helped them organize their data and reduce the number of steps and approvals in their original workflow. It also helped teams save countless hours through a simplified workflow that increased collaboration.

(IS-2022-57) A New Way to Work Requires a Novel Approach to Technology Investments

This report was authored by contributors to and staff at Frost and Sullivan and published in December 2021. The report is a compilation of 4 Chapters that describe the way business is adopting digital technologies and cloud services to enhance the work environment and increase productivity. The hybrid work environment, where employees, regardless of their location, have high-quality access to the tools and information they need to carry on their work, connect and collaborate with other team members, in a seamless, fully secure, uninterrupted way, is here to stay. API and integration unlock the full potential of Cloud communications and collaboration.

(IS-2022-56) The State of Commercial Real Estate Building Operations for 2022

This report was authored and published by Building Engines in January 2022. They partnered with BOMA (Building Owners and Managers Association International) to survey commercial property professionals about the state of CRE (commercial real estate) today, and their intentions and expectations for 2022. The survey results suggest an optimistic outlook for the commercial real estate industry in the year ahead. 93 percent of the CRE professionals we surveyed said their

property portfolio had stayed the same or gotten bigger in 2021. And 98 percent of them expected their investment in CRE software to stay the same or increase in 2022. Property teams are increasingly aware of the carbon footprint of commercial buildings. They are taking action to address this, with 71 percent of survey respondents prioritizing energy efficiency for 2022. And they are conscious of a change in tenant expectations, with 63 percent of respondents looking to address health, wellness, and air quality in their buildings.

(IS-2022-55) The Growing Demand for Resiliency Solutions as Extreme Weather Increases

This report was authored and published by Bloom Energy and Wood Mackenzie Power and Renewables in January 2022. The Department of Energy (DOE) estimates that power outages cost the U.S. economy $150 billion annually. Both the proliferation of more extreme weather events and America's aging power grid due that has much of the transmission and distribution built in the 1950s and 1960s. This aging grid is more vulnerable to outages caused by extreme weather. And utility initiatives to harden the grid against extreme weather are expensive, costs that will ultimately be passed down to ratepayers. In this report, Bloom Energy compares the various options for backup power with regards to costs, response time and environmental impacts.

(IS-2022-54) State of the Hybrid Workplace Report

This report authored and published by VergeSense in January 2022 analyzes workplace utilization data drawn from over 40M square feet from across the world, covering various industries and enterprises. Averaging utilization across company working hours it was found that office utilization has increased by 135% since the start of the pandemic. New space planning ratio is one collaboration space for every two desks vs. the previous one collaboration space for every six desks pre-pandemic. Since the start of the year (Q1 2021) the average number of collaborative spaces per floor has increased by 35%. The average number of individual spaces per floor has stayed the same. Utilization of collaborative spaces has increased by 50%. In Q3 2021, the most frequented work-from-office days were Tuesdays and Wednesdays with 46% of total office utilization happening on those days. This report underscores that the future of the office is highly collaborative and agile, and the following data will help equip business leaders to make informed decisions regarding their real estate portfolios and office spaces.

(IS-2022-53) Smart Building Connectivity Shaping the Always-on Business of Tomorrow

In this December 2021 CommScope discusses three consistent needs emerging as enterprises embrace the efficiencies of intelligent buildings: The need for mobile connectivity within the enterprise, as fewer employees are bound to desks but need ubiquitous wireless coverage. The need to lay a future-ready infrastructure foundation for the still-evolving, ever-growing internet of things (IoT). The need to converge many disparate or proprietary networks onto a single, unified IP over Ethernet physical network layer Each chapter includes specific recommendations you can put to work in your enterprise network to create a more intelligent, more efficient building that better serves the needs of your growing business.

(IS-2022-52) Intelligent Buildings - A Technical Overview

This July 2021 report released by the Center for Energy and Environment, based in Minneapolis, provides an overview of the state of intelligent building technologies. The authors look at what can be currently deployed to increase the efficiency of building operations, promote greater occupant comfort and productivity, and serve as an energy resource to the electrical utility grid. Details are provided on what it means for a commercial building to be intelligent and opportunities that can bring to building owners, operators, and occupants, as well as the grid.

(IS-2022-51) Intelligent Buildings Literature Review

This report by the Center for Energy and Environment came out in September 2021. In highlighting the areas that impact intelligent building energy use, this report focuses on the importance of ensuring that potential strategies are aligned with current design trends, market structure, building operation/maintenance, and work practices. Energy efficiency opportunities that intelligent buildings can provide are discussed along with their market potential.

(IS-2022-50) Smart Home Ecosystem Growth Opportunities

This report by Harbor Research (August 2021) highlights that smart home market is fragmented with competing networking standards, a myriad of multi-purpose hubs, and legacy-entrenched technology that tend to focus on single applications (e.g., home security, energy, entertainment). Further challenges include incomplete platforms, narrow point-solutions, and software incompatibility. Technical recommendations are proposed for greater industry collaboration to remove barriers to adoption, improve the overall user experience and lower cost.

(IS-2022-49) What Gets Measured Gets Managed - The Role of Real-Time Insights in Construction Project Success

This report from Procore Technologies (May 2021) explains how construction managers can improve product quality, overall efficiency, and productivity by having better visibility into project performance. Various strategies for gaining those real-time insights into projects are discussed, including performance monitoring systems (construction- specific platforms and point solutions) and artificial intelligence (AI) or machine learning technologies. The research suggests that companies can still improve their performance by shifting away from manual data collection and reporting tools and adopting integrated platforms that deliver real-time performance metrics.

(IS-2022-48) Grid-Edge DERMS - An Enterprise Platform Built to Manage DERS at Scale

This 2021 report from New York-based EnergyHub focuses on how electricity grid operators can manage distributed energy resources (DER) on both sides of the meter - at the grid-edge - using a combination of DER Management Strategies (DERMS). Following discussion of key challenges in managing grid-edge DERs, the authors examine five key capabilities required, including customer-centric aggregation, grid-edge situational awareness and a robust infrastructure.

Illustrations of operating models and examples of successful deployments are provided including one focusing on electrical utility Arizona Public Service.

(IS-2022-47) Draft Heat in Buildings Strategy - Achieving Net Zero Emissions in Scotland's Buildings

This draft strategy by the government of Scotland (February 2021) sets out actions and proposals for transforming the country's buildings and the systems that supply their heat, ensuring all buildings reach zero emissions by 2045. A framework for the country's long term local heat and energy efficiency, dubbed LHEES, is outlined. Strategic priorities include supporting those least able to pay; strategic investments in technology; showcasing net zero Leadership; and investing in Innovation and demonstration to drive forward competitive advantage. Under the £1.6-billion LHEES program, over two million homes and 100,000 non-domestic properties will transition from fossil fuel powered heating to non-fossil fuel energy efficient systems, by 2034, and, to zero emissions heating and cooling systems by 2045.

(IS-2022-46) Equipment Reliability - Basics Matter Now More Than Ever

This 2021 branded content report by GE Digital and Utility Dive produced by studio is subtitled "How changing operations and market dynamics put a renewed focus on cost- efficient plant-wide reliability." Power plant owners and operators are expected to continue to face greater reliability challenges. This report highlights that combining the workflows and fundamentals – that have always been essential to reliability – with advanced software and analytics that monitor all of the components of a power plant, traditional power generators can become more reliable even as their operations change.

(IS-2022-45) PoE Lighting Improves Firefighting Preparedness and Response

This 2021 report by the Siemon Company examines the ability to integrate a digital lighting system with an existing emergency alert system. A case study focusing on the Evendale Fire Department located in Cincinnati, Ohio, is provided. In the case study, it was possible to program the lights in the bunk room to gradually illuminate and wake the firefighters more gently when calls came. The benefits included more efficient response times and improved cognitive functioning, a more aesthetically-pleasing environment, and cost savings from less energy consumption and maintenance. The report suggests that PoE lighting is rapidly gaining traction in the commercial construction industry and the market is expected to continue growing in the years to come.

(IS-2022-44) Optimal Installation - The Key To A Successful HVLS Investment

This 2021 report from Hunter Fans proposes simplified framework for users to select a high-volume, low-speed (HVLS) fan for a facility. Outlining that temperature control and air quality are the primary reasons of fan installation, the report explores the technicalities and installation considerations to ensure that it is installed in the most cost- and time-efficient manner. Factors such as square footage of the space envisaged, ceiling height, the type of structure where the

fans will be mounted to, electrical requirements, and fan control options are explained.

(IS-2022-43) Energy Efficiency and Demand Response - Tools to Address Texas' Reliability Challenges

In this report for October 2021, ACEEE examines seven residential energy efficiency retrofit measures that could be adopted in Texas in light of the state's electricity reliability problems. Power shutoffs over the winter (February 2021) and the tight summer supply situation during the same year illustrated that Texas lags behind other states in deploying energy efficiency and demand response programs. The authors provide a preliminary analysis intended to offer ballpark estimates for what energy efficiency and demand response could accomplish quickly in Texas. An estimation of benefits (peak demand reduction, lower energy bills, reduced need for utility capital expenditures) to Texas consumers and power generation utilities is also carried out.

(IS-2022-42) Community Choice Aggregation and Energy Efficiency - Opportunities, Challenges, and Lessons Learned

This 2021 report by ACEEE examines the opportunity presented by Community Choice Aggregation (CCA) energy efficiency initiatives in the United States. It identifies the key obstacles, contextual regulatory and legislative factors that influence program opportunities, and offers a set of improvement opportunities for the CCA role in supporting energy efficiency in their local context. The analysis shows that a majority of CCAs operating nationwide are not currently offering energy efficiency programs. Findings suggest that communities pursuing energy aggregation can be more successful at realizing the benefits of energy efficiency programs by addressing resource funding, developing partnerships, and leveraging community support.

(IS-2022-41) Lighting for Health - Human-Centric Lighting

This 2021 report by Luminus Devices, Inc. from 2021 examines human-centric lighting (HCL), a decades-old concept that now through scientific and LED technology advancements is supported by more sophisticated approaches not previously seen. The analysis highlights that creating basic HCL schemes requires selecting fixtures with the appropriate color temperature and brightness that reach circadian standard targets while optimizing for human productivity, comfort, and rest. The report outlines what "healthful light" means and discusses the role of existing standards such as the WELL Building Standard, which provides an evidence-based system for calculating healthful light.

(IS-2022-40) Landlords Must Adopt and Refine Flex Strategies to Survive a Rapidly Changing Real Estate Market

In 2021, Essensy undertook to understand current trends in real estate related to flex spaces — and user and landlord expectations and strategies in a post-pandemic world. The findings reported here reflect data collected through an interview format across the UK, North America,

and Europe. Building occupant expectations highlighted the importance of technology in buildings, remote working, interior environments that support employee productivity. From the landlord perspective, the most common strategies cited were flexible meeting spaces, premium serviced offices and short lease office spaces. The analysis concludes that demand for flex space will become more common in the market and that a digital ecosystem can unlock new revenue generation opportunities to monetize more building services.

(IS-2022-39) Bringing Clean Energy Home

This October 2021 report from RMI, an independent nonprofit, is subtitled "Unlocking Innovation and Policy to Align US Household Energy Use with Ambitious Climate Targets." It describes the challenges, opportunities, barriers, and emerging solutions associated with aligning household energy decisions with ambitious climate policy targets. The authors conclude with recommendations for solutions providers, policymakers, regulators, and utilities, and an assessment of an example household energy service that could help unlock clean energy for U.S. households. The latter item involves in-depth look at the energy savings potential that can be realized through solutions like Nest Renew, providing customers with features that enable demand response and energy efficiency.

(IS-2022-38) Home Unbound - Transitioning Back to the Office After COVID

This 2021 report was by Brivo, a prover of cloud-based access control and video surveillance, and WhosOnLocation, a people presence management software company. The analysis showcases the results of an online survey of five hundred thirty-eight respondents in all U.S. states. The aim is to gauge people's willingness and main concerns regarding to the office. Human interaction with clients and colleagues was cited the main reason for returning to the workplace. Nonetheless, 59% of survey respondents expressed concern about returning to an office and worker proximity was identified as a major worry for all sectors. The report concludes that one-third of workers will eagerly return to the office, one-third will stay at home, and a final third will take a hybrid approach.

(IS-2022-37) U.S. & Canada Office Fit Out Guide

This 2021 report from JLL provides a useful tool to compare office construction fit-out costs across U.S. and Canadian markets relying on robust data collected by the company from several projects in the region. The analysis uses three different offices fit out styles and space configurations to assist the user to make better and more informed real estate decisions at the planning stage of the project. It suggests that while National average costs could increase by 3.5 to 5.5 percent over the course of 2021, salaries are forecast to keep rising at a steady pace in the range of 2 to 5 percent. The trends about how designs are adapting to the post pandemic world, are similar in both, Canada and the United States.

(IS-2022-36) Smart Home Light Based Service Oriented Architecture and IoT

This academic article was published by IOP Publishing in February 2021. The report presents an

application of Service Oriented Architecture (SOA) and Internet of Things (IoT) to build a control lighting system for smart homes. Based on the Raspberry Pi microcontroller, the system includes security features and can be deployed remotely using an Android smartphone.

(IS-2022-35) Machine Learning in Wireless Sensor Networks for Smart Cities - A Survey

This academic article appeared in MDPI's *Electronics* journal in April 2021. The report presents an in-depth literature survey of machine learning methods as an optimization tool for regular wireless sensor networks and Internet of Things (WSN-IoT) nodes deployed in smart city applications. The survey results indicate that the supervised learning algorithms have been most widely used (61%) as compared to reinforcement learning (27%) and unsupervised learning (12%) for smart city applications.

(IS-2022-33) How using smart buildings technology can improve indoor environmental quality in educational buildings

This report was published by EDP Sciences in April 2021. The report presents a case study of an architectural project for an elementary and junior high school academic campus in the state of Nuevo León, Mexico. The project takes into account extreme climate conditions, while applying the best alternative and bioclimatic strategies through the implementation of inmotics, a responsive architectural skin, sustainable construction systems, and native vegetation. The result of the project is a comprehensive environmentally friendly building that is based on the latest environmentally oriented systems and technologies.

(IS-2022-32) Artificial Intelligence Evolution in Smart Buildings for Energy Efficiency

This academic article that appeared in the MDPI journal *Applied Sciences* in January 2021. The report provides an in-depth review of recent studies on the application of artificial intelligence (AI) technologies in smart buildings through the concept of a building management system (BMS) and demand response programs (DRPs).

(IS-2022-31) An Automatic Aggregator of Power Flexibility in Smart Buildings Using Software Based Orchestration

This academic article appeared in the MDPI journals *Sensors* in January 2021. The report presents a software-based modular and hierarchical building energy management system (BEMS) to control the power consumption in sensor-equipped buildings. This system is able to aggregate the controls of the all-controllable resources in building to realize its flexible power capacity. The main novelty of this system is that it can handle the heterogeneity of the installed hardware system along with time bound changes in the load device network and its scalability; resulting in low maintenance requirements after deployment.

(IS-2022-30) The Guide to Smart Building Technologies

This October 2021 report by Cisco discusses how the COVID-19 pandemic accelerated the need to create "smart and intuitive" buildings. By providing a sense of health and well- being for users, these buildings also maximize space utilization around social distancing and other mandates. Architects, developers, and building operators have opportunities to leverage technology to add value to planned or existing structures. Through design with technology, they can build "trusted workplaces" featuring improved health and safety, more intuitive spaces, and reduced costs and resource usage, all while increasing sustainability.

(IS-2022-29) Advanced Supervision of Smart Buildings Using a Novel Open-Source Control Platform

This article which appeared in the MDPI journal *Sensors* deals with an advanced supervision model for continuous online monitoring and analysis of process behaviour in smart buildings or other industrial control systems. The model is developed using open- source tools and includes an artificial operator to autonomously supervise the process. The model has been successfully tested in a simulation and a practical case study of a two-storey family house.

(IS-2022-28) A Unified Methodology to Predict Wi-Fi Network Usage in Smart Buildings

This report was published in the journal *IEEE Access* in January 2021. The report looks at the use of Wi-Fi network association information as a basis for the design of intelligent systems for smart buildings. The proposed methodology enables the user to evaluate and to create machine learning models for energy efficient smart building management systems. The authors report that the model can be used to predict occupancy with an 87% accuracy.

(IS-2022-27) Emerging Trends in Wireless Infrastructure

This report by Rohde & Schwarz was released in August 2021. The report describes the emerging infrastructure trends of wireless networks for 4G, 5G, and beyond 5G. These trends provide more opportunities to service providers for network deployments, network customization, and network optimization. The analysis provides commentary on some of the key drivers, including spectrum, densification and coverage extension methods, virtualization and cloudification, and network customization and intelligence. These trends, which are presented in detail, are expected to continue in the coming years with the advance of 6G deployments.

(IS-2022-26) Consumer Systems and Home Automation - A Disruptive End to Silo Thinking

This report appeared in *Euromonitor International* in August 2021. The analysis focuses on the importance of consumer systems, rather than product silos, to reap new incremental profit opportunities with new business models. Key elements to creating new business models include holistic thinking, improving user experience, and creating partnerships. Business case studies are presented regarding pay-per-wash and Internet of clothing (IoC) initiatives.

(IS-2022-25) Demand Flexibility in New York City Buildings - Benefits Beyond Carbon

This report by RMI (May 2021) focuses on how electrical power demand flexibility provides benefits to New York City. Community level benefits include improved air quality, reduced pollution, and reduced operating costs. Buildings need to be incentivized to combine the electrification of heating with controls that allow their demand to be flexible. Compliance with Local Law 97 (LL97) will be supported with system wide decarbonization, combined with efficiency, demand flexibility, and electrification.

(IS-2022-24) BIPV Solutions in Europe - Competitiveness Status & Roadmap Towards 2030

This report from the Becquerel Institute, a research institute focusing on solar PV, was released in May 2021. The authors examine the "competitiveness" level of various building integrated photovoltaics (BIPV) solutions in key Western European markets. Competitiveness is assessed using a method of total costs and revenues of ownership to clearly identify the intrinsic economic attractiveness of BIPV as a building envelope solution. The methodology includes an "extra cost" assessment to consider the role of building components fulfilled by BIPV elements and consequently the avoided expenses for the façades or roof claddings. Findings highlight that as electricity generating units, BIPV systems can be competitive and an attractive investment.

(IS-2022-22) State of the Electric Utility Survey Report 2021

This report from Utility Drive was released in March 2021. Findings from a national survey of hundreds of utility leaders across the United States are presented. Survey results indicate that COVID-19 has impacted an increase in remote working and loss of revenue. The main drivers on the electrical load changes were the shifts that took place during the pandemic, and energy efficiency programs. Utilities expect an increase in use of grid-scale solar energy, distributed energy resources, grid-scale battery storage, and wind. Top priorities for utilities going forward are renewables, sustainability, and the environment.

(IS-2022-21) Utilizing Existing Copper Infrastructure for Deployment of Fiber-grade Services

This report from the Broadband Forum was released in January 2021. The report deals with fiber access extension as an alternative to existing copper infrastructure, one that provides service providers an architecture to deploy fiber services cost effectively. This architecture consists of a network where the fiber is extended by using a copper medium without causing significant degradation in quality of user experience as compared to the fiber to the home topology.

(IS-2022-20) Powering Forward to Net-Zero - AEP's Climate Impact Analysis

This 2021 report was authored AEP, a large power producing company in the Mid- Atlantic Region. The analysis focuses on the progress and direction of the company to achieve Net-Zero by 2050. The challenges to get to all renewables is complex and difficult. Nicholas addresses employment, technology, corporate responsibility, and technical obstacles that must be tackled to be successful. Having a large coal generation base requires much investment, training, tremendous building projects.

(IS-2022-19) Getting Control of Comfort and Energy: The Benefits of Upgrading to Automated Shades and Advanced Lighting in Commercial Buildings

This report by Denver Net Zero from May 2021 describes how upgrades in terms of automated shades and advanced lighting will help the energy effectiveness of building lighting systems as well as healthy working environments. Five key steps are outlined: 1. Focus on occupant improvements, what needs are not being met by the building; 2. Engage a single entity to provide turnkey design, installation, commissioning, and long- term system support for the system; 3.Get stakeholders at the table early, including the IT department, facilities managers, and key occupants and staff. Communicate the benefits of the new systems to generate buy-in from occupants; 4. When conducting a cost-benefit analysis of system upgrades include occupant health benefits such as improved comfort, well-being, and productivity. Pursue energy efficiency incentives to support the project; 5. Maximize your savings by bundling HVAC retro-commissioning, lighting upgrades, advanced lighting controls, and other advanced technology solutions.

(IS-2022-18) Denver's Net Zero Energy (NZE) New Buildings & Homes Implementation Plan

Denver's "NZE" plan was set out in this 168-page document prepared by the New Building Institute and Denver Climate Action, Sustainability & Resiliency (released in January 2021). The stated objectives focus on clean energy job growth, economic recovery, and improved energy equity through enhancements to the Denver Building and Fire Code with the goal of all new buildings achieving net zero energy by 2030. The plan envisages, in particular:

• Net zero energy, all-electric new homes in the 2024 Building Code

• Net zero energy, all-electric new buildings in the 2027 Building Code

• New buildings performing as designed with performance verification in the 2030 Building Code

(IS-2022-17) Seeds of Opportunity - How Rural America is Reaping Economic Development Benefits from the Growth of Renewables

This report by RMI was published in January of 2021. This report sets out to quantify the scale of the economic development opportunity from the growth of onshore wind and utility-scale solar projects in rural areas, and demonstrates what that means for communities through case studies of existing projects from three different regions. The report offers recommendations for local, state, and federal leaders to unlock this opportunity. In total, the analysis suggests that the approximately 600 GW of new wind and solar projected to be built between 2020 and 2030 would generate $220 billion in lifetime value across rural America.

