SPACEWELL
A NEMETSCHEK COMPANY

The Energy Challenge in Commercial Real Estate

How Analytics and IoT Help Drive the Sustainability Transformation

WHITE PAPER

CONTENTS

GLOSSARY

Some of the terms you'll read in this paper explained:

API

An **application programming interface** (API) is a way for two or more computer programs to communicate with each other without any user intervention.

AI

Artificial Intelligence is the ability of a machine to display human-like capabilities such as reasoning, decision-making, and learning. The availability of enormous quantities of data and new algorithms have led to major AI breakthroughs in recent years.

BMS

Building management systems are computer-based systems used to monitor and control building services, such as lighting, HVAC, security & alarm systems, etc. that are installed in buildings to make them comfortable, functional, efficient and safe.

Carbon neutral and Net zero

Both carbon neutral and net zero refer to different actions that are essential to combat climate change.

Carbon neutral can cover a defined part of business operations and typically accounts for CO2 emissions, but not other greenhouse gases.

Net zero on the other hand means that a company reduces all greenhouse gas emissions across its whole supply chain.

CRE

CRE can refer to:

Commercial Real Estate: property that is mostly leased and used exclusively for business-related purposes or to provide a workspace

Corporate Real Estate: the real property that a company owns or holds for the purposes of housing its operations. Multiple types of properties and facilities – including offices, warehouses, data centers, and retail spaces – can be part of a corporate real estate portfolio.

EMS

Energy management systems are automation systems that collect and analyze energy measurement data for rationally managing energy in a building and achieving energy savings.

Facility management

Facility Management (or Facilities Management) is a professional management discipline focused on ensuring the functionality, comfort, safety and efficiency of the built environment. It integrates people, place and process with the purpose of improving the quality of life of building occupants and the productivity of the core business.

Greenhouse gases

Gases in Earth's atmosphere that trap heat. They let sunlight pass through the atmosphere, but prevent the heat that the sunlight brings from leaving the atmosphere. The main greenhouse gases are: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

NZEB

Nearly zero-energy buildings are buildings with a very high energy performance, whose energy consumption is almost zero.