(IS-2022-16) Renewables in Cities 2021 Global Status Report

This article by REN21, a renewable energy policy think tank, was published in May 2021. The article provides insight to the progress that has made over the last 20 years and that current challenges and opportunities in relation to future progress. City governments in more than 830

cities in 72 countries had set renewable energy targets in at least one sector (power, heating and cooling, and/or transport), the analysis shows. Over 610 of these cities had set 100% renewable energy targets.

(IS-2022-15) From Traditional to Smart Building Materials in Architecture

This report was published by IOP Publishing in June 2021. A comparison between intelligent materials and traditional building materials for building efficiency is provided. The authors include an overview of the types of materials that can be used in construction and architecture, thus offering a new perspective on innovative techniques that will be available, or are already available, paving the way for improvements in both disciplines. Consideration is given to smart and sustainable design with emphasis on maintaining thermal, visual and acoustic comfort.

(IS-2022-14) Smart Materials in Architecture for Actuator and Sensor Applications A review

This academic article published by SAGE in August 2021 reviews smart materials-based technologies which are currently applied or developed for application in civil structures, focusing on smart material applications for actuation or sensing. Applications of the investigated materials are discussed, including shape memory materials, electro- and magnetostrictive materials, piezoelectric materials, ionic polymer-metal composites, dielectrical elastomers, polyelectrolyte gels as well as magneto- and electrorheological fluids, are presented for the fields of architecture and civil engineering.

(IS-2022-13) Smart Home Modification Design Strategies for Ageing in Place - A Systematic Review

This report was published in the *Journal of Housing and the Built Environment* in August 4 2021. It presents findings from a literature review of 34 scholarly articles regarding the current strategies and approaches directed to integrate innovative technologies in the home modification process to support independent living and ageing. The findings indicate that both home modification and smart technologies can support older adults' independent living, especially with fall prevention and indoor accessibility. The fundamental requirements in smart home modification phases are customization, minimum life interference, and extensible technologies to cope with the ageing process.

(IS-2022-12) Live, Work, Connect

This November 2021 report by WiredScore reports on the results of a survey of those who transitioned to home working or studying throughout Europe during the pandemic. The findings and analysis show that productivity levels when working from home have increased across Europe during the COVID-19 pandemic. As well, the desire to remain constantly connected has brought to light the need for the best digital connectivity, no matter the location. The authors highlight that while digital solutions are being implemented within buildings, a significant knowledge gap exists, leaving many unable to use the technology to its full potential.

(IS-2022-11) Smart Buildings - Our Future is Smart

This April 2021 report was released by SmartScore. With little agreement in the industry on fundamental questions for the smart building — how to create one, how to work with the supply chain, or even what 'smart' means – this report sets out to sharpen the meaning of the smart building with a user-centric, outcome-orientated approach. The report argues that smart buildings must above all use digital technology to deliver "outstanding outcomes" for users and exceed their expectations. The outcomes that users care most about, according to the authors, are an inspirational experience, a sustainable building, cost efficiencies, and a "future-proof by design" building.

(IS-2022-10) The Untapped 87% - Simplifying Controls Technology for Small Buildings

This December 2021 report was authored by James Dice and published by Keyframe Capital Partners, L.P. BAS are generally only installed in larger buildings—those above 75,000 square feet. But solving the climate crisis and maintaining a resilient electric grid depends on reducing complexity for ALL buildings, including the 5.5 million buildings under 50,000 square feet. This report delves into, among other aspects: the value of controls technology to small building owners and other stakeholders; how layers of complexity stack upon each other, and how to remove them; and innovative trends in small building controls. The analysis shows that scaling controls solutions to all buildings is a vital next step. Scalability will be enabled when the whole complexity stack comes together and is fit to each exact subset of this heterogeneous market.

(IS-2022-9) Decarbonizing Canada's Large Buildings - Summary Report

This report by RDH Building Science in collaboration with Dunsky Energy + Climate Advisors was released by Canada Green Building Council (CaGBC) in December 2021. The report evaluates the potential pathways to decarbonized building operations, including the estimated deep carbon retrofit costs for Large Buildings. Nearly all office building archetypes can reach net zero carbon operations, while at the same time achieving a positive net present value. The authors highlight that large building retrofits can reduce building-sector emissions by up to 51 per cent (21.2 million tons), the report notes.

(IS-2022-8) Net-Zero Energy & Net-Zero Carbon — Design Strategies to Reach Building Performance Goals

This report by cove tool was published on October 12, 2021. The reports highlights that architects, engineers, and all parties involved in the building design process must begin implementing sustainable strategies into their workflows to make a significant impact in the fight against climate change. In this e-book, the differences between net-zero energy and net-zero carbon are illustrated, along with key design strategies to help architects and engineers meet performance targets.

(IS-2022-7) The Financial Impact of Healthy Buildings

This report from the MIT Real Estate Innovation Lab appeared in October 2021. Using the commercial real estate data platform CompStak and healthy building public databases from Fitwel and WELL, a real estate hedonic model was created in order to ascertain the value of healthy spaces on the effective rent of offices spaces in ten U.S. cities. Findings show healthy building rents transacting between 4.4 and 7.7% more per square foot than their nearby non-certified and non-registered peers. This "premium" for healthy spaces exists independently of all other factors such as LEED certification, building age, renovation, lease duration, and submarket. These results indicate that healthy buildings are seen as an asset that correlates with employee or tenant well- being and productivity.

(IS-2022-6) SMART BUILDINGS Fall 2021 | Consulting-Specifying Engineer Ebook

This ebook by *Consulting - Specifying Engineer* produced in collaboration with Siemens focuses on chiller energy optimization systems versus building automation systems, highlighting four demand factors beyond COVID-19 prevention for smart buildings. The report explains that a chiller energy optimization system continuously looks at all of the operating equipment and seeks to minimize the overall chiller plant electric demand.

The technology has the ability to monitors and adjusts setpoints and equipment speeds, and it's this flexible readjusting of established control loops that makes the device "smart" — a system working in conjunction with the BAS to optimize the operation of the chiller plant without human intervention.

(IS-2022-5) Build Up 2030 Framework for the Transformation of Real Estate

This September 2021 report was authored by the Institute for Market Transformation (IMT). Along with the changes resulting from the COVID-19 global pandemic, the real estate industry is also transforming its understanding of and approaches to how buildings contribute to the economy and to healthy communities. IMT's "Framework for Transformation" comprises 10 principles it recommends real estate professionals and companies to use to actively transform their business practices and communities. Drawing on discussion with a coalition of 20 real estate industry leaders from across the U.S, IMT proposes vision that was informed by the "realities and potential seen by professionals" in terms of industry transformation.

(IS-2022-4) Modular Software Architecture for Local Smart Building Servers

This academic article was published in MDPI's *Sensors Journal* in August 2021. It presents the architecture and construction of a novel plug-and-play system for optimal monitoring and control of energy and water consumption in smart buildings. Based on the Raspberry Pi microcontroller, the system is cloud-based and includes nine modules that inter-communicate. The system was tested on fifteen social housing units was able to detect abnormal energy consumption.

(IS-2022-3) A Smart Home Architecture for Smart Energy Consumption in a Residence With Multiple Users

This academic article published in the journal IEEE Access presents an evaluation of a Smart Energy Control Systems (SECS) architecture called SmartCom. The system provides an accurate identification of electrical equipment through near field communication (NFC) between smart outlets (SO) and appliances. The results indicate that the system can achieve a rebalanced residential energy consumption 87.3% of the time with minimal disruption to users' comfort.

(IS-2022-2) Luminaire Level Lighting Controls and the Future of Healthy Buildings

In this report from May 2021, researchers with the Energy Studies in Building Lab at the University of Oregon describe ways to improve utilization of the presently disparate LLLC and BAS data streams to support energy efficiency and improve human comfort and human health outcomes. Published by BetterBricks, a commercial resource produced by NEEA (Northwest Energy Efficiency Alliance), the report outlines key potential benefits that include: improved ventilation management to support improved cognitive function; improved vertical field lighting scene management to reduce glare and improve circadian exposure; and data integration and situational awareness to support building operations that will reduce pathogen transmission risk. There are, however, notable obstacles to delivering on that vision, ranging from poor hardware and software interoperability and privacy/security concerns to the (complex) need to optimize the number and types of sensors in a network.

(IS-2022-1) Grid-Interactive Efficient Buildings Made Easy

This June 2021 report by RMI recommends actionable steps for GSA building managers to implement low- and no-cost measures that result in utility cost savings and greenhouse gas emissions reductions. The best candidates for grid-interactivity adjustments are buildings that are subject to time-of use utility pricing, are all-electric or have future electrification planned, or have existing energy storage and renewable energy capabilities, the authors note. Upcoming renovations or equipment replacement projects present ideal opportunities to add GEB measures. Moreover, building managers should consider "GEB-ready" measures, such as requiring smart controls on lighting, HVAC equipment, and other electric fixtures and equipment and integrating all new equipment into a central EMIS.

(IS-2021-266) Taking the Pandemic Pulse of Healthcare Real Estate

This BOMA International "Deep Dive" from August 2021 highlights that nowhere have COVID's transformational effects been more apparent than in healthcare; namely, the medical office building (MOB) sector. A key factor in MOB growth has been the move to take healthcare off the hospital campus and bring it out to patients. Competition between health systems, cost management and containment and insurance pressures are all drivers of this trend.

(IS-2021-265) The Future of Commercial Facility Management

This September 2021 report by Propmodo Research for Microshare looks at the tools and tech platforms that facility managers can enlist to make their jobs easier. The analysis identifies key challenges facing practitioners in the space and explores facility manager training requirements, providing a closer look at competencies and skill sets modern FM professionals should come to the table with.

(IS-2021-264) Raising Awareness Around IoT Strategy, A Mobile Network Operators Perspective on Approaches and Challenges

This report was prepared by Forrester Research and published in April 2020. The authors provide insight to organizations on how to integrate Internet of Things (IoT) solutions into their business. Fundamentally a customer-centric opportunity, the development of IoT solutions demands a long-term approach during which organizations focus on preparing for the competition ahead and learning the best techniques and processes to achieve full deployment, the authors highlight.

(IS-2021-263) Commercial Office – 7 Keys to a Successful Post-COVID Workplace

In a report from April 2021, Building Engines highlights that while COVID-19 upended the CRE industry, many keys to the property managers success pre-pandemic have been essential in navigating the current moment and will be crucial during what comes next. Timely communications, strong team collaboration and flexible thinking are key to any building portfolio's success. Moreover, as property teams know, many challenges lie ahead, including the fact that buildings now need to provide what home offices can't, including flexible coworking spaces and attractive amenities.

(IS-2021-262) Low Carbon Multifamily Retrofits: Garden Style 1-3 Stories

This report focusing on a distinct *garden style, 1-3 stories* building segment is part of a series authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The report emphasizes retrofit strategies that maximize occupant comfort and energy savings through a transition from fuel to electricity-based heating, cooling and hot water systems. Aligned with typical capital improvement cycles, the recommendations will prepare buildings for increasingly stringent efficiency and carbon emissions targets through careful phasing of work across all major building components, including upgrades to exterior walls, windows, and ventilation systems. The report describes the primary benefits of a low carbon retrofit with details on the major system upgrades needed to access those benefits.

(IS-2021-261) Low Carbon Multifamily Retrofits: Post 1980 8+ Stories

This report focusing on the "post 1980s, 8+ stories" segment is part of a series authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The report emphasizes retrofit strategies that maximize occupant comfort and energy savings through a transition from fuel to electricity-based heating, cooling and hot water systems. Aligned with typical capital improvement cycles, the recommendations will prepare

buildings for increasingly stringent efficiency and carbon emissions targets through careful phasing of work across all major building components, including upgrades to exterior walls, windows, and ventilation systems. The report describes the primary benefits of a low carbon retrofit with details on the major system upgrades needed to access those benefits.

(IS-2021-260) Low Carbon Multifamily Retrofits: Post-War 8+ Stories

This report focusing on a segment of buildings — 8+ stories — constructed in the post war period is part of a series authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The report emphasizes retrofit strategies that maximize occupant comfort and energy savings through a transition from fuel to electricity-based heating, cooling and hot water systems. Aligned with typical capital improvement cycles, the recommendations will prepare buildings for increasingly stringent efficiency and carbon emissions targets through careful phasing of work across all major building components, including upgrades to exterior walls, windows, and ventilation systems. The report describes the primary benefits of a low carbon retrofit with details on the major system upgrades needed to access those benefits.

(IS-2021-259) Low Carbon Multifamily Retrofits: Post-War 4-7 Stories

This report focusing on a segment of buildings (4-7 stories) constructed in the post war period is part of a series authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The post-war building selected by the authors for study is a 7-story, market-rate residential building in Brooklyn, New York. The building has masonry exterior walls enclosing 83 apartments across 76,113 gross square feet. Typical of a large swath of buildings in New York City (as well as many other regions), the building is thought to be representative of the most common challenges that will be encountered by anyone looking to perform a deep retrofit of an occupied multifamily building.

(IS-2021-258) Low Carbon Multifamily Retrofits: Prewar 4-7 Stories

This report focusing on "prewar, 3-7 story" building was authored by NYSERDA & Steven Winter Associates for Building Energy Exchange and published in March 2021. The report emphasizes retrofit strategies that maximize occupant comfort and energy savings through a transition from fuel to electricity-based heating, cooling and hot water systems. Aligned with typical capital improvement cycles, the recommendations will prepare buildings for increasingly stringent efficiency and carbon emissions targets through careful phasing of work across all major building components, including upgrades to exterior walls, windows, and ventilation systems. The report describes the primary benefits of a low carbon retrofit with details on the major system upgrades needed to access those benefits.

(IS-2021-257) Smart Buildings - A Framework for Assessing the Openness of a Building Management System (BMS)

This April 2021 report from Schneider Electric's Buildings Research Center emphasizes three

layers which the authors contend need to be understood in the context of "open" building management systems. These include (1) Data acquisition/sharing, (2) System integration, and (3) Building orchestration. The report proposes a framework, clarifies terminology, and outlines key criteria associated with being "open" — including how these criteria influence the complexity and performance of the BMS. Example use cases for each are presented.

(IS-2021-256) Why Sustainability Should be Your Competitive Edge

This March 2021 report is by Honeywell International. "Executives are increasingly turning to sustainability as a force multiplier for competitive advantage," the authors write. In the past, this was typically not a competitive focus – simply a means of demonstrating responsible corporate citizenship – and so sustainability initiatives often became silo," within the enterprise. Today, with the recognition deep ties between "sustainability" and "profitability, sustainably managed companies have become increasingly attractive to investors and customers. This report provides insight into the right "sustainability path" and how industry stakeholders can begin to identify the strategy that best fits their company by answering three critical questions: *What's my objective?; What are my opportunities?; And What will be my approach?*

(IS-2021-255) A Guide to Building Automation Systems and CMMS Integration

This March 2021 from Eagle Technology looks at how customers can win by integrating their building automation systems (BAS) with their computerized maintenance management system (CMMS). Maintaining a comfortable and efficient work environment is an important factor for any business, and with BAS integrated with the asset maintenance software, one system environment can be used to control the indoor environment and ensure that building equipment is running efficiently. "Whether they are monitoring the building's temperature or analyzing how efficiently the air conditioner is running, it can all be done by using the same software," the authors write. Because everything is completed using the same system, the faster it is to train and bring employees up to speed efficiently.

(IS-2021-254) Transform with Technology - Shaping the Future of Real Estate

This August 2021 report by JLL Research and MIT sets out to identify which real estate technology investments are the most impactful, and how stakeholders can use them to increase the employee health and wellness, maximize value of a property, and drive business forward. The digital transformation underway as the technology ecosystem around the built environment matures and consolidates is examined. The technologies available now or currently in development will radically reshape how people interact with and use buildings, with the potential to delivery much more "human-centric, resilient and responsible built environments."

(IS-2021-252) Energy Management in the Ontario Mid-Tier Commercial Real Estate Sector

This December 2020 report was authored by CIET and Knowenergy with input from a steering committee and published by the Independent Electric System Operator (IESO) in the province of Ontario. Focusing in particular on organizations that manage mid-tier commercial real estate

(CRE) buildings, the report proposes a strategy to engage them in the energy transition. The analysis was based on a survey conducted among 77 building owners and property managers, supplemented by site visits at eight mid- tier buildings. The research indicates that many respondents are lacking in their understanding of metering and lease mechanisms to monetize the value of investments in energy efficiency. The outcomes also highlight the need for education and capacity building in this market, focusing on how building owners can create value from energy efficiency.

(IS-2021-251) Flexible Buildings - Five elements to create buildings ready for the new world of work

This June 2021 report by Schneider Electric in partnership with WORKTECH Academy sets out to define "flexible buildings." With more flexible work patterns, flexible teams and flexible organizations, the market will naturally come to demand "flexible buildings" more and more as well. How should the term *flexible building* be defined? How should its key attributes be understood? This report provides practical considerations on how to specify and procure a flexible building. Designing for change, developing data science skills within the CRE team and treating flexibility as an office amenity are among the key issues raised.

(IS-2021-249) Corporate sustainability goal setting and measurement

GreenBiz Group presented the results of a survey of sustainability leaders at Fortune 500 companies as the starting point for a discussion around sustainability targets and evaluation criteria. The analysis argues that sustainability targets demand that companies consider operational planning horizons that can extend for decades. It shows that 80% of companies have emissions reduction targets and some of them have started to include "Scope 3" emissions to influence emissions of other companies and activities in their value chains.

(IS-2021-248) LEED building design and construction guidelines

This 2021 report by Gordian was designed to help architects, engineers, construction professionals and facility owners more easily grasp LEED sustainability principles. The resource reviews the highlights from each of the nine LEED guidelines and points out where they might prove valuable. The goal is to bring the main objective of each criterion to the forefront – adding practical recommendations where applicable.

(IS-2021-247) Low Carbon Strategies for Utility End-Use Sectors

This 2021 report by global consulting services company ICF examines the impact of electric infrastructure decarbonization on utilities. It analyzes challenges and opportunities linked to transportation electrification and argues that utilities can play a major role in shaping the uptake of electric vehicles. At the same time, EV charging will impact utilities as it increases the need to consider resilience upgrades and further grid hardening.

(IS-2021-246) Next-Generation Lighting Strategies

This 2020 ebook was prepared by I+S in collaboration with the industry outlet BUILDINGS is a compilation of articles by lighting industry experts. Keeping with the theme that good lighting must be about more than just illuminating a space, the authors provide overviews of technologies and strategies to carry out lighting retrofits in buildings and they explore an array of technical considerations associated with light quality, including lighting controls systems, energy efficiency, and quality metrics. Key Words: Light systems/controls, property management, system monitoring equipment, energy efficiency

(IS-2021-245 10 Predictions for Smart Building Technology in 2021 and Beyond

Verdantix analyzed the major trends that expected to influence the smart building technology market over the next 12 months and beyond in this report from December 2020. What will be the key objectives of building managers? Which technology areas will see strong levels of investment? How will integrated platform solutions fare? The analysis cover topic such as building electrification, smart controls and new applications to facilitate integrated solutions, digital twin applications and other "occupant centric" features.

(IS-2021-243) Automated Demand Response Non-Residential Incentive Structure

This report by Energy Solutions and Lawrence Berkeley National Laboratory, from August 2020, examines factors affecting the calculation of control incentives in the automated demand response (ADR) program within California's investor-owned utilities. The analysis highlights growing customer and industry interest in the program, the importance of incentives, trade ally networks and vendor engagement for program success, and the importance of cloud technologies to lower cost.

(IS-2021-241) iiSBE Frameworks for Performance Targeting and Assessment

This December 2020 report from the International Initiative for a Sustainable Built Environment focuses on development tools for the establishment of sustainability performance targets, with the goal of assessing predicted or actual performance for small urban areas and buildings. Consideration is also given to integrated design process and post-occupancy performance evaluation. With the proposed tools, users have the opportunity insert local context values, performance benchmarks and targets to suit certain building types, leading to a calibrated system that provides meaningful results.

(IS-2021-240) Unlocking Value Across the UK's Digital Twin Ecosystem

TechUK outlines how digital twins can be adopted effectively to cope with unprecedented levels of risk and uncertainty in this report from February 2021. Targeted support for the UK's digital twin ecosystem will unlock value for people, economy, society, and planet, TechUK argues in this report from February 2021. A series ofESG recommendations to level up digital twin innovation and investment to take advantage of UK expertise in this area are proposed for government and

innovation bodies. Accelerated adoption of digital twins will drive decarbonization, trigger the reduction of social inequalities, and drive sustainable R&D-led growth, the authors contend.

(IS-2021-239) Work Smarter to Live Better – Understanding the New Expectations of the UK Workforce When it Comes to Hybrid Working

This report by Microsoft, published in February 2021, presents the results of a survey of 4000 UK office workers carried out to understand the habits and new expectations of the UK workforce when it comes to hybrid working. Successful implementation of hybrid working will require people support through good management, ongoing fairness of opportunity, and prioritizing employees' health and wellbeing. Important takeaways include addressing employee resilience and workplace culture, mindfulness and ability to disconnect, and providing high flexibility with devices that can seamlessly integrate from the desktop to a mobile platform.

(IS-2021-238) A Scalable approach to residential EV management

This January 2021 report from EnergyHub presents a three phase EV management strategy that will ensure a safe and reliable grid. It is predicted that by 2030 more than 80% of the charging infrastructure will be residential and the strategy outlined here relies on smart charging stations that have the ability to capture charging behavior and provide load management capabilities. The components of the strategy include time-of-use (TOU) rates, an active event-based peak management, and automated managed charging that takes into account real-time grid and market constraints.

(IS-2021-237) New Era of Workplace Data & Analytics

This report was prepared by Comfy and published in February 18. The report provides insights to business owners for informed decision-making in a time of workplace transformation. Flexible working models, data and analytics for effective space utilization, workplace design, and strategies to maximize real estate savings are discussed. Through analysis of key metrics, businesses can better understand workspace usage patterns to support business continuity while reducing overall costs.

(IS-2021-236) A Feature Selection-Based Predictive-Learning Framework for Optimal Actuator Control in Smart Homes

This report appeared in the academic journal *Actuators* (April 2021). The authors propose a predictive- learning framework based on contextual feature selection and an optimal actuator control mechanism, with the goal of minimizing energy consumption in smart homes. The analysis also addresses how optimal control can reduce energy cost and improve performance resulting from lesser learning cycles and decreased error rates.

(IS-2021-235) A Novel Robust Smart Energy Management and Demand Reduction for Smart Homes Based on Internet of Energy

This academic paper published in the *Sensors Journal* (July 2021) presents a residential energy management (REM) technique capable of monitoring and controlling residential loads within a smart home. A new distributed multi-agent framework, which is based on the cloud layer computing architecture, is developed for real-time microgrid economic dispatch and monitoring. A system based on the Raspberry Pi microcontroller is implemented to test the proposed framework, which is shown to be capable of effectively tracking load (demand) changes.

(IS-2021-234) Latency-Optimal Computational Offloading Strategy for Sensitive Tasks in Smart Homes

This March 2021 report in *Sensors Journal* discusses a computational offloading strategy for processing large amounts of data generated by smart devices. The technique focuses on minimizing delay by applying the back-pressure algorithm (BMDCO) to determine an offloading decision and the number of tasks that can be offloaded. Simulation results show that BMDCO is stable and can reduce computational delay.

(IS-2021-233) LSTM Networks Using Smartphone Data for Sensor-Based Human Activity Recognition in Smart Homes

This February 2021 report in the *Sensors Journal* deals with human activity recognition (HAR) using smartphone sensor data. To explore this strategy, a generic framework is proposed based Convolutional Neural Network (CNN) and Long Short-Term Memory (LSTM) networks. The experimental results indicate that the proposed CNN-LSTM network performs well in activity recognition, enhancing the average accuracy by up to 2.24% as compared to prior state-of-the-art approaches.

(IS-2021-232) Multimodal Approaches for Indoor Localization for Ambient Assisted Living in Smart Homes

This report appeared in the *Information Journal*, a scholarly publication, in March 2021. The report deals with indoor localization for ambient-assisted living in smart homes. The localization strategy relies on Bluetooth low energy (BLE) beacons, BLE scanners, activity zones, and accelerometer and gyroscope data gathered from diverse behavioral patterns. Experimental results show system accuracy of 81% to track user's indoor position.

(IS-2021-231) Being Blind to Water Use

This July 2021 report by HydroPoint found that the biggest obstacle to eliminating water waste wasn't broken pipes — it was people and "institutional water blindness." The report covers many of the areas in buildings and outside that are wasting water and can be improved.

(IS-2021-230) Energy Management Information Systems Technical Resources Report

This technical resource report from July 2021 provides information and best practices for

understanding, designing, and implementing Energy Management Information Systems (EMIS). Its authors are with the U.S. Department of Energy, Energy Efficiency Renewable Energy Office and the National Renewable Energy Laboratory. An EMIS can help agencies improve energy performance, reduce operational cost, and for federal staff, can serve as a valuable component of an agency's portfolio-level energy and water metering strategy, the author highlight. EMIS functions and capabilities are discussed along with their applicability and benefits to federal agencies. These include information that can be used throughout the EMIS life cycle, ranging from system design to implementation and ongoing maintenance.

(IS-2021-229) HVAC Summer Edition

This Consulting-Specifying Engineer eBook was published by CFE Media in June 2021. The lead article covers four steps for designing a VRF system and how variable refrigerant flow offers an alternative HVAC solution, and it is followed by a case study focused on designing VRF for an office. This issue also has articles on what ASHRAE 90.4 does for data center energy efficiency; delivery and maintaining modular pumping systems for HVAC; and pumping controls methods and their impact on system efficiency.

(IS-2021-228) Improving Building Design with Division 25 Specifications

This e-book from Schneider Electric (first published in August 2020 and modified in February 2021) was designed to provide consulting engineers with the key trends driving smart building specifications. One of the biggest smart building hurdles for engineers is the fact that key "controls" conversations are not taking place among electrical, mechanical, IT, OT, and other divisions before design. As a result, engineers are forced to integrate systems that haven't been vetted in an iBMS atmosphere. This, in turn, causes data integration roadblocks, endangering the entire smart building project. Division 25 specifications help building owners and managers get what they want in terms of increased value and a platform that can be expanded with future technology.

(IS-2021-227) Smart Products - Building the Modern Home

This June 2021 white paper was developed for GE Appliances by Parks Associates. The authors describe new smart home applications and their market penetration. As consumers become familiar with market offerings, new smart product categories emerge, offering added benefits that address different pain points. New categories include solutions that monitor indoor air quality and facilitate independent living, safe package delivery, and energy resilience in the home.

(IS-2021-226) A Research Paper on Internet of Things Based Upon Smart Homes with Security Risk Assessment Using OCTAVE Allegro

This paper appeared in the International Journal of Engineering Research & Technology in June 2020. The paper provides an overview of the Frugal Labs IoT Platform (FLIP), based on the Raspberry Pi, for building an IoT-enabled smart home. OCTAVE Allegro methodology is applied to

the system to assess security risks and reveals that the system is vulnerable to both internal and external security threats.

(IS-2021-225) 67 An IoT-Based Smart Home Automation System

This paper appeared in MDPI's Sensors Journal in May 2021. The authors present Toggle, a system for interconnecting sensors, actuators, and other data sources for multiple home automation. The approach leverages application programming interface (API) for communication. A smartphone application is also introduced that allows users to control various home appliances and sensors.

(IS-2021-224) The Future of Smart Home Design

This report was published by Silicon Labs in June 2020. It examines what Original Equipment Manufacturers (OEMs) should know about the future of smart home design to develop compelling smart devices. By considering the ways that smart devices will improve ease of use, the report describes the role that artificial intelligence and machine learning will have in enabling new capabilities, and the security that will be needed to be implemented to protect users, devices, and OEMs.

(IS-2021-223) Stepping Up Europe's 2030 Climate Ambition

Subtitled "Investing in a Climate-Neutral Future for the Benefit of our People," this September 2020 report by the European Commission deals with the EU economy-wide 2030 greenhouse gas emissions reduction target. Actions that will be required across all sectors of the economy are discussed. Consideration is also given to launching revisions of the key legislative instruments to support this goal, as well as hosting a public debate to increase the EU's contribution to the Paris Agreement.

(IS-2021-222) An Economic Approach to Neutral Host Network Deployments

This report was prepared by Microlab and published in June 2021. The report describes Neutral Host Networks (NHNs), as a solution for addressing a demand for more capacity and connectivity in wireless networks, and provides a brief comparison between NHN ownership models. Benefits and challenges that affect the Total Cost of Ownership (TCO) for NHNs are outlined. The analysis provides insights into how NHN owners can lower the TCO by minimizing the deployment complexity while providing an "economical" path to leverage future spectrum allocations to improve capacity per user or monetize new use cases.

(IS-2021-221) High-Impact Programs Targeting Regional Multifamily Energy Savings Opportunities This July report was prepared by ACEEE reviews four multifamily utility efficiency programs and their

success in achieving high savings in regions throughout the U.S. Criteria considered in the review

include spending, savings, and participation data. The programs address regional energy-saving opportunities and include strategies to reach deeper savings by encouraging more-comprehensive energy-saving measures. Providing free or low-cost energy assessments and offering performance-based incentives or higher rebates for whole-building approaches are some of the most successful tactics.

(IS-2021-220) ICS Cybersecurity Year in Review 2020

This February 2021 report is the latest installment in a yearly analysis of cyber threats, vulnerabilities, assessments, and incident response insights pertaining to Industrial Control System (ICS) / Operational Technology (OT) by Dracos. The recommendations offered to improve ICS/OT cybersecurity include increased network monitoring, prioritization of assets, improved incidence response capability, continuous monitoring of network segmentation, and securing management of credentials.

(IS-2021-219) Lighting the Patient Room of the Future

Subtitled "Evaluating Different Lighting Conditions for Performing Typical Nursing Tasks," this study was published in the academic journal Health Environments Research & Design in November 2020. The paper explains how aspects of lighting in patient rooms are experienced and evaluated by nurses while performing simulated work under various lighting conditions. Insights are provided regarding lighting to support circadian synchronization, lighting at night, the distribution of light in the patient room, use of multiple lighting zones, and the use of colored lighting.

(IS-2021-218) SmartCitiesWorld City Profile – London

This report by SmartCitiesWorld (March 2021) explores how the London, U.K. uses technology and smarter approaches to deliver better services and improve citizens' quality of life. In 2010, the city created the London Data Store, an open data platform, to inform its infrastructure growth. In 2018, London launched the smart city roadmap (Smarter London Together) and the Emerging Technology Charter regarding use 5G and artificial intelligence (AI) to support the needs of Londoners. By demonstrating an ability to listen, adapt, evolve, and crucially collaborate, London has positioning itself well to continue evolving as a smart city.

(IS-2021-217) How Network Testing Ensures High-Quality In-Building LTE and 5G Deployments

This report was by the technology group Rohde & Schwarz and published in May 2021. The analysis deals with the entire indoor deployment cycle of mobile networks, such as distributed antenna systems (DAS) and small cells. It highlights the characteristics of these systems, the planning phase, installation and verification of the deployed system. Mobile network testing solutions to verify successful mobile network deployments indoors are discussed.

(IS-2021-216) OPC UA Users and Experts Conveying Knowledge and Experience

This report was published by the OPC Foundation in December 2020. Expert content from market leaders in communication, automation and industrial IT is brought together in an analysis highlighting the benefits and the potential of the Open Platform Communications Unified Architecture (OPC UA) technology for end users, system integrators, operators in the world of industrial IoT. Key areas covered include open process automation, a deep dive into OPC UA, field level communication, insights to the mechanical engineering industry association (VDMA), open serialization communication, Microsoft's role in OPC, and the smart factory web.

(IS-2021-215) SmartCitiesWorld City Profile – Sydney

This report was authored by Jon Glasco from SmartCitiesWorld and published in January 2021. The report profiles the city of Sydney, Australia as a smart city. With a global ranking of 14 in the Digital Capitals Index, and 18 out of 109 in the Smart City Index, Sydney boasts a high level of resiliency and particular strengths in areas like finance, education, manufacturing, technology, trading and tourism. To improve its current smart-city standing, Sydney focused on post-COVID economic recovery planning, investment in digital technology and infrastructure, recalibration of jobs, community wellbeing, remote work, and investment in transport and public spaces. Emerging technologies, combined with strategic use of digital technology to connect remote and disadvantaged communities, will be influential in ensuring Sidney's continued "smart city" growth.

(IS-2021-214) 2021 Industry Insights

This report was prepared by Electrical Construction & Maintenance (EC&M) and published in April 2021. The authors present an "inside look" at key technologies markets, technologies, and trends expected to shape electrical construction and building activity in 2021. The construction industry will face a hiring boom. Growth is expected in residential, commercial, and industrial projects, as well as economically charged regions and tech hubs. Material shortages in the electrical industry are likely to occur. Alternative materials are proposed, such as fiberglass, for conduits traditionally made from polyvinyl chloride or galvanized rigid steel. Maximizing revenues and increasing process efficiencies will be important keys to success this year.

(IS-2021-213) Profitably Decarbonizing Heavy Transport and Industrial Heat

This July 2021 report was authored by RMI, a non-profit organization focused on accelerating the clean energy transformation. The paper discusses how to transform by 2030 heavy transport such as trucking, aviation, and shipping to decrease impact on greenhouse emissions. Furthermore, consideration is also given to reducing industrial heat from production of materials such as steel, aluminum, cement, and plastics to lower the impact on climate change. Emphasis is placed on clean electricity as the key enabler for transformation hoped for.

(IS-2021-212) Brave New World - Leveraging the Private Networking Opportunity

This report was prepared by Sierra Wireless and published in May 2021. It examines why private Long Term Evolution (LTE) and 5th Generation mobile (5G) networks have emerged as an option

for many organizations. Operational basics for each network are presented, along with discussion of the differences between these options and Wi-Fi networks, public LTE and 5G networks. Use cases are featured to assist professionals to determine if a private LTE or 5G network might help organizations create more value for customers, employees, and other stakeholders.

(IS-2021-211) The Built Environment Investment Thesis

This report was prepared by Shadow Ventures, an Atlanta-based venture capital investment firm, and published in March 2021. It provides an assessment of the built world markets, challenges and technology solutions, and investment opportunities. Markets considered include real estate, architecture, engineering, construction, infrastructure and capital projects, security, utilities an energy, logistics, transportation, and distribution. Key challenges highlighted are labor shortage, fragmented communication, environment concerns, thinning profit margins, and climate change. Technology based remedies proposed include robotics, automation software, collaborative project management software, interoperable data models, and innovative building methods and materials. Significant opportunities exist for venture capital firms to invest in startups to bring those innovations to the built environment.

(IS-2021-210) ESG, SRI, and Building Energy - An Economic Imperative for Chief Executives

This report was prepared by ENTOUCH Controls and published in late 2020. The authors focus on Environmental, Social, and Governance (ESG) and Socially Responsible Investing (SRI) as it relates to the building sector. Market trends indicate that they have gradually become a standard for investing in real estate due to the multiple benefits in terms of costs savings, productivity, profitability and regulatory risk minimization. The report illustrates how commercial buildings can be a potential solution to the unsustainable buildup of atmospheric carbon by implementing energy efficiency measures and energy management systems to reduce consumption. It explains a seven-step process for smart retrofits developed by the sponsor of this report.

(IS-2021-209) America's Zero Carbon Action Plan

This report was prepared by the Sustainable Development Solutions Network (SDSN) and published in late 2020. This 347-page paper examines many aspects of moving to a zero-carbon economy. There is a chapter dedicated to the decarbonization of buildings, underlining how this sector accounts for almost half of the country´s greenhouse gas (GHG) emissions.

(IS-2021-207) Demand Response with Variable-Capacity Light Commercial HVAC Systems

This report was prepared by the Electric Power Research Institute (ERPI) and published in September 2020. The authors evaluate of the electrical demand response (DR) potential of variable capacity (VC) heating, ventilation, and air conditioning (HVAC) equipment in light commercial building applications through demonstrations at two field sites in Southern California. Variable refrigerant flow (VRF) systems and packaged rooftop units (RTUs) were considered. The findings for the VRF system suggest that capacity limit control can reduce

electrical demand with minimal impact on indoor temperatures. For the RTU system, it was not possible to implement advanced demand-response controls.

(IS-2021-206) Demand-Side Solutions to Winter Peaks and Constraints

This report from the American Council for an Energy-Efficient Economy came out in April 2021. The report describes the opportunity for electrical demand-side resources to address potential winter peaks and constraints. Examples of remedial strategies for utilities and market participants are provided. Some of the key strategies: using existing programs that target winter peak demand reductions through energy efficiency and demand response; applying demand-side measures that reduce heating load; residential weatherization measures; applying intelligent operation of heating equipment through residential smart devices; and energy storage and managed electric vehicle charging.

(IS-2021-205) Assessment of Occupational and Skills Needs for Energy Efficient Buildings

This report by ECO Canada was released in February 2021. The authors outline the capacity and challenges of today's building sector workforce in Canada to achieve energy efficiency within new and existing commercial, institutional, and multi-unit residential buildings. The key finding is that Canada's building sector workforce does not have the widespread experience or skills required to perform their roles in a manner that achieves energy efficiency goals. Seven recommendations are made regarding how stakeholders can address such skills gaps.

(IS-2021-204) Energy Smart Buildings Readiness Guide - How to Make a Building Energy Ready

This report from Iconics published in September 2020 describes building operational data can be used to optimize its performance. The key components considered include networking technology, protocols, system interoperability standards, documentation, and key performance indicators. A detailed example is provided summarizing typical properties monitored for HVAC equipment.

(IS-2021-203) Engineering Net Zero - Canadian Technical Report

This report by SNC Lavalin from March 2021 recommends key actions necessary for Canada to achieve a "net zero" greenhouse gas (GHG) emissions by 2050. Emphasis is placed on design, engineering, construction, operations, and maintenance, combined with a fundamental transformation of societal behaviours and lifestyles, to reduce carbon emissions. An overview of emerging technologies to achieve the "net zero" goal is presented.

(IS-2021-202) Future Energy Scenarios

This July 2020 report comes from Britain's National Grid Electricity System Operator (ESO). The analysis explores the assumptions and conclusions from the extensive modelling, research, and stakeholder engagement undertaken by the National Grid ESO on how energy system must

evolve while safely and reliably delivering low carbon energy to end consumers to meet the net zero goal by 2050. Taking into consumer and energy system perspectives, the key requirements include availability of open accessible data, consumer incentives, use of hydrogen and carbon capture and storage, immediate action across all key technologies and policies, and full engagement across society and end-consumers.

(IS-2021-201) Green and Equitable Economic Recovery

This April 2021 report was prepared by Climate Mayors. It highlights key policy priorities and local success stories contributing to a green and equitable recovery and demonstrating job creation and resilience. The areas to watch include sustainable infrastructure, a better coordinated government role (city, state, federal), emphasis on electric transit and citizen mobility, zero carbon buildings, transition to renewable energy, urban greening, and the necessity for federal funding.

(IS-2021-200) Improving the Customer Experience in the Utilities Industry

This report by Harvard Business Review from February 2021 offers a snapshot of the customer experience (CX) evolution in the electric, gas, and water utility industries. Key takeaways include that CX will be utilities' top business priority and that the existing siloed operating structure within utilities will need to change to align with demands of digital age. The customer experience overall will shape utilities' brand and determine whether customers see it as the provider of choice.

(IS-2021-199) Keeping the Lights On - How to Ensure Connected Lighting Systems are and Remain Secure Throughout Their Lifecycle

This report produced by SmartCitiesWorld in association with Signify was published in April 2021. The report describes how to ensure robust, end-to-end cybersecurity in connected lighting deployments. It contends that a model of "shared responsibility" is the best approach and highlights why cloud-based systems are better suited to the demands and rigors of today's connected world when compared to on-premise IT infrastructure. Best practices are presented and myths are discussed that can cloud an organization's decision-making.

(IS-2021-198) Net Zero by 2050 - A Roadmap for the Global Energy Sector

This report from International Energy Agency (May 2021) maps out the energy sector's path to global energy sector by 2050. Milestones to achieve the goal are provided spanning all sectors and technologies – for what needs to happen, and when, to transform the global economy from one dominated by fossil fuels into one powered predominantly by renewable energy sources Emphasis is placed on investment, innovation, fairness, inclusivity, skillful policy, design and implementation, technology deployment, infrastructure building, and international co-operation.

(IS-2021-195) Proving the Business Case for Building Analytics

This October 2020 report by the Lawrence Berkeley National Laboratory presents the results of the Smart Energy Analytics Campaign. From 2016-2020, the public-private sector partnership assessed the costs, benefits, and common practices of Energy Management Information Systems (EMIS). With support for 104 organizations and 6,500 buildings covering over a half a billion square feet of combined floor space, the initiative produced the largest-ever dataset on EMIS costs and benefits and revealed a 2-year simple payback. Key outcomes included median annual energy savings of 3% (energy information systems) and 9% (fault detection and diagnosis). The report discusses, among other aspects, monitoring-based commissioning practices (MBCx) that use EMIS tools.

(IS-2021-194) U.S. Department of Energy Progress Report 2021 - Partnering for the Future - Leadership, Innovation, and Proven Solutions

U.S. Better Buildings Initiative partners have been contributing energy, water, and waste solutions designed to support an accelerated transition towards clean energy. This progress report from May 2021 underlines that building owners and plant managers faced significant new barriers to energy efficiency caused by the COVID-19 pandemic: lower occupancy levels, the need to upgrade ventilation systems quickly, budget shortfalls, and layoffs/staffing disruptions. Despite these difficulties, new strategies and solutions have moved forward in four key areas essential to building a more efficient and cost-effective energy future.