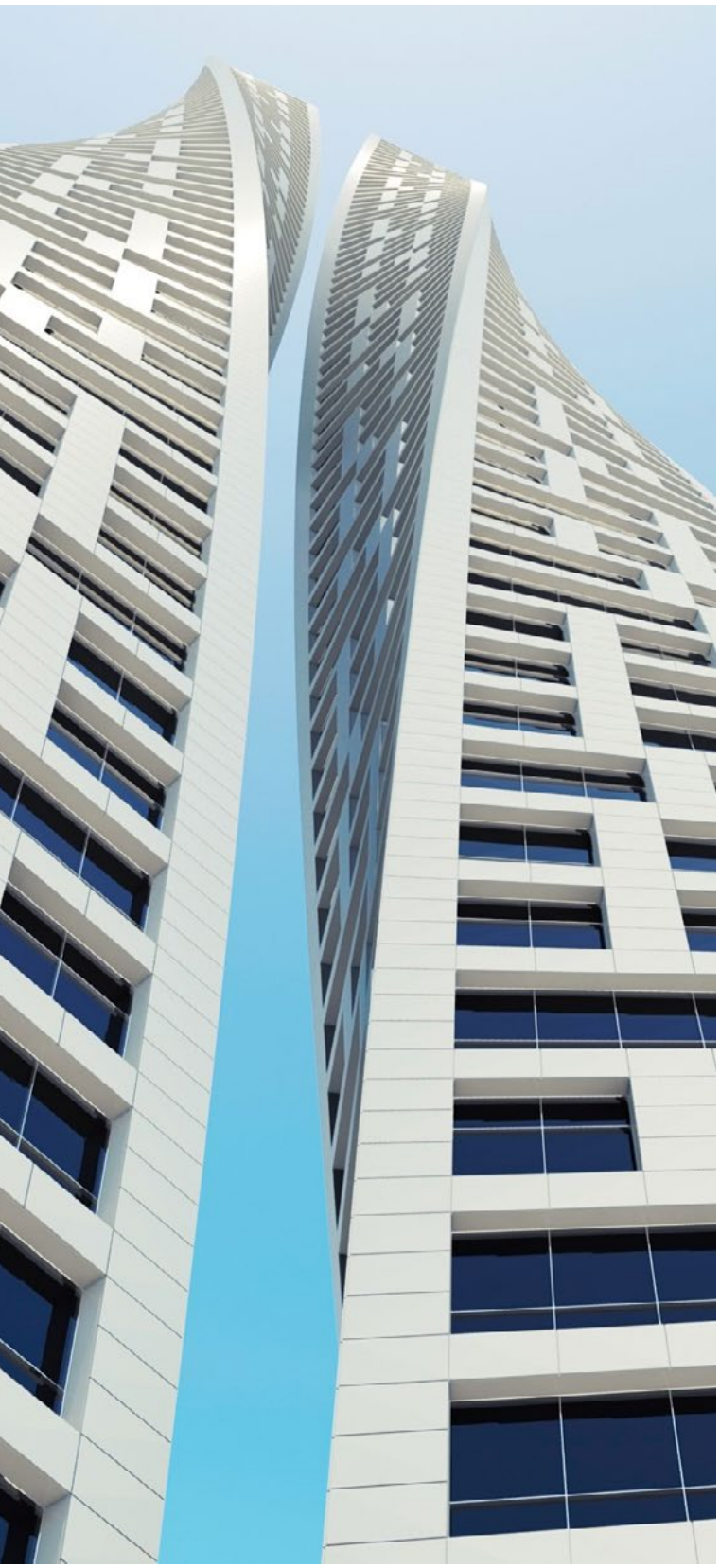
Smart meter

Digital device that measures energy consumption and enables energy usage tracking and remote access to the data.

Utilities

Companies that produce, transport and/or sell energy.

UNDERSTANDING THE QUICKLY CHANGING CONTEXT OF CRE



Before zooming in on the energy management challenges in CRE, we should look at some megatrends and recent evolutions that are transforming the world of commercial real estate.

It's important to understand this context in order to fully grasp the key role energy management and analytics are playing in CRE transformation.

Ulrike Beringer, Director Corporate Communications & Sustainability, Nemetschek Group.

"Climate change is the defining issue of our time. The built environment, as we know, is one of the largest contributors to carbon emissions that cause global warming. At Nemetschek Group, we believe in reducing this impact through our software and digital technologies that make the entire building lifecycle more efficient and sustainable. Over 50 years of driving digitalization in the AEC/O industry have earned us a spot in the '50 Sustainability & Climate Leaders'. For Nemetschek Group, digitalization is the answer to fight climate change and we are motivated to accelerate the decarbonization of real estate through eliminating inefficiencies and waste."

DISRUPTION IN COMMERCIAL REAL ESTATE

Commercial real estate used to be an 'easy' investment, with long-term leases and stable, predictable ROI. But the office real estate landscape has profoundly changed. First with the emergence of coworking spaces, shorter-term leases and pay-as-you-go flexibility. Then the market was shaken up by the COVID-19 pandemic and the massive remote work experiment that it forced almost overnight.

As a result of the pandemic WFH experience, most knowledge workers now prefer a hybrid work model, with part in-office and part remote work. And they have updated their expectations around the role of the office itself, too, with health and wellbeing moving up their list of priorities. All this had led to real estate becoming less about property assets, and more about people. In other words, the focus has shifted to the most valuable asset that companies have: the workers that use the buildings and whose productivity businesses seek to support. Because ultimately office buildings exist to serve the needs of employees – and these needs are changing fast.

For building owners and operators, this means they are facing increasing pressure to revitalize outdated offices in order to meet tenant demands. To entice workers back to the office commercial buildings need to offer consumer-grade amenities and spaces for connection. While at the same time keeping costs under control and complying with more stringent energy performance and sustainability requirements.

In addition to new flexible business models, space-as-a-service, and 'consumerization', there are other factors affecting corporate real estate. Consider these global trends:

Digital transformation

Compared to other industries such as financial services, real estate has been relatively late to leverage the potential of digitization. The first breakthrough was the use of workflow-based software for building and facility management. Such software still relied mostly on manual data entry, even if automated processes can push information to all relevant internal and external stakeholders. The next stage in the real estate digital transformation journey is smart building technology, which elevates the entire model with automated data collection using IoT devices, cloud, and big data analytics. By monitoring space occupancy, utilization, ambient conditions, and other aspects of buildings at a truly granular level, smart building technologies drive new insights into the way assets are being used. These platforms can guide management with dashboards while also using real-time data to improve the occupant experience, the delivery of services, and energy management.