(IS-2021-193) Buildings of the Future - Creating Safer, Healthier and more Responsive Environments This 2020 report from Schneider Electric sets out a vision to create "resilient, sustainable, hyper- efficient and human-centric buildings" — transforming today's buildings to meet tomorrow's needs. The importance of these foundational aspects has come to the forefront in the year of the pandemic, the author highlight. The report focuses on the potential for (1) Maximizing space efficiency (2) Enhancing occupant well-being (3) Improved employee experience, and (4) Reducing operating costs.

(IS-2021-192) Creating Truly Open Cities - The Importance of Building Interoperable Smart Cities from the Ground Up

This report by Smart Cities for Paradox Engineering came out in September 2020. It discussed 6LoWPAN's value in creating "open and interoperable smart cities" and Paradox Engineering's platform that uses 6LoWPAN. The Swiss company's PE Smart Urban Network is a connectivity platform and applications ecosystem that allows cities to manage a range of urban services. The authors also examine other developments in the open standards movement that will be "key to helping city authorities ensure future smart projects reach full maturity."

(IS-2021-191) The Evolving Importance of Effective HVAC Management

To understand how tenant expectations for HVAC systems have changed during COVID-19, Building Engines conducted a national survey of nearly 300 CRE building managers and engineers. Reporting on the results in late 2020, the company highlighted the increased

importance property managers give to HVAC systems — their capabilities as well as maintenance issues — and discussed how HVAC management should be handled to meet new air quality standards while maintaining tenants' trust throughout re-occupancy. The report focuses on the company's new Prism solution, designed to provide "transparent HVAC management" for buildings owners/tenants. The solution tracks, among other aspects, routine (and important) tasks such as filter changes demonstrating proficiency and responsibility.

(IS-2021-190) 2021 Multifamily Amenities Survey, Multifamily Design and Construction Magazine

Multifamily Design+Construction magazine surveyed respondents on how their amenities were affected by the pandemic and presented the results in June 2021. There were, not surprisingly, numerous examples of property managers closing fitness centers, pools, playgrounds, and game rooms, at least temporarily; other respondents removed amenities, pushed activities outdoors, or made modifications, such as using plexiglass separators in fitness areas. However, more than half said they had not made changes, either because a given construction/installation project was already far along, or because they believed the best course of action was to "weather the storm." The pandemic era will continue to raise difficult questions about how multifamily housing—including the amenities—should be designed in ways that best support occupant health and wellness.

(IS-2021-189) 2020 Luminaire Level Lighting Controls Incremental Cost Study

This NEEA report by Energy Solutions (January 2021) estimates the incremental cost of Luminaire Level Lighting Controls (LLLC). The analysis grouped these products/systems into "smart" and "clever" based on their differing features and price points. It showed that the average price for more complex, smart systems has oscillated but shows an overall decrease in costs over time. The variation was thought to be due to the continued addition of incremental feature packages and capabilities that the smart systems can enable. Smart systems remain more expensive than their clever-hybrid counterparts, and their value proposition tends to be linked to increasing value from nonenergy benefits.

(IS-2021-188) 048 Atlas of Energy Efficiency - Brazil 2020 Indicators Report

This February 2021 report was authored by members of the International Energy Agency technical team and the *Empresa de Pesquisa Energetica* (Brazil's federal public agency focused on energy sector research). The research explores the impacts of the COVID-19 pandemic crisis and measures related to energy consumption and efficiency in different economic sectors in Brazil.

(IS-2021-187) Broadband Insights Report - 4th Quarter, 2020

This February 2021 report by OpenVault breaks new ground by exploring the cumulative impact of pandemic growth on broadband networks. Broadband service providers have experienced across-the- board growth in consumption and speeds, testing networks as never before due to COVID-19, the analysis shows. Data on two distinct categories is provided: subscribers on flat-

rate billing (FRB) plans that offer unlimited data usage and those on usage-based billing (UBB) plans, which bill subscribers based on their broadband consumption. The average monthly bandwidth usage at the end of 2020 approached one- half of a terabyte (TB) of data, or close to 483 GB. Subscribers on unlimited usage plans, or FRB plans, were closer to 497 GB.

(IS-2021-186) Maintenance Key Performance Indicators

This report from Eagle Technology (November 2020) discusses Key Performance Indicators (KPI's), their benefits and key examples for maintenance managers. Computerized Maintenance Management System (CMMS) KPIs are used to track performance in several areas over time and indicate when an organization is operating inside or outside of acceptable levels. An enhanced KPI reporting would include analysis of data collected by assets, work orders, labour and material history, and costs. Details on major maintenance KPIs are provided.

(IS-2021-185) NLPIP Lighting Answers UV Disinfection Products

This report by the Lighting Research Center from December 2020 was published by Lighting Answers. Guidance on use of ultraviolet (UV) light for disinfection of surfaces and air in buildings is provided; the authors report on the results of a recent survey and testing that was undertaken to look at issues of effectiveness, safety and energy expenditure. While there are no clear UV specific regulations, the report references the many associations and organizations that have articles and books on the topic of UV lighting applications.

(IS-2021-184) 5 Ways to Lower Energy Use Intensity on Your Building Project

This report by Cove.tool (June 2021) discusses why engineers should be calculating the EUI of buildings, to better predict their projects' yearly utility costs — useful in understanding the impact of each design decision. EUI or Energy Use Intensity is a building's annual energy consumption relative to its gross area and broadly, it can be divided into heating, cooling, lighting, equipment, fans, pumps, and hot water. Building design that responds sensitively to the local climate conditions can improve occupant comfort and significantly reduce energy consumption, the report highlights. As an example, "solar heat radiation can work against or in favor of whole-building energy consumption, depending on the building location."

(IS-2021-183) 7 Must-Have Capabilities for Your Next Building Operations Platform

This March 2021 report from Building Engines underlines that in a competitive CRE climate, having an outdated building operations platform makes it much harder to become more efficient, generate more revenue, and provide a top-notch tenant experience. Armed with the right building operations software, build owners can complete all their tasks more efficiently, and this e-book sets out 7 "must-have" capabilities in a modern building operations platform. They include, among other aspects: 1. Scalable cloud infrastructure, 2. Automation of slow workflows, 3. Mobile capabilities, 4. Tenant experience functionality, 5. Robust analytics and reporting, 6. Ability to capture all revenue.

(IS-2021-182) 2020 - Our Air in Review

This January 2021 report was by AirRated, which provides a certification for Indoor Air Quality (IAQ). Just 22% of customers stated that they are knowledgeable about air quality and only 40% and 45% of customers said they understood the sources of indoor and outdoor air quality respectively, in a recent AirRated survey. Furthermore, 62% of business owners said that the reason why they hadn't made changes to the air quality in their buildings was due to a lack of information. When building, renovating and occupying spaces, it is important to prioritize the need for to establish standards that outline improvements for ventilation, filtration and air cleaning for new offices and commercial properties, while maintaining a sustainable approach to building design, the report argues.

(IS-2021-181) Best Practices Guide - Predictive Maintenance Using Automatic Fault Detection and Diagnostics

This October 2020 guide from the International Institute for Sustainable Laboratories was authored by Cimetrics. The report examines the opportunity represented by predictive maintenance to save money and increase facility reliability. The risk of equipment failure can be reduced by continuous, automated analysis of equipment performance to identify faults before they become critical. A successful predictive maintenance program requires investment in a data-rich building automation system, configuration of that system to perform analytics, development of a process and workflow to manage the automatic fault detection and diagnostics (AFDD) results, and training of facilities personnel on the program. The result is a leaner, more efficient lab facility operation, helping to eliminate energy-wasting faults while freeing up funds and labor for other types of sustainability improvements.

(IS-2021-180) Connected & Protected - The Vulnerabilities and Opportunities of IoT Security

ABI Research identifies three distinct IoT markets based on low, moderate, and high security requirements in this report from April 2021. The "low security" requirements category included buildings, home appliances, home monitoring, home security & automation. The "moderate" category included commercial building automation, condition-based monitoring, gas meters, video surveillance, smart meters, and water meters. "High security" category in buildings could include Automated Teller Machines (ATMs), healthcare equipment monitoring, patient monitoring, OEM telematics, and usage- based insurance. The amount of IoT security revenue available does not always correlate with the amount of IoT connections, and "disproportional" allocations of revenue can be seen in some markets.

(IS-2021-178) The State of Demand-Side Energy Management in North America

The third volume of CPower's State of Demand-Side Energy Management in North America (June 2021) provides a breakdown of the most important issues, trends, and regulations designed to help commercial and industrial organizations make better decisions about their energy use and spend. The report takes up questions such as: FERC 2222 is poised to usher DERs into the

wholesale energy markets in the US. How are the markets responding? How will California rebound after suffering its first blackouts in nearly 20 years?; What has Texas learned from the devastating grid failure this past February?; What will New England and PJM do to appease states that are angered at the policies they feel affect their desired fuel mixes?; and How is New York tracking toward its climate goals and what market designs might it employ to help achieve them?

(IS-2021-177) Decarbonizing the Built Environment

This JLL Global Research report was released in June 2021. A survey of senior executives representing 647 occupiers and investors was conducted in the first quarter of 2021, with results showing a clearer, stronger understanding of how organizations across the globe are progressing in their journey toward net zero carbon via their investment in more responsible real estate, and to what level sustainability ambitions are being translated into actions. "Occupiers, investors and city leaders each have a role to play in meeting demand for greener, more sustainable spaces."

(IS-2021-176) How to Make Smart Buildings Even Smarter

This report from Siemens Industry was published in April 2021. Buildings and facilities could still benefit from even greater measures of openness to ease integration challenges, some quite costly. The authors report that 82 percent of decision-makers confirm that building automation is important or very important, and 64 percent plan investments in integration solutions in the next year. But 30 percent of system integrators estimate they lose up to $1 million a year due to integration-related issues, resulting in them turning to open-source data-integration tools. This report describes the Desigo Optic program for better optimization of a structure's performance without making its operation too complex to manage. The program also helps in the management of the data that must be stored in a BMS and most importantly, in deriving insights that can drive greater operational efficiencies.

(IS-2021-175) The 2021 Buyer's Guide to CRE Building Operations Technology

This report was published by Building Engines (July 2021). CRE tenant expectations are rising, budgets have tightened, and competition is increasing. "Amid this change, one theme is clear: Assembling the right technology stack can be the difference between cementing your portfolio's long-term growth or falling behind competitor buildings". Modern software platforms and point solutions hit the market each day and can help a team work smarter, faster, and more cost effectively. But choosing the right solutions—and avoiding clunky, overpriced, and difficult-to-deploy options—takes research. The authors list "must-have capabilities" and support features for choosing a building operations platform.

(IS-2021-174) The Future of Building Design, Construction and Operations

This eHandbook from the Global Wellness Institute was published by Buildings in November 2020. COVID-19 has impacted the design and operation of commercial buildings in myriad ways— from shutting facilities down for months on end at the start of the pandemic to

rethinking the way we view physical space and how it can help keep occupants safe as businesses reopen. Given the challenges, this resource sets out to highlight opportunities that can be found in best practices that support health and wellness efforts. It provides a breakdown of different building components that can have a positive impact on occupants; guidelines for incorporating wellness strategies in commercial facilities; as well as case studies.

(IS-2021-173) 2021 Pandemic Guide

BOMA Canada sets out a blueprint to manage pandemic-specific challenges for employees, tenants, and other stakeholders in this guidebook from July 2021.

(IS-2021-172) Engineering an Intelligent Building

This report by Newcomb & Boyd (July 2021) discusses the state of the market for Intelligent Building Technologies, the market forces driving strategies, and the implications for operations and occupants. Highlighting that engineering an intelligent building requires "putting people at the center," the authors provide case examples from the operations and user experience realms and shows the paramountcy of having a dedicated strategic planning process & team.

(IS-2021-171) Smart Buildings: Spring Edition

This e-book was produced by Consulting-Specifying Engineer magazine and ABB (April 2021). Among other topics, this e-book discussed: integrating buildings systems through controls; selecting a building automation system, getting started in designing a smart building; and smart building consulting: integrating people and systems.

(IS-2021-170) The City of Toronto's Net Zero Existing Building Strategy

The City of Toronto has set a goal of reducing city-wide emissions to net zero emissions by 2050 or sooner, relative to 1990 levels. Achieving this goal requires a significant reduction in the emissions derived from energy use in buildings, as they represent over half (55%) of Toronto's GHG emissions, highlights this report by the city's energy and environment division from May 2021. The authors discuss the bigger challenge of achieving the net zero goal with the large number of existing buildings. It reports on a concerted and coordinated market shift involving multiple actors, including federal, provincial and municipal governments, as well as industry associations, financial institutions, trade unions, the real estate sector, and of course – home and building owners.

(IS-2021-169) IoT at the Edge - How AI will Transform IoT Architecture

This report by wireless provider Kajeet (April 2021) underlines that the vast amounts of information gathered by IoT devices can be a serious challenge. But thanks to advancements in AI and machine learning, the authors argue, AI can be used to lower costs and improve productivity through data-driven decision-making and smart automation. Smart devices and

sensors are rapidly changing the ways in which all industries and buildings operate – from healthcare and telecommunications to industrial maintenance and utilities management. Sensors and devices that can automatically generate or capture real-world data for analysis are now available, making it possible to shorten product and service delivery times, better understand the consumer, track assets, plan resource allocations, predict machine breakdowns, lower costs, and streamline production and service delivery processes.

(IS-2021-168) Canada's Climate Retrofit Mission

This report by think tank Efficiency Canada (June 2021) defines the contours of a climate retrofit mission for Canada. It quantifies the retrofit potential and demonstrates the scale required to confront the climate emergency. The authors set out a "mission-oriented" policy framework to the building retrofit challenge and then proposes a way to organize the public sector to achieve it.

(IS-2021-167) DroneDeploy Deep Dive - Transforming Facility & Property Inspections with Drone Solutions

This eBook by DroneDeploy came out in May 2021. It discusses the benefits of drone technology for inspections and takes a closer look at how drone software transforms facilities and property management inspections. Through drone inspections, decision makers become more strategic: managing more effectively, lowering costs, determining measurable outcomes, optimizing assets, and driving unparalleled ROI, the authors argue. To start, drone solutions help companies collect an accurate baseline view of their assets. Creating a pavement condition index (PCI) empowers users to see pavement conditions down to the foot-by-foot level. Low-cost drone flights over roofs and walls provide thermal imaging and empowers clients to understand where problem areas are and can often detect leaks or water erosion invisible to the naked eye. More importantly, customers save time for their employees, take preventative action before problems get more costly, and spend millions less on annual maintenance.

(IS-2021-166) Unlocking the Queue with Grid-Enhancing Technologies

This February 2021 report by the Brattle Group was prepared for the WATT (Working for Advanced Transmission Technologies) Coalition. The analysis discusses how Grid-Enhancing Technologies (GETs) can resolve the transmission issue hindering the deployment of renewable generation and the analysis focuses on three GETs, in particular: Advanced Power Flow Control, Dynamic Line Ratings, and Topology Optimization. The authors provide a case study illustrating how the Southwest Power Pool use of 3 GETs enabled more than twice the amount of additional new renewables or 2,600 MW to be integrated for annual cost savings of $175 million and annual carbon emission reductions of over 3 million tons.

(IS-2021-165) Planning for the Future - FERC's Opportunity to Spur More Cost-Effective Transmission Infrastructure

This January 2021 report by Americans for a Clean Energy Grid describes the need to update and

replace a now 50-year-old electricity transmission infrastructure with a more regionally connected one to better accommodate shifting demand and a changing resource mix. The report calls on FERC (Federal Energy Regulatory Commission) to establish guidelines to ensure proactive planning for future needs; require planners to employ the best available data and forecasting methodologies; require planning authorities to consider the diverse benefits of transmission holistically; require planners to evaluate all available solutions, including new physical infrastructure options and grid-enhancing technologies; and direct planners to select a portfolio of solutions that is likely to maximize aggregate net benefits.

(IS-2021-164) Unrealized Potential - Expanding Energy Efficiency Opportunities for Utility Customers in Florida

This report was authored from ACEEE and published in January 2021. The authors take the measure of Florida's underperformance in energy-efficiency programs and provide the following recommendations: setting utility energy saving targets; requiring EE programs for underserved customers; moving from "ratepayer impact measure" approaches to better utility cost test measurement approaches; and eliminating the two-year payback screen. Such measures would incentivize utilities to invest in cost- effective energy efficiency programs, the report argues.

(IS-2021-163) A Case Study on Integrating Customer DER - Moving the Needle on Utility DERMS Innovation in Australia

This report by Peter Asmus and Michael Kelly from Guidehouse Insights was published in January 2021. The authors discuss a successful Distributed Energy Resources Management System in Onslow, Western Australia. Utilizing a single DERM platform and behind the meter applications, a standalone microgrid was optimized to successfully integrate and instantaneously manage solar PV/diesel/natural gas generation, storage batteries and energy demand. An advanced DERMS algorithm combines real-time data with historical patterns to make real-time decisions. The combined microgrid helped reduce costs and the carbon footprint while providing sustainable energy.

(IS-2021-162) Accelerating Decarbonization of the U.S. Energy System

This February 2021 report from the National Academies of Sciences, Engineering and Medicine and provides a technical blueprint and policy manual for the U.S. energy system over the first critical 10 years of a 30-year effort to transform to net-zero GHG emissions. The report identifies federal policies to advance five technological and four socioeconomic goals and to how to achieve quantitative milestones along this path. Upwards of $2 trillion in costs would be funded through federal appropriations and carbon pricing. The benefits would be significant, including a more competitive and inclusive U.S. economy. Extensive policy summary tables with cost benefit analysis are provided.

(IS-2021-161) Annual Energy Outlook 2021 with Projections to 2050

This report was authored by the U.S. Energy Information Administration and published in

February 2021. Utilizing the National Energy Modeling System, various energy projections to 2050 are provided. Energy consumption fell faster that GDP in 2020 and "will take years" to return to 2019 levels, the analysis concludes. Demand for transportation fuels will return to 2019 levels in 2025. Petroleum will remain the most consumed fuel, while coal and nuclear generating capacity will gradually be replaced by natural gas and renewable technologies. High natural gas production will support exports and industrial use. The report sets out a variety of projections related to energy consumption, GDP, carbon dioxide emissions by fuel type, and electricity use by end-use sector projections based on different assumptions.

(IS-2021-160) Blueprint for State Action: NARUC-NASEO Task Force on Comprehensive Electricity Planning

A joint task force involving NARUC (National Association of Regulatory Utility commissioners) and NASEO (National Association of Energy Service Companies) set out two years ago to examine how electricity system planning processes can achieve greater alignment "after being siloed for decades." The result report, from February 2021 summarizes the work and offers practical ways to accelerate state actions in aligning electricity system planning approaches, building upon the experience of the 15 Task Force member states. The recommendations were driven by a desire to: improve grid reliability and resilience; optimize use of new and existing resources; avoid unnecessary costs to rate papers; support state policy priorities; and increase the transparency of grid-related investment decisions.

(IS-2021-159) AMI Survey January 2021

This report was authored by Maravedis and published in January 2021. A smart metering survey, conducted in the fourth quarter of 2029, reviewed: meter and WAN requirements, top use cases for Automated Metering Infrastructure (AMI), and key challenges requiring resolution. The top identified AMI use cases include measuring, detecting leaks and improving operational efficiency, and the authors underscore that AMI must incorporate data security and network availability. LoRaWAN and LPWAN options are compared, including applicability for Smart Cities and Home Energy Management Systems. Private networks are preferred 2:1 over public networks. Challenges with AMI include interoperability issues and validation of business models.

(IS-2021-158) Determining Utility System Value of Demand Flexibility from Grid-Interactive Efficient Buildings

This report was authored by Johanna Zetterberg and Monica Neukomm from SEE Action and published in April 2020. The authors focus on methods and practices for determining the economic value of grid- interactive buildings, and how to design market-based programs to optimize demand flexibility, costs and efficiency of the energy network. Data requirements for the economic valuation modeling of demand flexibility grid services are outlined. The analysis includes a summary of valuation enhancements and an extensive list of implementation resources and offers illustrative utility examples.

(IS-2021-157) Powering Our Net Zero Future

This report from the UK Secretary of State for Business, Energy and Industrial Strategy focuses on initiatives under way to drive the country toward net zero. This white paper presents a vision of how the UK makes the transition to clean energy by 2050 and what this will mean for consumers of energy in homes and places of work, and for how businesses use energy to produce goods and services. The way energy is produced and used will rest on a decisive shift away from fossil fuels to using clean energy for heat and industrial processes, as much as for electricity generation.

(IS-2021-156) The Intelligent Automation Global Market Report

This January 2021 report by Shared Services & Outsourcing Network (SSON) presents 5 case studies by 5 authors illustrating where intelligent automation can impact performance and aims to help readers better understand the ROI. Intelligent automation has proven its efficacy when it comes to improving customer experience, driving new revenue opportunities, supporting digitization across an enterprise, improving data's value add, and finally, offering greater transparency.

(IS-2021-155) Demand Side Energy Management in the Time of COVID

This report by CPower published in January 2021 focuses on the energy challenges major industries faced in 2020 and continue to face in 2021. The analysis presents demand-side energy strategies each industry should consider to offset pandemic year losses and/ or to optimize energy use and expenditure by monetizing existing energy assets in U.S. energy markets. The authors also provide an explanation of the deregulated U.S. energy markets and discuss demand-side energy management opportunities available in each market for commercial organizations.

(IS-2021-154) How smart is your office?

This report from SmartCitiesWorld (February 2021) examines the current state of the smart office movement and identify not only the most in-demand applications and technologies, but what approaches organizations are taking and what the main barriers are to creating more intelligent workspaces. A smart office benefits from being built on a common connected infrastructure capable of accommodating different applications and devices and gathering data from these applications and devices. Responses show that most companies are not taking this integrated approach. Moreover, in practice, a connected lighting infrastructure often serves as an ideal entry point for businesses who want to distribute IoT capabilities throughout their workspaces. However, as the survey revealed, many are not maximizing the use of connected lighting as a cost-effective starting point for smarter indoor spaces.

(IS-2021-153) How the Smart Office Acts as a Team Player in Crisis Management

This report from Siemens Industry was published in May 2020. The role of the smart office in contributing to a crisis management response is examined, with discussion of some of the digital technologies available and how they support the operation of office buildings while keeping the

occupants healthy and safe. With the use of workplace applications, it is possible to deliver timely and local communication, showing how density management can be facilitated through sensors and booking software and how risk mitigation can be achieved with data and access control. "The lines are becoming increasingly blurred between buildings, technology and community as new workplace solutions are introduced based on intelligent building infrastructure." The analysis concludes that it is crucial to acknowledge the different layers within an office building which generate data points – from infrastructure to spaces to people – and the ability to connect them. The building itself has an ever- increasing role to play throughout the lifecycle of the crisis – and beyond.

(IS-2021-152) Building Better Places

This report was from SmartCitiesWorld was published in March 2019. Smart, connected technologies are helping to make buildings more efficient, productive, healthy, comfortable and personalized for the people who work in them. And because commercial buildings make up a significant percentage of the built environment, smart buildings have a significant role to play in creating a sustainable future for cities and the planet.

(IS-2021-151) Air Conditioning and COVID-19: Slowing the Spread

This report from Carrier (May 2020) explains the various systems for indoor air quality and the ways to improve and monitor them. A generation of research and experience has proven that when properly maintained and operated, heating, ventilation, and air-conditioning systems (HVAC) can reduce the spread of viruses. HVAC systems work in a built environment to supply comfortable, clean, recaptured air, mix in healthy levels of fresh air, and contain or exhaust contaminants. Air delivery systems can reduce the transmission of viruses through inline filtration and are also critical in maintaining healthy humidity levels between 40% and 60% indoors which may help to limit the spread and survival of SARS- CoV-2 within the building, while minimizing the risk of mold growth and maintaining hydrated and intact mucosal barriers of human occupants.

(IS-2021-150) Leading Better than Normal

This January 2021 report from JLL highlights that COVID-19 exposed the social and economic inequities and vulnerabilities across healthcare, education and social systems. As a result, the importance of environmental, social and governance (ESG) goals has increased, and it is with this momentum that stakeholders can increase these commitments for a better future. The report provides specific recommendations from JLL's leaders on the improvements that can be made—across industries, property types and regions—in the year ahead. In 2021, the real estate industry has the opportunity for transformative change in the areas of emissions, climate change, social justice and equality. Smart building technology, machine learning and predictive analytics can be powerful tools to enable greater building efficiency, predict maintenance needs and optimize performance for a reduced environmental impact, a healthier human experience and reduced operating expenses.

(IS-2021-149) Buildings are Getting Smarter - Are They Also Getting Healthier

This report was published by SmartCitiesWorld in June 2020. This report examines how connected lighting can lead to a more efficient workplace and healthier workforce. A flexible approach to managing the indoor environment and workspace is vital because each building is unique, and each building occupant has unique preferences. Research confirms that indoor air quality (IAQ) affects the well-being of building occupants and that poor IAQ is linked to lower productivity levels and "sick building syndrome." A connected lighting system can serve as a platform to host sensors and enable facility managers to leverage the value of a building's lighting infrastructure by monitoring workspace parameters such as occupancy, temperature, light, noise, air quality, relative humidity, volatile organic compounds, CO_2 levels, dust and pollution.

(IS-2021-148) Smart Buildings and Carbon Neutrality – A Race Against Time

This report was authored by Jon Glasco for SmartCitiesWorld was published in June 2020. This report examines the potential for policy interventions and innovative technologies to mitigate building emissions, support carbon neutrality measures and facilitate green initiatives. Examples of innovation in energy efficiency include e energy-saving retrofits and upgrades (reducing energy loss and emissions by modernizing the building envelope); and microgrids combined with renewable energy sources, providing capabilities to achieve a more balanced energy supply. Other types of innovations include energy storage solutions combined with on-site renewables; use of intelligent platforms, sensors and user-centric communications to support energy-efficient behavior and reduce energy use; and AI and machine learning to provide notification about energy waste or loss.

(IS-2021-147) Impact of Glazing Properties on Energy Use Intensity and Daylight Quality

This report from building performance platform COVE.TOOL was published in March 2021. The analysis focuses on the energy and daylight impact of selecting different types of glass products based on their performance properties. The author highlights the impact of changes in glass properties on the energy use intensity and daylight quality of this office project. With energy regulations becoming stringent around the world, and glazing leading to a significant impact on performance, using iterative testing can be a cost-effective way to design a higher-performing building.

(IS-2021-146) Microgrids Find Their Business Case with Climate Resilient Internet

This December 2021 report by David Theodore of Climate Resilient Internet (CRi) highlights that microgrids remain the future for resilient, sustainable energy, but cost is a stumbling block. This paper confronts that challenge with a stronger value proposition; one that taps a new revenue stream and maximizes client resilience. In this new vision, microgrids extend resilience to mission critical Internet and cloud data, where extreme weather is causing blackouts so consequential, they must be avoided at all cost. Internet resilience isn't so simple, because data—even from a

user's Wi-Fi or their smartphone—relies on untold miles of fiber optic infrastructure, all of which is vulnerable to weather, and dependent on the electric grid. However, a new solution has emerged, called "Climate Resilient Internet"— based on a new certification for climate change and operating on the same "resilience is local" principle as the microgrid. One of the compelling facts put forward is that the savings from a single prolonged internet outage could fund an entire microgrid deployment (typically $2-$4 million/MW).

(IS-2021-145) Charting a Path to the Future of the Office

This report published by BOMA International Deep Dive was published in March 2021. This report provides a reflection on the how the COVID-19 has changed commercial real estate. In "stage one," tenants and property managers established hastily constructed work-from-home (WFH) protocols and the placement of plexiglass and hand sanitizer stations. The office space industry "normalized" under new—but often changing—rules of engagement in "stage two," as employees grew accustomed to wearing masks and adjusted to working in a more solitary context. "Stage three" centered on planning for a return to work, albeit in fits and starts and in numbers still greatly reduced from the days of full occupancy. Stage four is still taking shape, and it will require decisions on how the office of the mid- term future looks both in physical appearance and in the protocols that will ensure tenant confidence.

(IS-2021-144) Architects vs Contractors vs Owners - Who Can Most Impact Climate Change in the Built Environment?

This report was authored by building performance platform Cove.tool and published in April 2021. The challenges of reducing carbon emissions in the building industry requires a multi-pronged effort on the part of owners to drive demand, architects to design for the demand, and contractors to execute design in a climate-conscious manner. But today data-driven workflows and analytical tools make it easier for buildings to account for sustainability concerns, with powerful digital tools that provide in-depth analyses of a project for its entire lifecycle, and tools that provide quick metrics and graphical representations of information to drive client discussions and design decision-making. External stakeholders like global organizations, advocacy groups, and governments can push for greater efforts and collaboration between owners, contractors and architects to create a sustainable and carbon- conscious building industry in the future.

(IS-2021-143) Designing Electricity Rates for An Equitable Energy Transition

This February 2021 report was produced by California non-profit Next 10 in collaboration with the Energy Institute at UC Berkeley's Haas School of Business. The groundwork for the transition to renewable energy has been laid, but changes to how the California and its residents pay for electricity will be needed to ensure equitable outcomes as the state pursues a carbon-neutral path, the report concludes. In particular, the current system of recovering system costs through high volumetric prices is not only inefficient; it imposes a relatively large burden on lower- and average-income households while it recovers a shrinking fraction of system costs from higher-income households because of the diffusion of rooftop solar. A variety of potential approaches

to ensure utility revenues can be kept stable without relying on the current rate model are described.

(IS-2021-142) 2020 Construction Technology Report

JBKnowledge reviewed construction industry technology trends in this report from December 2020. Challenges faced by construction companies — and their adaptation strategies — are presented. The analysis covers top software and mobile apps for the construction industry with innovation forecasts and budget benchmarking. A comparative analysis is provided between current and prior year data to highlight important trends.

(IS-2021-141) 2020 Year-End Data Center Trends

JLL Research focused on data center trends and projections for 2021 in this January 2021 report. Demand for data centers, and creation of new capacity, continued to increase with millions of people working from home, attending online schooling, shopping online, and gaming. That growth is likely to continue based on strong investment, demand for 5G, and need for sustainability.

(IS-2021-140) Building Digital Twins

This report by Ken Dooley and José Carlos Camposano from Granlund was published in December 2020. The report explores digital twins through a user-centric approach to determine user needs and the benefits that could be created by connecting data to a digital twin. Different digital twin categories exist, with varying degrees of complexity and timelines for adoption, and less complex solutions are likely to achieve a better balance between the customer value and the resources needed for their implementation and maintenance.

(IS-2021-139) The Advent of Private LTE and 5G

This April 2020 report by Harbor Research offers recommendations for organizations to develop new business opportunities by leveraging smart systems and the Internet of Things. The key enabler includes high performance networks such as Long-Term Evolution (LTE/4G) and next generation 5G. Use of private network services is proposed to act as an abstraction and orchestration layer to link existing networks and optimize data flow and operational efficiency. Successful deployment of new technologies will strongly depend on organizations being able to engage different channels and deploy new technical and business models.

(IS-2021-138) Global Economic Value of Wi-Fi

This February 2021 report from the Wi-Fi Alliance forecasts that the value of Wi-Fi globally will rise from $3.3 trillion in 2021 to $4.9 trillion in 2025 and highlights the importance of ensuring sufficient spectrum for Wi-Fi use to continue the benefits of this technology. Updating results from an earlier study (2018), the analysis presents economic value results for 14 countries and

the EU that were developed by economists at Telecom Advisory Services. The data on Wi-Fi's economic value was developed by assessing several key factors and global developments impacting the Wi-Fi industry that contribute to the value of Wi-Fi for 2021 and beyond.

(IS-2021-137) Momenta Prediction Report | 2021: A Look Ahead

This report was authored by digital industry venture capital firm Momenta and published in January 2021. The report discusses how evolving technologies will impact consumers' lives and transform how they communicate, collaborate and do business. Technologies discussed include artificial intelligence, the Internet of Things, cloud computing, 5G, and blockchain. Factors impacting how people work are presented and include social responsibility, wellness, distributed work, and automation. The report also highlights advances in clean energy, electric vehicles, and space technology as indicators of where the market is heading.

(IS-2021-136) Foundations for a Science-Based Net-Zero Target Setting in the Corporate Sector

This report by CDP, the global environmental reporting non-profit, was published in September 2020. The paper describes how companies can apply a science-based targets initiative to achieve net-zero global CO_2 emissions by mid-century. Key items discussed include the importance of public awareness regarding CO_2 emissions, common understanding on what net-zero means for companies, and the development of a science-based framework for the formulation and assessment of net-zero targets.

(IS-2021-135) COVID-19 and the Economic Value of Wi-Fi

This report by Telecom Advisory Services, from December 2020, demonstrates the economic importance of Wi-Fi under pandemic conditions. "Critical contributions" of Wi-Fi include provision of Internet through free access points, efficient and concurrent access to the Internet by multiple devices, reduction in wireless expenditure, support of unserved communities through wireless Internet service providers (WISPs), and virtualization of business processes.

(IS-2021-134) Broadband Myths - Are High Broadband Prices Holding Back Adoption?

This report from the Information Technology & Innovation Foundation published in February 2021 deals with factors impacting broadband accessibility in the U.S. Key takeaways are that while U.S. broadband prices are competitive with other nations, wider broadband access can be achieved through government subsidies for low-income users, improved user literacy and device cost, and user access to private ISP providers.

(IS-2021-133) The Future of Enterprise Networking and Security - Are You Ready for the Next Leap?

CATO Networks presents the results of a global survey that polled 2,376 IT executives on the impact of the COVID pandemic and secure access service edge (SASE) technology on IT

purchasing and strategies. The key findings in this January 2021 report reveal that IT enterprise budgets and priorities will focus on remote access performance and security. SASE presents important benefits to organizations such as increased security, time savings in management and maintenance, overall cost savings, and greater agility in adapting to new challenges. CATO's SASE solution is promoted as the first SASE platform to help organizations reap such benefits.

(IS-2021-132) A National Roadmap for Grid-Interactivity Efficient Buildings

This report from the Office of Energy Efficiency & Renewable Energy was released in May 2021. The Building Technologies Office, with industry support, put together a roadmap that outlined how to achieve, by 2030, triple the deployment of Grid-interactive Efficient Buildings (GEBs) over 2020 levels. A GEBs are defined as industrial, commercial or residential facilities which can provide both energy efficiency and optimization of grid services through control and automation. Grid services include resource adequacy, capacity firming, frequency and voltage regulation, ramping reserves, resiliency, black start, etc. The paper highlights both the barriers preventing — and pillars that support — GEB adoption.

(IS-2021-131) The State Transportation Electrification Scorecard

This report from the American Council for an Energy-Efficient Economy (ACEEE) was published in February 2021. This comprehensive report evaluates and provides a scorecard of states' policy activities and efforts to electrify transportation. While transportation accounts for 28% of GHG, EVs currently represent only 2% of the American vehicle market. California led in five of six categories, including: planning & goal setting; incentives; efficiency; grid optimization; and equity. Recommendations pertaining to benchmarking, data collection, investment and establishing clear policy direction are provided, with policy guidelines for transportation electrification.

(IS-2021-130) Anatomy of a Healthy Building

This September 2020 report by Honeywell provides a technical guide to improving air quality and health safety with regards to COVID, with detailed references. Specific information is provided for: temperature & relative humidity; air filtration; cleaning & disinfection; ventilation; pressurization; and surface cleaning & disinfection. Information on the effectiveness of various air-filtration devices is provided.

(IS-2021-129) The Building Electrification Technology Roadmap (BETR)

This report from the New Buildings Institute was published in January 2021 and provides a guide to developing, implementing and supporting electrification programs. Extensive qualitative research drawing from California efficiency programs of 38 technologies across four end-use areas (Space Heating, Water Heating, Cooking and Clothes Drying & Laundry) is provided. A Technology Assessment Graphic Tool is provided. As an example, heat pumps use 36% less energy, produce 71% less GHG and are 300% - 400% efficient compared with high-efficiency condensing gas furnaces. Electrifying the four main gas-using technologies of space and water

heating, cooking and clothes drying cuts energy use by over 40% and GHG emissions by over 75%. The analysis discusses key roadblocks and recommendations.

(IS-2021-128) Building a Successful Smart Home Strategy

This report was authored by Plume Design and published in December 2020. Consumers will require fast, ubiquitous and reliable connectivity from their communications service providers (CSPs) as smart home ecosystems evolve. By 2023, the consumer segment will be three times as large as the business segment, with the global smart home market reaching $317 billion by 2026. This report discusses the current market state, business models, challenges and solutions. Plume's integrated CSP solution is said to reduce customer churn by 30%, truck roll rates and service deployment timelines by 67% and support calls by 50%, resulting in net promoter scores increasing by 60 points.

(IS-2021-127) Building Automation Opportunities to Meet NYC Emission Laws in Existing Buildings

This 2021 paper from EnOcean Alliance highlights that New York City now requires that large (over 25,000 square feet) existing buildings (residential and non-residential) reduce their carbon emissions by 40% by 2030 and by 80% by 2050. As an ambitious climate regulation for buildings, the new law invites discussion about the opportunities available for carbon reduction for buildings which involve building automation, intelligent control Systems and widespread sensor implementation and provides examples of projects where EnOcean-based systems have been installed. The authors provide real-world cases where the EnOcean's resource-saving energy harvesting technology has been adopted in NYC to enable buildings there to be sustainably digitalized for a reduced carbon footprint.

(IS-2021-126) Better than Normal

JLL explores long-term opportunities for improvement in residential, commercial and industrial real estate in the wake of COVID-19 in this 2021 report. Demand for more space and flexibility and use of technology solutions for operations and maintenance have become essential for residential users. Given the shift, trends involving the distribution of office spaces in urban and suburban areas and the continuity of working from home model are discussed. The implications of the new focus on wellness and sustainability in many sectors like work offices, industrial and hotels are also examined. The authors conclude that the real estate industry has the opportunity for transformative change in the areas of emissions, climate change, social justice and equality — and grounds for optimism about large cities' long-term resiliency.

(IS-2021-125) Energy Efficiency Snapshot 2020

This report was prepared by Northeast Energy Efficiency Partnerships (NEEP) and published in 2020. It provides an overview and jurisdictional scan regarding public policy advancements in energy efficiency policies and performance metrics for twelve U.S. states located in the Northeast and Mid-Atlantic region. Figures indicate that energy efficiency is the fastest-growing

jobs sector in the energy industry and most of the investments are directed towards electric programs followed by natural gas efficiency programs. A correlation to the reduction of regional carbon emissions in the region for the period 2014- 2018 is also given.

(IS-2021-123) Energy Storage - Impacts of Electrochemical Utility-Scale Battery Energy Storage Systems on the Bulk Power System

This report was authored by the North American Electric Reliability Corporation and published on February 2021. This report confirms Battery Energy Storage Systems (BESS) will grow exponentially with utility-scale storage increasing from 899 MW in 2019 to 3,500 MW by 2023. BESS provides system reliability through frequency regulation, voltage support, and peaking capacity. However battery storage is an emerging technology and lags in integration with renewable resources. North American market development information is provided. California leads with 1,300 facilities in operation or under construction. Lithium-ion and flow battery applications and market potentials are discussed. Recommendations for modifications of NERC standards to address specific issues are provided.

(IS-2021-122) Property Owners Guide to Private Networks

This report was authored by the Connectivity Wireless Solutions and published in April 2020. This report provides an understanding of Citizens Broadband Radio Systems (CBRS) designed to enhance mobile broadband, open connectivity to cable operators, and extend broadband service through a private network. Real-use cases discussed include airports, stadiums, hospitals, convention centres, universities and commercial buildings. Results of a successful Times Square NYC pilot included enhanced Wi-Fi, mobile and monitoring device connectivity in one of the most densely populated tourist spots in the world.

(IS-2021-121) Leading by Example - How Multifamily Real Estate Companies Approach Energy Management and Savings

This report from the American Council for an Energy-Efficient Economy (February 2021) reports on the results of a comparative study of energy and carbon emission reduction programs for three multi-family real estate companies. An Urban American initiative in NYC achieved a 30% reduction in energy consumption through equipment upgrades and additional weather sealing. A 439-unit apartment in Union City, California achieved an ROI of 42% with a simple payback of 2.4 years on a $1.44 million project. The third program was a Joint Ownership Equity NYC project involving 386 units and $14.3 million in upgrades. Over all, energy efficiency is prioritized in capital planning and ongoing operations in each of these programs, leading to tangible energy savings and better energy management.

(IS-2021-120) The Modern Energy Minimum - The Case for a New Global Electricity Consumption Threshold

This report by the Energy For Growth Hub was published in January 2021. The authors link energy poverty with economic poverty. The sectors that account for energy consumption include

industrial (44%), residential (28%), commercial (23%), agriculture (3%) and transportation (2%). The energy poverty line is assessed at 100 kWh, corresponding to an annual income of $208 per year. By comparison, the median for high-income countries is 6,270 kWh and $20,000 per year. The authors propose establishing a two-threshold global energy minimum consumption of 1,000 kWh per person per year (300 kWh residential, 700 kWh non-residential), which would correlate to an average income of $2,500 per year.

(IS-2021-119) State of Construction Tech

JLL looks at the current state and key trends in construction technology in this report from December 2020. The analysis proposes a "construction technology hierarchy," growth trends, and the data on current venture capital investment. The technology hierarchy includes details on different construction tech categories which are ranked as foundational tools, a "primary impact" technologies, or "secondary impact" technologies. Most of growth due to the pandemic have been digital collaboration platforms, virtual scanning tools, and safety focused wearables. Venture funding was on par with prior years and with new funding being concentrated in categories that have grown because of the pandemic.

(IS-2021-118) Connected Complexity | The Padi Platform: Open-Source Tools For Open Data

This white paper by Harbor Research and published in March 2021. The paper deals with a software tool, Padi, that enables simple, durable and context-sensitive integration between complex systems without wasteful custom development. It is argued that by using open-source connection profile mechanism, Padi addresses integration issues and enables system developers work more collaboratively by integrating data flows in a reusable way with generalized and extensible concepts.

(IS-2021-117) The Dematerialization Path to Profitability and Sustainability

This report was prepared by Ericsson Consumer & Industry Lab and published in February 2021. Based on a survey involving 5,059 online respondents, the report examines the future of enterprises, white- collar work, and the role of ICT in the next 10 years. Key findings focus on the importance of dematerialization for increased profitability, the remote-work trend for white-collar jobs, the growing adoption of extended reality (XR) and the increased use of renewable electricity for enterprises.