Volatility

Business cycles are more difficult to predict than they used to be, and companies change course faster and more often. This makes it harder for CREs to always be ready to provide space at the right time, in the right locations, and for the right uses – whether their company expands, merges or consolidates. On top of this comes the adoption by many companies of a hybrid work model, which only adds to the uncertainties faced by real estate teams. On the plus side, IoT-related technologies and intelligent workplace systems can provide actionable data that informs agile planning and increases resilience, as well as valuable information to control another source of volatility, directly affecting the P&L of the business: the energy cost.

Energy supply and price surges

Since the second half of 2021, energy prices have skyrocketed in the EU and worldwide, rising to their highest levels in decades, with an unprecedented increase in gas prices on the global markets of over 170% in 2021. These increases have been caused by a combination of factors, including post-COVID-19 economic recovery and the relaxation of travel restrictions, a long, cold winter in 2021, followed by a hot summer with a greater use of cooling devices. Another important factor is Russia's military aggression in Ukraine and the use of fossil energy as a geo-strategic weapon by the Russian Federation, in response to economic sanctions. This has further disrupted energy markets and added pressure on prices, in particular of gas and oil, while also generating concerns over energy dependencies and the security of energy supply in the EU. Occupiers are increasingly wary of leasing energy-inefficient buildings as they pay the energy bills, which in many cases have more than doubled in the case of gas or electricity.

Climate change

Climate change mitigation depends on global commitments to net zero. It is now at a critical point. The world must take action fast so as not to trigger tipping points in the climate system leading to irreversible shifts. Without immediate and deep reductions in greenhouse gas emissions, limiting global warming to close to 1.5°C will be beyond reach, the Intergovernmental Panel on Climate Change (IPCC) warned. Buildings are typically large contributors to global warming: building operations are responsible for 27% of total CO_2 emissions annually. Considering this impact, decarbonization of real estate assets and portfolios must rapidly move up the agenda. With increasingly strict regulation of GHG emissions, addressing reporting obligations and compliance will become more strategic for CRE in the years to come.

GLOBAL ACTION ON CLIMATE CHANGE

With human-induced global warming currently reaching 1.1°C above pre-industrial levels, the world is already paying the price in the form of more violent storms, devastating floods, extreme droughts, scorching heatwaves, and wildfires raging out of control. The speed at which this is happening also surprises experts, as it was not predicted by even the more pessimistic early climate models.

Net Zero

At the Cop26 climate meeting in Glasgow last year, it was agreed that "every effort should be made to try to limit global warming to 1.5°C." To achieve this goal, it was calculated that **global carbon emissions must be reduced by 45% by 2030** (compared to 2010 levels) and that the **transition to net-zero emissions must be complete by 2050**.

Why 1.5°C?

Anything above 1.5°C will lead to a world plagued by the dramatic consequences of extreme weather, reduced crop yields, desertification, melting polar ice caps and surging sea levels. An increase of 2°C and more will take a dramatic toll on the planet and make certain areas of the world uninhabitable.

Is there a global effort to reach net zero?

A growing coalition of countries, cities, businesses and other institutions are pledging to get to net-zero emissions. More than 70 countries, including the top 3 biggest polluters – China, the United States, and the European Union – have set a net-zero target, covering about 76% of global emissions.

Is progress being made?

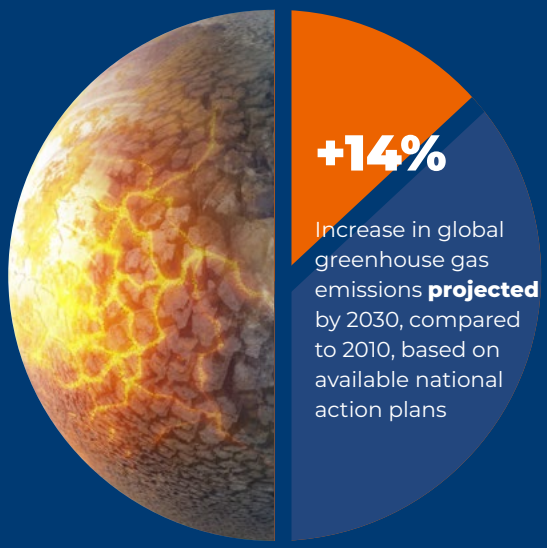
Before the **2015 Paris Climate Agreement** – now signed by 194 countries and the EU – the world was on course to heat up almost 4°C. Since then we have started to bend the emissions curve, thanks in part to the rapid growth in renewable energy – with wind and solar power now the cheapest new source of energy in many markets. Current policies put us on track for roughly 3°C of warming by the end of the century, an outcome still widely seen as disastrous. So yes, we've made a step forward, but current achievements are still far behind Net Zero milestones.