(IS-2021-116) The global economic impact of 5G

This report was authored by Wilson Chow from PWC and published in January 2021. By considering use- cases in health care, smart utilities, consumer and media, industrial manufacturing, and financial services, the analysis highlights that the adoption of 5G will add US$1.3 trillion to global GDP by 2030. To achieve such gains, companies will need to factor 5G into their technology road maps and strategically apply use-cases that will deliver the greatest value. Policy makers and governments, for their part, will need to regard 5G as fundamental component of societal infrastructure.

(IS-2021-115) The Future Telco-Connected Home

This report by Omdia Research for the Broadband Forum was published in January 2021. Opportunities for broadband providers to differentiate their products by offering new services and deriving additional revenue from the connected home are explored. Standards are needed to avoid fragmentation, for open platforms to encourage third-party developers, and "to maintain customer trust," the analysis shows. The security of the router and home network, and customer privacy, remain top challenges.

(IS-2021-114) The 2020 State Energy Efficiency Scorecard

The 14th edition of the American Council for an Energy-Efficient Economy's ranking of U.S. states on their policy and program efforts to save energy; and their progress in pursuing efficiency as a cost- effective tool to achieve state clean energy goals. Score cards covering utility policy, transportation, building energy efficiency policies, state initiatives, and appliance efficiency standards are provided in this report, from December 2020. California leads and sets standards which are adopted by other states, particularly regarding low- emission and zero-emission vehicle programs. Regionally, the northeast leads the way.

(IS-2021-113) Sustainable Recovery - World Energy Outlook Special Report

This report from the International Energy Agency (July 2020) provides a three-year sustainable recovery plan for the electricity, transport, industry, building, fuel and emerging low-carbon technology sectors. A $USD1 trillion investment would yield a 1.1% increase in global GDP, create 9 million jobs, and reduce GHG emissions by 4.5 billion tonnes. New policies and regulatory frameworks would be required to support this plan, which would help achieve the long-term climate goals of the Paris Agreement.

(IS-2021-112) Side Effects: How Renewable Energy Policies Drive Innovation in Complementary Grid Technologies

This January 2021 report from the Information Technology & Innovation Foundation evaluates the impact of seven renewable policies in OECD countries on patenting rates of technologies that complement renewable energy; in particular, solar and wind. Modeling shows the impact that strong renewable policies, market-based demand policies and R&D investment have on innovation. Renewable policy scores by country (Denmark leads) are provided. The analysis shows how the U.S. compares against the global mean over the past 20 years, across 7 metrics.

(IS-2021-111) Responding to Automation Technology Adoption in Canadian Industries

This report Conference Board of Canada report, which came out in January 2021, covers industry- specific trends and attitudes that shape how Canadian organizations adopt automation, using surveys and interviews of managers and frontline workers. Key findings indicate the

importance of integrating digital applications and mobile devices, workforce preparedness, understanding the pressure placed on employees to 'up-skill,' and compatibility of automation with existing systems. Barriers to embracing automation are also discussed and include labor shortages, reactive response by employees, insufficient system testing, and inconsistent regulations.

(IS-2021-110 IoT Spotlight Report 2020

This report was authored by Erik Brenneis from Vodaphone and published in September 2020. Based on a survey of 1,639 businesses globally, the report describes how business leaders are using IoT, how the technology is helping them become 'future ready,' and the next steps forecast for IoT. Business adoption of IoT remains strong, with IoT at the core of digitalization enabling business to seize new business opportunities. Many businesses are also turning to it to help them grow stronger and adapt in the face of unforeseen events such as COVID-19.

(IS-2021-109) Canada Real Estate Market Outlook 2021

This 2021 report by CBRE Limited takes a closer look impacts of the COVID-19 pandemic on the commercial real estate market across Canada. It explains how different market sectors (e.g., industrial, logistics) will continue growing as e-commerce demand remains strong, while the rebound in other sectors (e.g., office, retail, hotel) will depend on how vaccination roll-out evolves. The authors go on to provide a long-term outlook linked to demographic trends and the evolving digital economy. They provide a regional market analysis of Canadian urban centers using statistical information and underline that it is probably too soon to say exactly how remote working will impact demand for office space until workers return safely to office.

(IS-2021-108) Meeting the dual challenges of Covid-19 and climate change

This report was authored by Nils Larsson from ISSBE and published in November 2020. It aims to establish a business case for responding to the dual challenge of climate change and COVID-19 impacts. The analysis explores actions needed in buildings to comply with anticipated health requirements for the post-pandemic period, as well to tackle climate related impacts. It is argued that an integrated action framework that incorporates a variety of strategies for the building industry is urgently needed. As examples, decision-makers should prioritize measures such as focusing on building renovations and retrofits, improving ventilation rates and strengthening energy performance and housing programs for low income populations.

(IS-2021-107) IoT Signals

This October 2020 report by the Hypothesis Group was commissioned by Microsoft. Part of a series of reports on the Internet of Things (IoT), the analysis offers "new learning and insights around the current and future state of IoT." A survey was undertaken involving decision makers in large companies (1000+ employees), where 91% of these companies worldwide (94% in Germany) are involved in IoT adoption in some form. Most projects have moved from "learning" and "trial" to "purchase" and "use" stages. Adoption is highest in retail and energy. IoT is being

adopted to enhance productivity and security. Barriers to IoT adoption include complexity and cost. Companies adopting IoT are also developing their familiarity with artificial intelligence (AI) and edge computing, and 70% are using digital twins for simulation with IoT.

(IS-2021-106) Functional Requirements for Broadband Residential Gateway Devices

This technical report by the Broadband Forum, titled "TR-124," was published in December 2020. It contains requirements for a residential gateway between a broadband network such as DSL (digital data over analog telephone wires) or GPON (gigabit passive optical network using fiber optics) and a home network. Applications include voice, data, broadcast video, video-on-demand and two-way video using broadband networks. Among the requirements is support for IPv6 (Internet Protocol version 6), which extends the address space of IPv4 from 32 bits to 128 bits, in that way making it possible to accommodate billions more devices.

(IS-2021-105) Artificial Intelligence: The Future of Coworking

This report was prepared by Yardi company and published in October 2020. The ways in which artificial intelligence (AI) and the Internet of Things (IoT) impact the shared workspace industry today–and how they will shape coworking as a whole in the near future–are the focus of the report. The authors argue that growth and adoption of AI will be influenced primarily by user trust. As AI and IoT become more powerful, refined, and accepted, operators will ultimately free up more time from manual tasks, gaining the ability to focus on the community-driven aspects of coworking.

(IS-2021-104) A U.S. Grand Strategy for the Global Digital Economy

This report was authored by Robert D. Atkinson from the Information Technology & Innovation Foundation and published January 2021. This paper presents a stark view of world competition in information technology: "Today's era is one of nationalization, mercantilism, increased authoritarianism, and tension." The author urges the U.S. to focus on developing hardware and networks to support communications necessary for "the digital economy." Moreover, the U.S. faces a risk where much of the world, including the EU, could align against U.S. IT and digital interests, leading to a many-against-one environment, with detrimental consequences. Various scenarios are present for how the U.S. might ally with countries outside of China and Russia or might be thwarted by these allies.

(IS-2021-103) 2021 State of Disruptions

Avant Communications released this report in January 2021. The results of a survey of 500 US U.S. executives in IT, security and finance were presented, pointing to business transformation as a key business driver that enterprises need to understand well in to stay ahead of the competition and sustain growth. The main trends and takeaways include the use of software-defined networks, multi-protocol label switching, growth in as-a-service models (contact centers, infrastructure, unified communication), co-location, inclusion of trusted advisors, and cybersecurity preparedness.

(IS-2021-102) Intelligent Buildings and COVID-19 | Executive Summary & Module 1

In this CABA Landmark Research project, Frost & Sullivan evaluated the key issues and challenges presented by the pandemic for the intelligent buildings industry, assessed the implications for current and future technology evolution, and outlined measures that will help build future resiliency for the sector. The Executive Summary report and Module 1 of 3 are available as a free download.

(IS-2021-101) Energy Technology Perspectives 2020

This International Energy Agency report from January 2021 offers detailed analysis and advice on the clean energy technologies the world needs to meet net-zero emissions objectives. The analysis maps out the technologies that will be required to tackle emissions in all parts of the energy sector, including areas where technology progress is still lacking, such as long-distance transport and heavy industries. The authors show the amount of emissions reductions that are required from electrification, hydrogen, bioenergy and carbon capture, utilization and storage. An assessment of emissions from existing infrastructure and the recommended countermeasures is also provided.

(IS-2021-100) Dissecting IoT for the Rural Broadband Ecosystem

Finley Engineering released this report (December 2020) focusing on six to ten-year planning for the potential growth of connected devices, informally called Internet of Things (IoT). The estimated 30 billion connected devices in 2020 are expected to reach 50 billion by 2025. Business and industrial applications are expected to outpace home applications. Use cases in rural America are described for agriculture, healthcare, town operations, and education. The role of fiber optics and fixed wireless networks for a data infrastructure is presented in summary form. Public funding programs are discussed.

(IS-2021-99) Automation 2020: OT/ICS Cybersecurity

This December 2020 eBook was published by Automation.com, a subsidiary of the International Society of Automation. It examines emerging cyberthreats—in particular, the misuse of DNS protocols—and sets out a "zero-trust" cybersecurity approach that should work within Operational Technology (OT), industrial control systems (ICS), and supervisory control and data acquisition (SCADA). There are key takeaways on the value of open and secure SCADA systems, safety best practices for improving OT cybersecurity, and how to strategically communicate cybersecurity information to corporate board members.

(IS-2021-98) 5G Standalone Architecture

This January 2021 report by Samsung examines the advantages of 5G networks over 4G networks (LTE) in terms of throughput, latency and reliability. 5G allows operators to provide unprecedented communication services for end-users and to explore innovative business use-

cases that can generate new revenue streams by using 5G-specific services. Migration strategies from 4G to 5G are presented, including standalone (SA) and non-standalone (NSA). Over all, NSA can be an attractive option for customers who have interest in quickly deploying 5G by utilizing legacy network and minimizing upfront investments. "However, the SA architecture is the best choice for operators that want to tap new 5G opportunities, as 5G-specific services are available only in SA architecture."

(IS-2021-97) Zero Carbon London

This November 2020 report by New London Architecture in the UK reports on a survey of challenges and solutions to help industry support the path to carbon neutrality in the city of London. Over 100 businesses involved in the whole-building industry were surveyed. According to the respondents, lack of policies and green funding are the two major obstacles to achieve zero carbon emissions. The resulting proposals emphasize the importance of retrofits of existing buildings, the adoption of a circular economy approach for design and construction as well as a complete transition to clean sources of energy. Lastly, the annex provides a list of existing projects in London that set the bar for environmental design.

(IS-2021-96) Energy Efficiency 2020

This December 2020 report from the International Energy Agency (IEA) reviews energy efficiency (EE) trends with a special emphasis on the impact of the COVID-19 crisis on EE technology adoption and global energy markets. Facts showing how the pandemic influences the energy demand and energy intensity in the building sector, appliances, manufacturing industry as well as transportation (urban and long distance) are illustrated and discussed in depth. In light of government funding on energy efficiency and COVID-19- related stimulus measures, the report provides analysis of the role of the energy efficiency industry as a driver for economic recovery and job creation.

(IS-2021-95) Global Renewables Outlook: Energy Transformation 2050

This 2020 report published by International Renewable Energy Agency (IRENA) examines energy transformation with closer a look at needs and impacts at the regional level, in both energy and socio-economic terms. This study also outlines a vision of transformative energy policies as the path to decarbonization. On the innovation and technology side, carbon dioxide (CO_2) emission reductions in shipping, aviation and heavy industry remains the most difficult obstacle. Addressing such challenges soon will be crucial to achieve net-zero emissions in the second half of the century.

(IS-2021-94) Canada's Net Zero Future: Finding Our Way in the Global Transition

This February 2021 report from The Canadian Institute for Climate Choices proposes credible pathways for Canada to reach its goal of net zero greenhouse gas (GHG) emissions by 2050. Policy options across sections are evaluated and discussed as "safe bets" and "wild cards." The

report highlights the need for government action to implement and enforce strong policy, manage the risk linked to "wild-card" solutions, implement an accountability framework, and ensure the transition to a net zero economy is fair and inclusive. References to supporting studies are provided.

(IS-2021-93) Building the 22nd-Century Utility

This January 2021 report by Val Jensen of consulting giant ICF is subtitled "How a utility CEO remakes her business to survive—and even thrive—into the future." Instead of providing a future model based on incremental improvement of past practices, this paper provides a fresh approach based on what the future consumer is likely to need in the coming years—and how these needs could be monetized. A two-tier structure involving network capabilities and energy-as-a-service provides a utility with a more responsive, resilient and consumer-friendly business model, one better structured to respond to changing future demands. Illustrations of how this model would work in practice are provided.

(IS-2021-92) Automated Facial Recognition - A Guide to Ethical and Legal Use

This January 2021 report from the British Security Industry Association proposes terms of reference and frameworks for governance and compliance for the legal and ethical use of AFR. The report provides verification and identification decision trees and discusses how AFR storage and data privacy should be approached. This report helps frame the discussion around AFR, and the inherent rights individuals should retain as the technology continues to progress.

(IS-2021-91) 2021 Strategic Directions: Megatrends Report

This February 2021 report from Black and Veatch looks to inform the 2021 decision-making process that will drive capital spending and help utilities position for the future. Supported by survey results from 1,000+ power, water, telecommunication and natural gas professionals, the report identifies three significant trends: Customers Driving Sustainability in the C-Suite; Next-Level Reliability Through Resilience; and Turning Data into Action. Results suggest that 83% of utilities are pushing capital towards clean energy with 70% leading innovation in this area; 73% are focused on improving reliability; 85% have a water/drought management plan; and 60% identify regulatory changes as a risk.

(IS-2021-90) Affordability and Resilience: The Challenge of Tower Renewal in Private Rental Apartment Buildings

This December 2020 report by the Urban Land Institute presented the conclusions of a special panel tasked with proposing creative renovation and redevelopment solutions for tower clusters in the Greater Toronto Area (GTA). Based on analysis of the challenges facing these sites, the panel developed recommendations on selected sites that could be applied more broadly. The panel underscored that Toronto's apartment towers remain critical landing points for new immigrants and housing strivers constrained by the "missing middle." Refocusing on tower

renewal is crucial, as no alternative housing currently exists for much of the city's residents.

(IS-2021-89) Combined Heat and Power and a Changing Climate: Reducing Emissions and Improving Resilience

This January 2021 report by the Combined Heat and Power Alliance looked back on the national three-day summit it held in the fall on the role of combined heat and power in a low-carbon future. This report is based on the presentations and discussion by those who attended the event, as well as on previous research and analysis undertaken by the alliance. Key benefits of combined heat and power systems are examined. CHP is a climate change solution because it can both reduce emissions and be a resilient energy resource, reliably providing electric and thermal energy even during severe weather events, the authors write.

(IS-2021-88) Data Automation is the New Battleground in the Mortgage Industry

This report by Barbara Hodge, Principal Analyst and Global Digital Editor, Shared Services and Outsourcing Network (SSON) was released in September 2020. It is argued that the mortgage industry is in desperate need of a "digital overhaul." Automating data ingestion will underpin operational resilience, reduce costs and deliver new revenue streams as mortgage providers tap into customer and property data currently trapped in applications, contracts and valuations. The author predicts that swift, seamless workflows combined with reliable data analytics will become "game-changing" for the mortgage industry, and the extent to which the opportunity is taken up will greatly influence the success of different industry players.

(IS-2021-87) Guide to Building a Connected Workplace with a Remote Workforce

This COVEO report released in April 2020 discusses the need for today's employees to be equipped with up-to-date tools and information resources in order to work effectively from any location. There are currently several organizational challenges preventing a unified digital workforce, including siloed and disconnected systems which lead to inaccurate and inconsistent data, the authors write. The report describes the key measures companies can undertake to build an intelligent and connected digital workplace—one that creates trust and confidence among employees, while allowing them to adjust to the new realities of remote work.

(IS-2021-86) OpenBlue Healthy Buildings | Pulse Survey

Johnson Controls surveyed more than 400 firms in the U.S. and Canada on their approach to supporting healthier buildings and a successful return to work in 2021. The resulting report, published in January 2021, revealed a keen interest in healthy buildings initiatives and valuable insights on what that means to companies today. A universal spending pattern across industries also became clear. In particular, while some industries spend slightly more on clean air initiatives (commercial real estate) and others on disaster response and healthy workspace (healthcare), overall, the need and desire for healthy buildings and safe workspaces transcends vertical markets.

(IS-2021-85) Lessons from a Heat Pump Retrofit at Walpole Ave: A TAF Case Study

This report prepared by The Atmospheric Fund (TAF) was released in November 2020. To advance climate action and reduce carbon emissions in the Greater Toronto and Hamilton Area (GTHA), The Atmospheric Fund (TAF) is focused on scaling up the adoption of deep energy retrofits (defined here as savings of 40 per cent or more) in multi-family buildings. Deep retrofits offer multiple benefits to communities including carbon reduction, cost savings, and health and comfort improvements. The report describes the results of installing heat pumps at a nine townhouse blocks having 120 suites in total, ranging in size from one- to three-bedrooms. To demonstrate the viability of retrofits focused on electric heat pumps, TAF installed and monitored eight cold climate air-source heat pumps (CC- ASHPs) as a pilot project. The results and lessons of the pilot project are summarized here. The heat pump pilot demonstrated that the multi-split systems can effectively maintain comfortable conditions through a cold Toronto winter.

(IS-2021-84) Most Innovative Projects of 2020

This report by Enel X (January 2021) shows how some of its leading commercial, industrial, institutional, and utility clients meet their energy challenges. While 2020 will be remembered as a pandemic year, it also marked a major, positive shift in the way energy is consumed, the authors write. Fossil fuel companies continued to lose market share as deployments of renewable energy projects accelerated. Even in oil- and gas-rich Texas, solar, wind, and energy storage projects dominated the queue to connect with the grid. The report highlights the effectiveness of: 1) Highly coordinated demand-response programs that protect the grid and local communities in hours of need; 2) Innovative solar-plus-storage initiatives that are replacing grid instability with energy resiliency, while also reducing GHG emissions; and 3) Ingenious fleet and infrastructure electrification efforts that are making carbon-free travel possible.

(IS-2021-83) Adoption of Light-Emitting Diodes in Common Lighting Applications

This report by the U.S. Department of Energy (August 2020) examined the effects of LED for lighting in terms of energy saved for markets where non-LED technologies were traditionally installed (incandescent, halogen, etc.). Estimates for energy savings if there were 100% penetration of LEDs are presented. As of 2018, indoor penetration of LEDs was about 30% and outdoors was 51%. Indoor penetration was slower than outdoors because of LED light quality aesthetics. About 4 quadrillion BTUs could be saved with 100% LED installation, the analysis projected.

(IS-2021-82) Why Local Solar for All Costs Less: A New Roadmap for the Lowest Cost Grid

This report was authored by Vibrant Clean Energy, LLC and published in December 2020. Using software modeling, the researchers analyze the potential impact of local solar power generation on total emissions of carbon dioxide. Fossil fuel generation accounts for 32% of all energy-related carbon dioxide emissions, the report notes. The current mix of fuels is about 20% coal

and almost 50% natural gas. Coal for electricity generation is expected to end by 2040. The modeling compared business-as-usual with government mandates to reduce emissions. With clean energy mandates in the U.S., potential savings of $473 billion by 2050 are projected.

(IS-2021-81) Sector Coupling: Creating an Interconnected Decarbonized Energy System Benefiting Industry, the Power Sector and Society

This December 2020 report from DNV GL investigates the relationship between power sources for various industries as they move toward electricity and hydrogen as the primary fuel source. He analysis describes coupling between different economic sectors (e.g., industry, services, households and transport) as they transition towards the use of electricity and hydrogen as the dominant energy carriers. Traditionally, economic sectors have been tied to specific energy carriers and energy carriers are tied to specific uses. Electrification is a main enabler of the energy transition and a main aspect of sector coupling. Sectors that previously used various energy carriers will now compete for the same source: electricity. Sector coupling will lead to "market coupling", meaning that prices of energy will depend on its use in different markets. Market coupling may well have a positive effect on the business case for renewable electricity generation and lead to promising new opportunities for industry.

(IS-2021-80) How Technology Can Save Traditional Retail

This report was authored by Juniper Research Ltd and published in September 2020. A review of technologies to improve the operations of a retail store to be more competitive with online sales was undertaken. The technologies included: smart checkout (faster checkout), smart mirrors [not explained], beacons using Bluetooth (to help the customer find a specific product in the store), RFID (electronic tags with product data read wirelessly at a short range for inventory management), and robotics. The use of AI (artificial intelligence) is discussed for improving the customer experience. Smart checkout technology was a $2-billion market in 2020 and is expected to reach $387 billion by 2025.

(IS-2021-79) Vision for Driving a Clean Energy Transformation

This November 2020 report was authored by the American Wind Energy Association. The authors set out recommendations for driving renewable energy to meet climate and economic-expansion targets, delivering renewables to consumers at the least cost, expediting federal permitting or renewables, and removing competitive barriers for renewable energy to reduce the costs of decarbonization. Recommendations for specific executive orders, laws, regulations, and tax policies are listed.

(IS-2021-78) The Italian Superbonus 110 Percent Economic Recovery Program - A Golden Opportunity for Energy Efficient Technology

This November 2020 report is by EnOcean Alliance. A new Italian law aims to boost the economy by providing financial incentives promoting sustainability and improving energy efficiency, especially in older residential properties. COVID-19 economic recovery programs will strongly

support a shift towards energy-efficient solutions by allowing for the tax deduction of up to 110% of the costs incurred over several years. Italian law already provides an "ecobonus" that has made it possible for building owners to offset the cost of installing remote monitoring/control systems for heating, air conditioning and hot water supply in a property. Enhanced legislation that took effect in July 2020 extends fiscal detraction to 110% when building automation systems are installed in conjunction with other, more extensive works aiming to reduce energy consumption within the same building.

(IS-2021-77) The Smart Home Opportunity: Room-by-Room

Parks Associates prepared this June 2020 report for ESA Research, with support from Resideo. The authors examine the challenge of marketing professionally-installed home automation equipment, especially security and safety systems, versus selling do-it-yourself (DIY) equipment. The analysis provides three choices around DIY: DIY as a fallback if the customer refuses professional installation, DIY as an alternative to professional installation, and DIY as the only option built around voice recognition. Companies are advised to tailor their product offerings to specific rooms in the house according to customer needs. Moreover, security companies should position their offerings in smart home devices as appropriate for specific locations in the house. These companies should be sensitive to consumer's privacy concerns.

(IS-2021-76) Advancing Deep Retrofits in the UAE

This report was authored by Majd Fayyad and Jason John from the Emirates Green Building Council and published in October 2020. The analysis aims to help industry and government explore solutions, approaches and incentives to retrofitting buildings—measures that must go beyond current renovation programs to achieve greater energy and financial savings. Moreover, this study presents the views of key stakeholders in the UAE retrofit market and seeks to establish roadmaps for deep retrofits and decarbonization of the existing building stock.

(IS-2021-75) A Powerful Priority: How Appliance Standards Can Help Meet U.S. Climate Goals and Save Consumers Money

This paper published in the last quarter of 2020 by the American Council for Energy Efficiency Economy shows how updates to national appliance standards could mean significant carbon reductions, utility-bill savings, and better management of peak electricity demand. Estimates are provided to quantify the savings if 47 products are subject to upgraded efficiency standards. Water heaters, commercial and industrial fans, and furnaces for space heating and lighting offer the greatest carbon reductions opportunities, the analysis shows. Improving test procedures can also help ensure that standards deliver the expected savings.

(IS-2021-74) Decarbonizing Public Sector Buildings

This NEEP report (November 2020) is an update to a 2012 report entitled *Greening the Public Sector, Maximizing Energy Efficiency*. The original report provided recommendations and exemplars for how public sector buildings could achieve higher levels of energy efficiency. Some

of the recommendations that remain relevant include reducing cost barriers for constructing energy-efficient buildings and schools, increasing workforce training and education, and establishing the goal of zero energy for all public buildings. However, while zero energy was considered a long-term goal for public sector buildings in 2012, it is now a proven performance target for many buildings today, the authors write. Their analysis sets out updated recommendations to help states implement strategies to rapidly decarbonize public sector buildings and demonstrate how building decarbonization can drive market transformations in the overall building sector.

(IS-2021-73) Smart Home, Healthy Home

This report published in 2020 by Park Associates provides an overview of how the healthy home concept was developed as an extension of the green building movement and the type of goods and services found in the market. "Healthy home" is a powerful new value proposition for builders. Second, the report illustrates the results of a recent consumer study which found that interest in health- related use cases increased due to COVID-19 concerns. Topics such as safety, clean air, clean water, energy management and senior care technology have emerged as top concerns in consumers' minds. The report also analyzes the implications for dealers in the security industry as potential suppliers of integrated solutions linked to their security platforms.

(IS-2021-72) State of Operations and Maintenance Software

James Dice, Founder, Nexus Labs, and Raj Subramanian, Co-Founder and CPO, Facilio analyze the current state of software in building O&M and the barriers for technology adoption. They examine the possibilities that can be unlocked with modern software and suggest a viable strategy for real estate owners and operators to unlock that potential. The paper presents insights and observations based on the changing real estate technology landscape and backed by learnings from working closely with the industry.

(IS-2021-71) Energy Efficiency Program Financing: Size of the Markets

This ACEEE policy brief from November 2020 estimates the volume of residential and commercial energy efficiency financing from five programmatic sources. Energy-efficiency financing programs typically aim to increase the scale of investment in energy efficiency, as grants, rebates, and other incentives alone will not be enough to reach efficiency goals and targets, the authors. Due to the decentralized nature of energy efficiency financing programs and the dearth of publicly available data, there has been a lack of sufficient information on the volume of recent annual lending to energy efficiency from programmatic sources. This brief aims to fill this knowledge gap and provide a baseline for future research.

(IS-2021-70) Energy Impact of Human Health and Wellness Lighting Recommendations for Office and Classroom Applications

Researchers from the Pacific Northwest National Laboratory evaluated the potential energy impacts of circadian lighting designs. Specifically, this research from August 2020 investigated

the potential energy impacts of circadian lighting design recommendations that are gaining attention in a variety of common applications such as offices and classrooms. Within the two applications considered, parameters like surface reflectance distribution and desk orientation were also evaluated to explore the magnitude of potential effects. Using results from 45 unique simulation conditions, the analysis estimates that energy use may increase between 10% and 100% because of increased luminaire light levels used to meet circadian lighting design recommendations listed in current building standards (WELL v2 Q2 2019, UL Design Guideline 24480, and CHPS Core Criteria 3.0.)

(IS-2021-69) WBA Annual Industry Report 2021

This November 2020 report by the Wireless Broadband Alliance examines how new levels of Wi-Fi speed, security and reliability have become available through innovations such as multi-access point mesh, Wi-Fi 6, very high throughput, and ultra-low latency. As industry turns to enhanced Wi-Fi, the latest Wi-Fi standards (Wi-Fi 6 and 6E, based on IEEE 802.11ax standards) will deliver a sea change in Wi-Fi capabilities and performance on 1200 MHz of additional spectrum. The Wi-Fi community has worked to turn an impressive core standard into a fully deployable, monetizable platform, the authors, write. With publications like the Wi-Fi 6 Deployment Guidelines and Scenarios, the WBA seeks to aid service providers in deploying networks that are optimized for many different markets and applications, and that consequently have far greater commercial potential than previous platforms.

(IS-2021-68) Fire Safety Challenges of Green Buildings and Attributes

This October 2020 report was published by the Fire Protection Research Foundation. Specifically, the goal was to examine fire events involving green / sustainable building materials, features and technologies, and to assess the current state of research, regulatory changes, engineering approaches, risk mitigation strategies, and firefighting tactics associated with fire challenges with green / sustainable building materials, features and technologies, which have emerged since 2012, when the group previously examined this issue. The analysis recommends integration of sustainable buildings attributes into fire incident reporting systems. It calls for more robust and appropriate test methods for assessment of materials, components, and systems performance. The importance of having better tools for holistic design and performance assessment, taking advantage of BIM and other technologies that are defining the future of the construction market, is also discussed.

(IS-2021-67) Fit For Future: The Impact of COVID-19 on Workplace and Portfolio Strategies

This December 2020 survey was conducted by Fit for Future with support from the Royal Institution of Chartered Surveyors. The pandemic brought a radical transformation to the world of work. Supply chains are being reconfigured, consumer preferences have changed and working practices and expectations have adapted, influenced by technology use. There will also be longer-term impacts that greatly affect the way workplaces and real estate strategies are planned and managed. Looking ahead to those changes, collaborative research team sought to canvas opinions from those at the forefront of the decision-making process. A questionnaire

survey was conducted with the support of more than 100 organizations spanning governmental bodies and private sector companies. Approximately 20% of the survey participants were interviewed and their views are captured in this report, which is aimed at real estate occupiers, the supply chain and policymakers.

(IS-2021-66) Lead-Free Perovskite-Inspired Absorbers for Indoor Photovoltaics

This report from October 2020 highlights the potential to use indoor photovoltaics (IPV) to power autonomous devices. Lead-free perovskite-inspired materials (PIMs) have recently attracted significant attention in photovoltaics research, due to the similarity of their electronic structure to high-performance lead-halide perovskites, but without the same toxicity limitations. The capability of PIMs for indoor light harvesting has not yet been considered, however. Calculations around low- toxicity PIMs reveal their considerable potential for IPV, thus encouraging future efforts for their potential to power IoT devices.

(IS-2021-65) Prediction of an OT Attack

This Tenable white paper, published in December 2020, discusses the need to update the current operational technology (OT) security paradigm. Some organizations wanting to be more efficient and cost-conscious buy into IT-OT convergence, while others deploy Industry 4.0 or IoT technology. These two initiatives yield massive benefits but can also open the door to new risks. A newer form of security takes both the network and both IT & OT devices—together—into account. This is called attack vectoring, which redefines how one can address attacks by identifying the high-risk pathways an attack may take if it were introduced to the OT environment. An important aspect to attack vectoring is running simulations that can best determine weak points and where security interventions will be needed before an attack is launched.

(IS-2021-64) Canadian Provincial Energy Efficiency Scorecard

This 2020 report from Efficiency Canada, housed at Carleton University's Sustainable Energy Research Centre, assessed provincial energy efficiency policies and outcomes introduced or implemented between January 2019 and June 2020. Provincial scorecards are provided, covering five policy areas: Energy Efficiency Programs; Enabling Policies; Buildings; Transportation; and Industry. British Columbia and Québec retained the top two spots in the overall rankings. British Columbia continues to lead in both Enabling Policies and Buildings, and Québec again places first in Transportation. Overall, energy efficiency improvement was less than 2% and also less than the 3% target for Canada. The energy efficiency methodology, data on program spend, and recommendations provide helpful reference material for policymakers and energy efficiency sector professionals.

(IS-2021-63) Identified & Authorized: Sneaking Past Edge-Based Access Control Devices

This September 2020 paper from Trend Micro Research September 2020 examines the capabilities and security of new access-control devices based on edge computing architecture.

Many popular access control solutions based on biometric technology are more secure and less prone to issues such as credential theft and fraud than traditional security solutions. However, biometric authenticators are usually computationally heavy. Offering an alternative approach is edge computing, a distributed architecture design that places computing nodes at the edge of the network. This brings them much closer to information-gathering sensors and devices, thereby eliminating the need to send large amounts of data to computational services in distant locations. The analysis concludes that many edge-based access-control devices are fully capable of controlling access through facial recognition, but they lack basic security features. Manufacturers should apply the necessary guidelines and measures to make sure that these devices are as secured and protected as possible.

(IS-2021-62) the Time is Now for a Holistic Approach to Assessing Smart Buildings

This April 2020 position paper from TIA discusses the need to define smart buildings, identify gaps in existing measurement methods, and develop preliminary assessment criteria. Those critera, to support the objective of holistically measuring building technology and performance, should encompass six primary smart building operational categories, the authors write: connectivity, health and wellbeing, life and property safety, power and energy, cybersecurity and sustainability. Buildings are to be scored on a sliding scale and their operators provided with the information and guidance they need to improve scores all building lifecycle stages. The TIA launched the new SPIRE program for smart buildings recently, and are currently running SPIRE pilot buildings.

(IS-2021-61) Transparency, Digitization, Decarbonization: The Imperative for Transparent, Sustainable and Resilient Real Estate

The 11th edition of the Global Real Estate Transparency Index (GRETI), produced jointly by JLL and LaSalle Investment Management, was released in July 2020. With data from 163 cities in 99 countries and territories, the report provides a comprehensive survey of the availability and quality of performance benchmarks and market data, governance structures, regulatory and legal environments, transaction processes and sustainability metrics. GRETI is intended to guide cross- border investors, developers and occupiers of real estate—as well as government and industry bodies looking for international benchmarks. This year's edition was extended to quantify 210 separate elements of "transparency," with additional coverage on sustainability and resilience, health and wellness, proptech and alternatives sectors.

(IS-2021-60) Addressing Subscriber Security Challenges with Comprehensive Gateway Security Controls

This Calix white paper published in May 2020 looks at current and emerging options for home Wi-Fi network security. The analysis describes various security solutions that subscribers can purchase, such as endpoint security software and standalone cybersecurity hubs. These options, however, come with significant limitations, the white paper notes. Given those drawbacks, service providers can integrate best-in-class technologies like PUF, WPA3 and software-based

security controls in the residential gateway, it is argued. This approach ensures "complete protection at the network perimeter" while minimizing the impact on performance and maximizing the subscriber experience, the authors write.

(IS-2021-59) Changes in SSL Device Efficiency and Optical Performance Under Accelerated Aging Conditions

This report for the U.S. Department of Energy's solid state lighting technology division came out in June 2020. Lighting application efficiency (LAE) describes the efficient delivery of light from the light source to the lighted task and is viewed as a new frontier—increasing energy savings with solid-state lighting (SSL) technologies. A LAE framework that takes into account light source efficiency, optical delivery efficiency, spectral efficiency, and intensity effectiveness is discussed. This research focuses on a sampling of the available SSL products that can be broadly defined as having modified spectral output; the method of spectra modification has a significant impact on light source efficiency and long-term optical delivery and spectral efficiencies. Enhanced optical performance came at the cost of reduced light source efficiency for the lamps and light engines examined in this study.

(IS-2021-58) Multi-Tenant Datacenters and Sustainability

This September 2020 study by 451 Research based on primary-research survey data assesses the market dynamics of a key enterprise technology segment. In the coming years, major technology players and their datacenter providers will need to demonstrate they are working aggressively to improve their sustainability practices. IT vendors and cloud service providers are instrumental in achieving a smaller environment footprint by improving efficiencies across industry, including enterprise IT. To gauge how this segment views the importance of sustainability measures in datacenter operations, 451 Research was commissioned by Schneider Electric survey MTDC operators. The resulting study is based on more than 800 datacenter service providers globally.

(IS-2021-57) Data Center Outlook | Outperforming Other Sectors Amid the Pandemic

This September 2020 report by JLL combines forecasts from analysts across the company's regions. According to Nareit, data center REITs outperformed other sectors amid the pandemic in total returns, due to immediate demand for e-commerce and virtual connectivity. While they have challenges with manned operations and increased demand, the report projects that data center REITs will continue to outperform other sectors throughout the year. Operators with diverse tenancy have been largely unscathed from direct COVID-19 impacts. Other operators, such as QTS and CyrusOne, have set record revenue backlogs.

(IS-2021-56) Energy End-Use Data Collection Methodologies and the Emerging Role of Digital Technologies

This publication is authored by the Energy Data Centre (EDC) of the International Energy Agency (IEA) and released in October 2020. The paper explores the role of new and digital technologies for energy end-use data collection. It reviews applications, strengths, and weaknesses of the

major existing technologies, dividing them into three broader categories based on whether the purpose is data collection, data management, or data analysis. The case studies and analysis provided may serve as a starting point for energy statisticians and energy efficiency experts in guiding the design, and/or informing the implementation of new technologies for data collection.

(IS-2021-55) Building Analytics Comparison Guide

This December 2020 report by Dennis Krieger of Clockworks Analytics and James Dice of Nexus Labs examines and compares the range of tools available to O&M teams, from building automation system (BAS) alarms to fault detection and diagnostics (FDD). This paper tells the story of that second "D" and why it is so important. To illustrate, the example of a large air handling unit experiencing several issues is examined. The paper concludes by issuing a challenge to the industry: building owners need FDD, not just FD.

(IS-2021-54) The Post-COVID Recovery: An agenda for resilience, development and equality This 2020 report was published by the International Renewable Energy Agency (IRENA). It

makes the case that action on clean energy can be instrumental in the post-pandemic period to strengthen the economic recovery, bolster sustainable development and ensure carbon emission reductions. This report provides practical insights, options and recommendations for governments to consider. It is intended to support informed policy-making as countries devise recovery measures specific to their circumstances.

(IS-2021-53) Sharing Knowledge on Electrical Energy Industry's First Response to COVID-19

This 2020 report from IEEE's PES Industry Technical Support Leadership Committee (ITSLC) examines how the electrical power and energy industry has been dealing with emerging challenges resulting from the pandemic. It compiles the results of a survey carried out to identify the type of mitigation measures and practices implemented by some electric utility operators around the globe to keep workforces safe and mitigate technical issues that might occur.

IS-2021-52) Framework Document on a Transformational Plan for the Built Environment

This November 2020 report by Holger Wallbaum and Colin Fudge was presented at the World Sustainable Built Environment online conference Beyond 2020. Its main purpose was to provide clear guidance to the global built environment and interconnected sectors such as urban planning, urban design, urban landscape and green infrastructure to achieve the UN's Sustainable Development Goals by 2030. All these sectors are critical in capturing life-cycle assessment at the neighbourhood, city and regional level, the analysis show. Specific initiatives with measurable activities and outcomes in nine areas are provided.

(IS-2021-51) Transforming Data into Action

This October 2020 report from Northeast Energy Efficiency Partnerships (NEEP) is subtitled "A report on how benchmarking data can be used to achieve deep energy savings." It highlights the importance of energy benchmarking to understand energy usage across city and state jurisdictions, which is helpful in developing strategies to achieve climate goals. Interactive energy dashboards and maps, home energy scores, building performance standards, and policy guidelines are discussed.

(IS-2021-50) Interpreting Global Energy Scenarios for Emissions Planning at the Utility Scale

Researchers at the University of Wisconsin-Madison were asked by the primary utility company in Madison to evaluate IPCC scenarios relevant to its operation (Intergovernmental Panel on Climate Change). The resulting report published in November 2020 focuses on the application of IPCC scenarios to the Madison Gas and Electric Company's planning to reduce carbon emissions. The analysis makes clear that when applied to specific goals at the organizational level, electricity demand and carbon intensity of generation affect carbon emissions.

(IS-2021-49) The New Era of Energy Management - How to Reduce you OpEx While Achieving Sustainability

This report by ABB was published in March 2020. It outlines the need to measure and monitor electrical systems to obtain real-time data which, when coupled with robust energy modelling reveals patterns and opportunities to better manage energy waste. The authors discuss energy bill verification; multi-utility validation; load profiling; multi-site comparison; and optimized equipment performance. Implications for the integration of SaaS, AI and machine learning are discussed.

(IS-2021-48) IoT Connectivity Buyer's Guide

This report was released by Aeris in October 2020. The analysis is intended to help organizations to evaluate cellular IoT connectivity providers against the critical dimensions of coverage, support, cost control, and security. The authors focus on the specific capabilities that "make or break" IoT deployment success at scale and their analysis could be of interest to engineers, technologists, system integrators, wireless carriers, and business owners/directors deploying IoT devices and systems.

(IS-2021-47) Lighting Control in Patient Rooms - Understanding Nurses' Perceptions of Hospital Lighting Using Qualitative Methods

This article from Health Environments Research & Design Journal (August 2020) is by Lindsay

McCunn from McCunn & Associates Consulting. Findings underlined that controllability was among the "best" lighting attributes—although more refinement is necessary for optimal staff productivity and patient satisfaction—and daylighting was also considered to be among the best attributes. The study also found that "trespassing" of light is an issue. more attention can be paid to the ways in which window shades, and light sources outside of rooms, penetrate spaces and

affect users. Qualitative analysis of four hospitals with results on lighting control is provided.

(IS-2021-46) State of the Ecosystem Report

This July 2020 report by the Z-Wave Alliance focuses on smart home and connected technologies both inside and outside of the home. The authors discuss the current state of smart home technology, current and future trends, opportunities, and the developing role of Z- Wave in smart homes. The report will be of interest to smart home technology distributors and installers, companies providing home accessibility solutions, and system integrators.

(IS-2021-45) Macro Grids in the Mainstream - An International Survey of Plans and Progress

This November 2020 report is by James McCalley and Qian Zhang from Ohio State University. Their analysis identifies the value of developing inter-regional transmission and macro grids in the U.S. An extensive global comparison is presented, along with a cost-benefits analysis, engineering design options/requirements and a discussion of three characteristics said to be essential for successful implementation. The authors lay out a 21st-century vision of macro grids with various possible scenarios.

(IS-2021-44) Smart IoT Applications and Environments: Key Antenna Considerations in Designing Your Smart Ecosystem

This report was prepared by TE Connectivity and published in September 2020. It covers technological challenges, explores specific demands, and shares considerations for selecting the optimal antenna for IoT applications. Highlights of the discussion center on how the growing use cases of IoT are posing challenges for wireless connectivity and insights on smart building and smart tracking applications trends and challenges. The report will be of interest to wireless operators, antenna manufacturers, engineers, technologists, and system integrators.

(IS-2021-43) Facility Services Now: Results from the 2020 CMM In-House Facility Management Benchmarking Survey

This report was authored by Amy Richardson from Cleaning & Maintenance Management and released in March 2020. Results of a survey of in-house service providers and facility managers conducted prior to the pandemic are presented. Top concerns included health and safety; improving facility image; security; improving productivity/efficiency; and staff training. Additional detailed survey information regarding cleaning and maintaining facilities is provided.