Are we on track to reach net zero by 2050?

Commitments made by governments to date still fall far short of what is really needed. Instead of a 45% drop in global greenhouse gas emissions by 2030, current national climate plans would lead to an ***increase*** of almost 14%. According to the most hopeful estimates of emission cut pledges made at **Cop26 in Glasgow** in 2022, the world is on a course to heat up by between 2.4°C and 3°C by the end of the century. Moreover, countries have now begun to turn back to using carbon-heavy coal – the world's dirtiest fossil fuel – because of energy supply uncertainty and soaring gas prices following Russia's invasion of Ukraine.

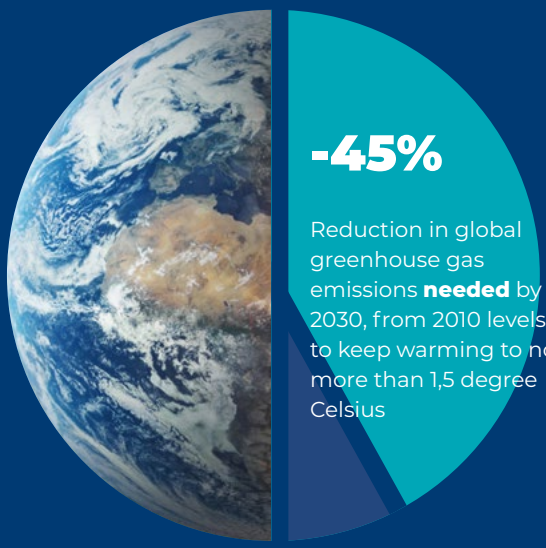
Current national plans fall short of what is required

Source: www.un.org



+14%

Increase in global greenhouse gas emissions **projected** by 2030, compared to 2010, based on available national action plans



-45%

Reduction in global greenhouse gas emissions **needed** by 2030, from 2010 levels, to keep warming to no more than 1,5 degree Celsius

On the positive side, demand for clean energy sources has never been higher, and the global energy crisis is also acting as an accelerant for the clean energy transition. Despite supply chain constraints, global investment in renewable energy spiked 11% in the first half of 2022 relative to the same period in 2021, rising to $226 billion and setting a new record according to data from BloombergNEF. The bulk of that spending went to finance solar and wind projects, with investment in solar up 33% and financing for wind projects jumping 16%. China, the United States, and Japan are among the biggest investors, which is significant because they are also among the largest emitters of greenhouse gases.

THE ENERGY TRANSITION: AN ECONOMIC IMPERATIVE

The energy and carbon transition is a daunting task.

Just implementing what has been committed so far will require funding in an order of magnitude of between 120 and 160 trillion dollar between now and 2050, according to Axel Weber, chairman of Swiss banking giant UBS.

However, climate inaction is a far costlier choice than net zero transition. A low-carbon future is not only a societal imperative but also an economic one. A 2022 report from the Deloitte Center for Sustainable Progress (DCSP) highlights the steep cost of inaction: it indicates that – if left unchecked – climate change could cost the global economy US$178 trillion over the next 50 years, or a 7.6% cut to global gross domestic product (GDP) in the year 2070 alone. With a systemic net-zero transition on the other hand, the global economy could see new gains of US$43 trillion in 2070 (a boost to global GDP of 3.8%).

EUROPEAN GREEN DEAL

Climate action is central to the European Green Deal, a package of policy initiatives, first presented in December 2019. Measures range from reducing greenhouse gas emissions, to investing in cutting-edge research and innovation, to preserving Europe's natural environment.