(IS-2021-42) Foundational Cybersecurity Activities for IoT Device Manufacturers

This May 2020 report was released by the National Institute of Standards and Technology (NIST). The report describes recommended activities related to cybersecurity that manufacturers should consider performing before their IoT devices are sold to customers. These "foundational cybersecurity activities" can help lessen the cybersecurity-related efforts   needed by customers,

which in turn can reduce IoT device compromises and attacks carried out using compromised devices. The topics include assessment of customer needs and goals, communication with customers, and device support issues. The report will be useful to manufacturers of IoT devices, engineers, technologists, and IoT system integrators.

(IS-2021-41) Why Digital Twins Are Critical to the Industrial IoT

This June 2020 report from Juniper Research centers on the application of virtual models in Industrial Internet of Things (IIoT) applications to detect issues, advance both learning and understanding, as well as to test and simulate scenarios in the physical model counterpart. The topics include key drivers, values, and challenges associate with implementation of digital twins (virtual and physical models). The target audience for the report includes engineers, technologists, IT professionals, and system integrators.

(IS-2021-40) Luminaire Level Lighting Controls Replacement vs. Redesign Comparison Study

This September 2020 study by University of Oregon researchers summarizes the results of a field study which compared Luminaire Level Lighting Controls (LLLC) to Networked Lighting Controls (NLC). Specifically, the research set out to determine if LLLC systems, applied as one- for-one (1:1) replacement retrofit solutions, can provide lighting energy savings and lighting quality comparable to more comprehensive networked lighting control (NLC) redesign solutions. The latter also require significant cost investment in design, specification, and install. Cost data indicates LLLC savings of one-third to one-half the cost of more comprehensive NLC solutions. Methodology and detailed analysis are provided.

(IS-2021-39) 2020 Energy Efficiency Indicator Survey

Johnson Controls released the results of its annual Energy Efficiency Survey in December 2020. Half of organizations plan to increase investment in energy efficiency, renewable energy and smart building technology in 2021, the analysis showed. Surprisingly, facility energy usage in 2020 dropped little despite lower occupancy rates. 79% indicate data analytics and machine learning will have a very signifiant impact on buildings. 70% will have one or more net-zero facilities in the next ten years. The authors provide a discussion of current funding mechanisms.

(IS-2021-38) Enable Operational Agility with a Digitally Connected Workforce

This report authored by Peter Bussey, Matthew Littlefield and Vivek Murugesan from LNS Research was released in December 2020. This research focuses on how industrial organizations are implementing "connected worker" initiatives as a core pillar of their industrial transformation programs. Results point to a new focus on increased operational agility; improved safety, productivity; and improved performance and profitability. Actionable recommendations and a solution architecture are provided.

(IS-2021-37) DERMS Fact Versus Fiction - Debunking Six Myths About DER and DERMS

This report by Peter Asmus of Guidehouse Insights was released in December 2020. Distributed energy resource management systems (DERMS) run algorithms frequently and quickly to keep the distribution grid in balance. This report defines six key aspects of enterprise DERMS, and their relationship to Advance Distribution Management Systems (ADMS), Virtual Power Plants (VPP) and Distributed Energy Resources (DER).

(IS-2021-36) Crisis-Tested IT Teams Accelerate Digital Agility Plans

This report from IDG Communications was released in September 2020. A survey of 100 IT decision-makers revealed that those who were already engaged in some stages of digital transformation believed that their investments left them better prepared and able to cope with widespread disruptions of normal business operations. 74% of companies have elevated IT leadership to the executive team recently. The analysis also projects that nearly half of knowledge workers will work from home after this crisis. 45% will change both their IT priorities and investment levels. Survey results of future infrastructure-oriented technology initiatives are also provided.

(IS-2021-35) Transactive Energy Market for Energy Management in Microgrids

This April 2020 article the academic journal Energies, by researchers from Monash University in Australia presents a transactive energy market (TEM) framework for implementation within microgrids. The TEM facilitates the integration of distributed energy resources (DER) into existing electricity networks and orchestrates energy management and energy trading through appropriate market mechanisms. An efficient solution is required to ensure DER owners are incentivized to participate, especially in countries such as Australia, where there is 21.6% installed grid capacity of roof-top PV systems. The report discusses pricing mechanisms and market scenarios and concludes with a case study for the TEM as it would apply in a real-world example - the Monash University microgrid.

(IS-2021-34) OpenVault Broadband Insights Report

This report from OpenVault was released in September 2020. This report highlights continued growth among "power users" who consume 1 TB or more of data, the steady migration of subscribers to faster speed tiers, and revenue implications for broadband service providers. Average monthly data consumed at 384GB was up 40 percent in the third quarter of 2020 vs. over the same period in 2019. Although flat since the second quarter of 2020, 8.8 percent of subscribers consumed more than 1TB, compared to just 4.2 percent in the third quarter of 2019. Comparisons between flat rate billing and usage base billing, and between North American and European data usage are provided.

(IS-2021-33) Building the Case for Net Zero

This report was authored by Karl Desai, Richard Twinn, and Alexandra Jonca from the UK Green Building Council and published in September 2020. The report presents the findings of a feasibility study that highlights real-world implications for achieving new net zero buildings. It

illustrates how new buildings can be designed to reach net zero performance targets and the effect this has on cost. The report is useful to builders, building owners, engineers, architects, and designers.

(IS-2021-32) Network Convergence

This August 2020 report by CommScope, subtitled "Building a smart, simple infrastructure with advanced network capabilities," sets out a strategic approach for planned and building network convergence. By embracing such an approach, operators can solve issues of network complexity with "one smart, simple network architecture which provides a common network to handle today's demand." Topics include enhanced mobile broadband and the path to convergence, planning and building for convergency, and the many ways convergence transforms an operator's network. The report will be of interest to engineers, technologists, IT professionals, wireless operators, and network service providers.

(IS-2021-31) Rural Broadband Valuations Remain High as Investors Move Down Market for New Opportunities

This report by economist Jeff Johnston of CoBank ACB was released in September 2020. With the accelerated need due to COVID to improve broadband access to under and unserved rural markets, investor interest is growing. The $80B government commitment to infrastructure spending will contribute to the market support for high valuations of fiber-based operators. Low earth orbiting satellites are not anticipated to have a significant impact on these valuations in the near future. Overall, the abrupt shift in 2020 to working from home and remote learning has significantly increased high-speed data subscriptions, representing a new catalyst for the broadband market.

(IS-2021-30) Rural Broadband – 8 Actions to Ensure Fiber Deployment Success

This report from Black & Veatch was released in November 2020. Twenty three percent of rural Americans do not have access to fixed high-speed broadband. To help close this gap, the U.S. is prioritizing rural broadband, enabled by fiber, to connect rural citizens and foster much-needed innovation across rural services, businesses, and industries such as healthcare, education, and agriculture. Rural electric co-ops can take a leading role in fiber deployment. The authors list eight recommendations designed to remove hurdles, accelerate implementation, and minimize costs. Case studies are provided.

(IS-2021-29) Performance Incentive Mechanisms for Strategic Demand Reduction

This February 2020 report from ACEEE defines performance incentive mechanisms (PIMs) for strategic demand reduction (SDR) as "megawatt reductions comprised of energy efficiency and demand response that aim to minimize system costs by displacing the need for services traditionally provided by the supply side." A new generation of SDR PIMs is on the rise, driven by a need for flexibility at times of peak demand and a shift toward more variable generation. Thirteen states have an SDR PIM in place for at least one utility. A review of case studies

demonstrates that PIMs can be an effective strategy for incentivizing SDR. Key remedies are proposed to unlock SDR, which the analysis indicates is largely untapped, reaching nowhere near the potential cost-effective load flexibility.

(IS-2021-28) Impacts of the E-QUIP Tax Proposal

This report authored by Lowell Ungar, James Barret and Chris Perry from ACEEE was released in December 2020. This report estimates the cumulative impacts from the Energy Efficient Qualified Improvement Property (E-QUIP) proposal would be: 130,000 net additional job-years; $15B in energy-bill savings (NPV); $11B additional business and federal investment; and 100M tons of CO_2 emissions avoided. Detailed analysis including assumptions is provided.

(IS-2021-27) Building Opportunities for the New COVID-19 Reality

This July 2020 report by Impact Infrastructure, Inc. explores HVAC systems and their role in reducing the airborne transmission of COVID-19. Best practices for HVAC usage within the built environment set out by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and REHVA (Federation of European Heating, Ventilation and Air Conditioning Association) are discussed. It also discusses Cost Benefit Analysis (CBA) and provides a case study to showcase how to evaluate investments into recommended HVAC strategies.

(IS-2021-26) Tomorrow's Smart Connect Products Require Smarter Connectivity Services Today

This report by James Moss from ABI Research was published in November 2020. It examines the role of Connectivity Management Platforms (CMPs) and global connectivity coverage solutions. The evolving needs of—and challenges faced by—operators and enterprises are discussed. Recommendations, with a case study, for next generation CMPs are provided.

(IS-2021-25) The Smart Home Floor Plan - Three Key Device Strategies

This report authored by Steven Jones and James Moar from Juniper Research was released in November 2020. It provides an overview of the smart home market and discusses aspects such as device forms; smart home value chain and product strategies; disruptive technologies; and portfolio diversification options. The number of global installed smart home devices is forecast to rise to 13.5 billion by 2025. Additional research is available, including related to market trends; five-year forecasts; strategic analysis; and vendor strategies.

(IS-2021-24) Tech Giants Collaborate to Create Digital-Native Smart Building

This report from Microsoft was prepared in July 2020. The discussion outlines the value of creating a digital twin of a building's physical space and operations on a modern platform that allows a safer and more secure integration of sensors and devices as technologies evolve. Energy and maintenance costs are reduced, design is improved, space is optimized and the overall user

experience is enhanced. A user case study is provided.

(IS-2021-23) Residential Security Market Trends

This November 2020 Park Associates research report was commissioned by the Electronic Security Association (ESA) and sponsored by Resideo. It provides an analysis of residential security trends related to competition, attach rates and the market impact of COVID-19. Findings include: home ownership (34%) and professionally monitored security systems (31%) continue to increase; 76% of security system purchasers want interactive services while 63% want a self-installed system; and 35% of broadband households are extremely concerned about their household's safety and security. Resideo and Parks Associates are CABA members.

(IS-2021-22) IoT - The Internet of Transformation 2020

This report was authored by Markus Rothmuller and Sam Barker from Juniper Networks and published in April 2020. The report presents an overview of key factors regarding IoT deployment. The main topics include market challenges, strategic recommendations, IoT industry leaders, and total connected IoT units. Vendors must implement security procedures that are highly scalable and can cope as network architectures become increasingly complex, the author note.

(IS-2021-21) Forecast Outlook for Residential Security and Add-On Devices

This report was authored by Brad Russell from ESA Research and published in October 2020. The report examines new trends regarding residential security monitoring and devices to help security companies grow their business. The main topics include projected growth trends in professionally monitored security subscribers, consumer interest in home control services, and smart home devices. The report will be useful to security company owners, IT professionals, technologists, and system integrators.

(IS-2021-20) Artificial Intelligence in the Field of Building Automation

This report from November 2020 is by Michael Kröder and Graham Martin from Enocean Alliance and the IGT Institute. Their analysis covers the application of cloud-based artificial intelligence (AI) for building automation. The main topics include cognitive buildings, AI learning process, and applications. The report will be of interest to building owners and managers, IT professionals, engineers, and system integrators. EnOcean Alliance is a CABA member.

(IS-2021-19) A Review of Existing Test Methods for Occupancy Sensors

This report was published in August 2020 by the U.S. Department of Energy. It presents the results of a literature review regarding test methods for evaluating occupancy-sensor performance and categorizes those methods according to which spatio-temporal properties they were able to discern. The reviewed articles are representative of research published over the

past 20 years.

The authors provide a technical discussion of the methods as well as suggestions for future test-method development.

(IS-2021-18) Financing a Net-Zero Economy

This October 2020 report from Ceres examines the impact of climate risk on loan portfolios of the largest U.S. banks. Over half the syndicated lending of major U.S. banks is exposed to climate transaction risk due to inadequate preparation for emissions reductions in line with the Paris Climate Agreement, the analysis shows. Banks may face substantial losses from this direct exposure. Incremental climate risk and the financial system's interconnectivity could result in balance-sheet contagion. Detailed analysis, case studies and modelling are provided. Recommendations include actions to assess and disclose risk; improve measurement and decision- making tools and methods; and act to mitigate climate risk and its ultimate impact.

(IS-2021-17) Transforming Smart Building Technology

This white paper from Planon from July 2020 discusses how real-time integration of smart building technology with an Integrated Workplace Management System (IWMS) enables better management of energy costs and improved efficiency. The systems bring together features of building modeling, computer-aided facility management, building management, and fault detection diagnostics within the IoT ecosystem of a Smart Building. A real-time and dynamic integration of a smart building technology platform with an IWMS offers the potential to boost ROby monetizing the combination of the technical building setup and the functional business context.

(IS-2021-16) Wireless Lighting Control – Simple to design, Cost-Effective, and Flexible

This report from Lutron published in July 2020 discusses the merits of wireless lighting control, which removes the need for communication wires and allows for fewer power wires and less conduit. Wireless lighting control makes it possible for cost and complexity to be reduced, while design/ installation flexibility and scalability are enhanced. Another significant feature of wireless systems is that the keypads, sensors, and remotes are often battery powered, further eliminating cost and complexity while expanding the opportunity for installing flexible control wherever it is needed in the space.

(IS-2021-15) LoRa Devices: Smart Home Business Case Overview

This August 2020 report from Semtech discusses the merits of LoRa devices and the LoRaWAN protocol to address the connectivity challenges of traditional platforms. LoRaWAN-based networking is a platform of choice for low-power, wide areas networking (LPWAN)-based IoT solutions, the report notes. Applications and case studies discussed in the report include water leak detection, senior care in the home, precision gardening and antique & art preservation.

(IS-2021-14) Transition Faster Together

Subtitled "Setting the scene: Solutions, strategies and policies for a clean energy future," this report was authored by Ditlev Engel from DNV GL - Energy and published in September 2020. It outlines the need to transition the energy economy and deliver on sustainable development goals. Ten measures to achieve this transition are discussed, including solar, EV charging, green hydrogen, rail expansion and carbon capture. The technology solutions proposed cut across three vital areas: renewables, power grids and energy use and efficiency.

(IS-2021-13) Guide for Sustainable Projects

This report was prepared by The American Institute of Architects and published in September 2020. It provides general background information on topics of interest to those pursing sustainable projects, and explanation of new provisions in AIA's recommended approach to sustainable projects. Four main topics include: general background about sustainable projects; Sustainable Projects Exhibit; sustainable considerations in AIA Agreements; and a discussion of an example of a Sustainability Plan. AIA's resources aim to "advance, disseminate and advocate" for design practices that integrate built and natural systems and enhance both the quality and environmental performance of the built environment.

(IS-2021-12) COVID-19 Impact - Offices Will Find a New Purpose

In July 2020, JLL reported on a global survey of 3,000 employees from diverse industries focusing on the importance of physical office space in ensuring organizational success in the post-pandemic world. Tackling this challenge demands a rethinking the office as a social hub, a shift from merely "surviving" to "thriving" in remote-work arrangements, and ensuring that the workplace functions "elastically" but still as a single community. Key findings outlined in this report include: the need for hybrid/elastic models; "tech empowerment" as a significant booster of productivity; the home work environment's crucial role in productivity; offices as "anchors" to corporate culture; and the new imperatives of flexibility and empowerment. This report will be of interest to office planners, building innovators and building occupants.

(IS-2021-11) Characterization and Analysis of the Energy-Reporting Accuracy of Connected Devices

The authors of this June 2020 report, from the Pacific Northwest National Laboratory for the U.S. Department of Energy, Energy Efficiency and Renewable Energy explore the energy-reporting accuracy of market-available connected electrical outlets. The results of the study and subsequent related work may be relevant to stakeholders in industry-specification and standards- development organizations. The research methods employed could inform test- and measurement procedures and performance classifications for connected outlets, lighting products, and other building systems capable of reporting their own energy consumption.

(IS-2021-10) Cable Companies and Municipalities: Natural Smart Community Partners

This report from Connected Communities LLC was published in 2020. It makes the case that cable companies are uniquely well-positioned to help a growing ecosystem of smart community partners advance their objectives. They possess both dense network infrastructure across large service areas, and valuable experience deploying and managing wired and wireless networks designed to solve complex connectivity challenges. The analysis and case studies highlight that rather than approach partners with a one-size fits all approach to smart community deployments, cable providers are working with organizations to co-create approaches that best achieve common goals.

(IS-2021-9) Guide to Electric Vehicle Charging in Multi-Residential Buildings

This 2020 report from Pollution Probe and The Delphi Group sets out to demystify the process of installing electric vehicle (EV) charging infrastructure in multi-unit residential buildings. Looking at both new and existing buildings, the research explores key technical considerations, potential challenges and opportunities, stakeholder roles and responsibilities, and regulatory instruments. The report should interest building owners and managers, policy makers, as well as condominium boards and others involved in the planning and installation of EV charging stations.

(IS-2021-8) Industry Perspective: Understanding Barriers to Smart Grid Adoption This September 2020 report from the MaRS Discovery District, *Industry Perspective:*

Understanding Barriers to Smart Grid Adoption, was prepared with support from Natural Resources Canada. The research used stakeholder interviews and secondary research to highlight key challenges and barriers facing the smart grid sector. The authors describe changes that will be needed in the areas of policy and regulation; business models and market structure, energy sector culture/customer awareness; and technology and digitization. The report is intended for market players and policy makers focused on energy efficiency and smart grid development.

(IS-2021-7) The State of IoT and Smart Buildings

This report from April 2020 was led by Smart Energy Decisions and sponsored by Siemens. It provides a baseline of where the industry is today and what the current trends in building energy management and control could bring. Respondents were surveyed about current IoT deployments, key drivers, barriers encountered, and rewards realized—both intentional and unintentional—with connected facilities. The gap between legacy systems and new digital connectivity, and lack of internal knowledge to achieve corporate buy-in, are cited as prohibiting factors.

(IS-2021-6) The Case for Deep Retrofits

The size, scale, and condition of multi-residential buildings should make them a key target segment for scaling up deep retrofits, notes this August 2020 report from the Atmospheric Fund. The authors write that current business case evaluation for energy retrofits places an overwhelming emphasis on simple payback based on energy cost savings, at the expense of

more robust Life Cycle Cost Analysis (LCCA). It is argued that incorporating financial metrics like Net Present Value and Internal Rate of Return would improve the accuracy of business case evaluation.

(IS-2021-5) National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy

This report from the National Energy Screening Project, released in August 2020, is intended to help guide the development of "cost-effectiveness tests" for more robust benefit-cost analyses (BCAs) of distributed energy resources (DERs). It sets out a systematic approach for gauging investment cost-effectiveness by consistently and comprehensively comparing the benefits and costs of individual or multiple types of DERs against each other and with alternative energy resources. The research will be of interest to those involved in energy policy, smart grid development, and protocols and standards.

(IS-2021-4) Future Energy: The Technologies Shaping the Energy Transition

This August 2020 report by Wood Mackenzie Limited highlights technologies needed to achieve a decarbonised future. Challenges and opportunities linked to *green hydrogen*, and what might need to change to make this technology a leading decarbonization strategy are discussed. The research goes on to explore the growing potential of *carbon capture and storage* in decarbonization strategies. In reference to *zero-carbon heating*, the report asks if could heat pumps could soon displace gas in homes. Finally, the report discusses *offshore wind* as a zero-carbon technology that continues to attract major capital.

(IS-2021-3) No Capital Needed: Your Guide to No-Cost Energy Projects

This report by Enel X published Sept 2020 notes that as the grid adapts to new realities, utilities and electric grid operators are making changes to their rate structures and market rules. They are imposing new and increasingly complex charges on their customers' bills, and offering financial compensation for large energy consumers that help alleviate some of their most complex challenges. For commercial- and industrial (C & I) energy consumers, this creates incentives to invest in distributed energy resources (DERs) that can manage facility exposure to the high costs of consuming energy from the grid. New opportunities could emerge for flexible financing options to help C&I energy consumers integrate and upgrade DERs to capture that value without taking on the risk of a capital investment.

(IS-2021-2) Three Essential Elements of Next-Generation Building Management Systems

This July 2020 white paper by Schneider Electric notes that building stakeholders face increasing pressure to save more energy, reduce costs, and maintain availability—all while enhancing occupant experience and well-being. "Achieving these varying objectives is best solved by a new type of building management systems (BMS) that goes well beyond HVAC controls." The authors argue that these modern next-generation BMSs benefit stakeholders by being a more open integration platform that uses IoT, cloud computing, data analytics, and artificial intelligence technologies to get more out of available resources and connected systems. The paper will be of

interest to building owners, facility managers, and system integrators.

(IS-2021-1) Smart Buildings: A Foundation for Safe, Healthy and Resilient Cities

This blueprint by the Smart Buildings Super Cluster released in August 2020 aims to inform smart city stakeholders about the design of smart buildings within the broader framework of the smart city. The discussion centers on the smart building, exploring how smart buildings can be deployed to advance diverse smart city objectives. These include accelerating the deployment of smart city, Internet of Things (IoT) enabled, connected infrastructure; infusing robust and adaptive features into the smart city infrastructure through integrated smart building designs; and providing a roadmap to sustainable advantage and ROI for communities that adopt this approach. The report will be of interest to policy makers, municipalities, developers, integrators, property owners, and managers.