The first climate action initiatives under the Green Deal include:

- European **Climate Law** to enshrine the 2050 climate-neutrality objective into EU law
- European **Climate Pact** to engage citizens and all parts of society in climate action
- **2030 Climate Target Plan** to further **reduce net greenhouse gas emissions by at least 55% by 2030**. This new enhanced target – a higher commitment than its previous figure of 40% below 1990 levels – represents a milestone for Europe's net zero transition as it shapes the EU's Nationally Determined Contribution (NDC) and those of its member states.
- New **EU Strategy on Climate Adaptation** to make Europe a climate-resilient society by 2050, fully adapted to the unavoidable impacts of climate change

Furthermore, there's the EU Emissions Trading System (EU ETS), a cornerstone of the EU's policy to reduce greenhouse gas emissions by **putting a price on carbon**. It is the world's first major carbon market and remains the biggest one.

WHAT DOES THE ENERGY TRANSITION MEAN FOR CRE

Energy transition investments have so far been mainly focused on renewable energy, energy storage, and electrified transport.

Real estate, which is a fragmented world, has been a bit on the periphery of the energy turnaround. However, given the long lifecycle of buildings and their significant contribution to global warming, the real estate sector has a critical role to play. This calls for better efficiency in the portfolio operation, energy management, but also funding for retrofits of older buildings, and grid-interactive buildings that communicate with the grid to save money and carbon.

The Return on Sustainability

With increasing ESG and regulatory pressures, "green buildings" are in higher demand and yield sales and rent premiums. Green certifications are also valuable to companies concerned about their environmental impact and reputation, and employee health and well-being beyond the directly linked efficiency savings and cost reduction. JLL's "Decarbonizing the Built Environment" report found that 63% of leading investors strongly agree that green strategies can drive higher occupancy, higher rents, higher tenant retention and overall higher value.

A meta-analysis of green premium studies in a real estate context by Dalton and Fuerst showed green certifications yielded a rent premium of 6.0% and a sales premium of 7.6%.

Digital Twins for Retrofits

As the U.S. Department of Energy states: "Renovation, retrofit, and refurbishment of existing buildings represent an opportunity to upgrade the energy performance of commercial building assets for their ongoing life." Digital twin technology may become a game changer for retrofitting buildings and helping with sustainability goals. Digital twins are virtual replicas of physical assets, that integrate (real-time) data from various sources so as to understand real-world conditions. They can drive building refurbishment plans by

- Identifying what upgrades a building requires
- Reducing inefficiencies and waste
- Enabling simulations that gauge the impact of improvement projects and help calculate ROI.

Virtual Energy Audits

Energy audits to increase energy efficiency can become a tough process when handling a big portfolio of buildings or installations. Often non-monitored sites represent the majority of a CRE portfolio. In the absence of comprehensive real-time data, a virtual energy audit allows energy managers to benchmark their sites thanks to a large database of buildings worldwide. They know at a glance which sites have a greater ROI, and which energy saving measures are most effective for each location.

> Faced with an energy crisis and the climate emergency, building owners, investors and operators have a renewed focus on energy management. This is not only because of the direct impact on operational costs, but also because of the pressure on businesses to be responsible citizens, and because it increases real estate asset value. Thanks to digitization, organizations can now make more effective, data-driven decisions around energy efficiencies, beginning with a virtual energy audit, benchmarking sites to identify cost saving opportunities, prioritize energy-saving measures, and avoid energy wastage.

Miguel Cruz Zambrano,
CSO of Dexma Energy
Intelligence by Spacewell

THE IMPACT OF THE BUILT ENVIRONMENT ON GLOBAL WARMING

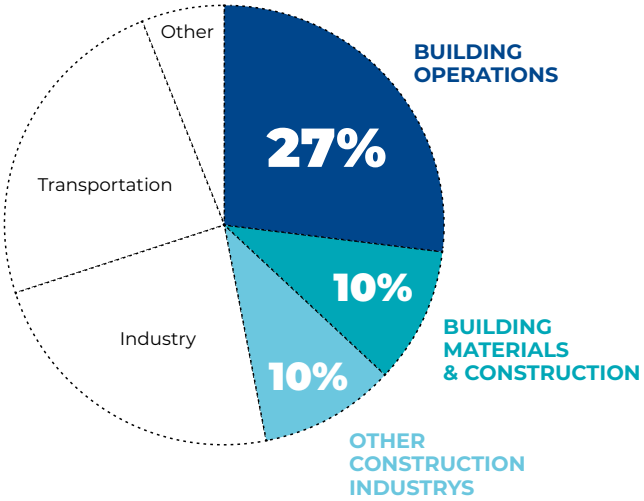
According to Architecture 2030 – a non-profit, non-partisan and independent organization established in 2002 in response to the ongoing climate emergency – the built environment is responsible for nearly 50% of annual global CO_2 emissions.

Building operations account for 27%, while building materials (such as cement and steel) and construction generate an additional 20%, totalling 47% of global annual CO_2 emissions.

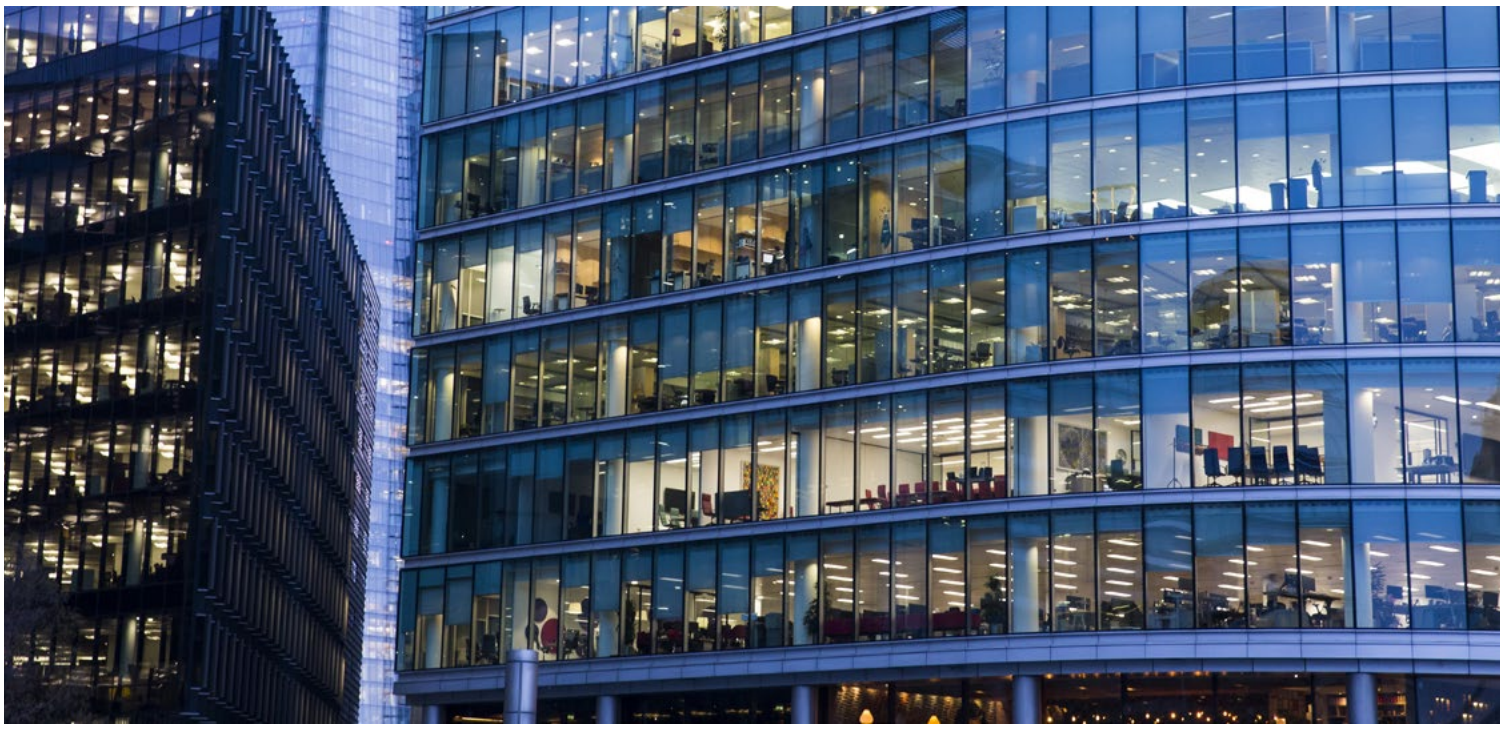
Around 2/3 of the buildings that exist today, will still be in use in 2040. If this existing building stock is not decarbonized, it will still be emitting CO_2 in 2040, which would make it impossible to achieve the Paris Agreement's target of a temperature rise limited to 1.5 °C. Achieving NZE from existing buildings will require increasing energy efficiency, eliminating the use of on-site fossil fuels and production or procurement of 100% renewable energy.

Even if we aim for max. 2 °C of global warming, the building sector must operate at net zero carbon by 2050. To meet this goal, all new construction and at least 20% of existing buildings would need to be zero carbon by 2030. That means that the buildings' sector energy intensity needs to drop nearly five times more quickly over the next ten years than it did in the past five to be in line with the Net Zero Emissions by 2050 Scenario. And that the energy consumed per square meter in 2030 must be 45% less than in 2020. The world is currently not on track to achieve this.

Annual Global CO_2 Emissions



Sources : Global ABC Status Report 2021, EIA



> Winston Churchill famously said: 'Never let a good crisis go to waste.' As the energy crisis sets in, it creates an incredible opportunity for real estate owners, investors, managers, tenants, and users, to accelerate and disrupt the future. We can focus on low hanging fruit by better managing occupancy, natural light, LED lighting, and controlling CO2. But now is the time to think about significant impact. In this crisis, larger 'smart' investments can make or break the value case for our real estate (i.e.: demand response, national grid alignment, battery and solar systems, and sophisticated energy management systems) could literally and figuratively keep us above water. We need to think holistically, start with the basics, start small if needed, but we have to do something, so let's do something big!

Nicholas White – Founder Smart Building Collective

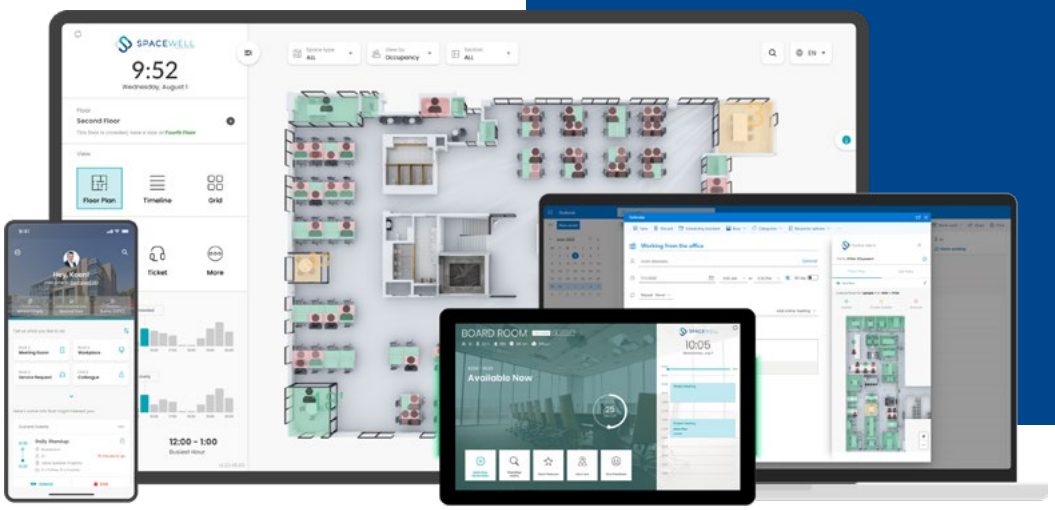
Space Efficiency and Energy Efficiency Go Hand in Hand

It's well known that many organizations waste as much as half their office space. And that was the situation before Covid. With the increased popularity of remote and hybrid work, even more office desks are sitting empty now. In the United States, utilization is currently at about 22-25% utilization on any given month. This low occupancy rate accelerates the trend towards shared seating arrangements, supported by employee-facing workplace apps. Gartner says workplaces with shared seating will be the new normal after COVID-19 and predicts that by 2023, the percentage of employees in shared seating will double to 40%. (source: Gartner 2022 IWMS Market Guide). Shared desks save space and enable companies to reduce their office footprint.

Space Monitoring

In recent years, tracking office utilization using accurate data from IoT sensors has become more common. It enables objective insight into actual occupancy and utilization of office space, and supports workplace teams to establish the right ratio of employees to desks. By focusing on data trends, companies can identify which spaces are being under- or over-provided, optimize the office configuration and align supply and demand over time. Using tools like the Opportunity Simulator, they can right-size the office footprint and repurpose or dispose of excess office space.

A **smaller office footprint also reduces the need for energy** for heating, cooling and lighting. It reduces energy consumption, thereby contributing to achieving climate goals. Because ultimately, the greenest building is the one you don't need to build.



IMPACT OF GLOBAL WARMING ON REAL ESTATE

Real estate is not only an important contributor to global warming, it will in turn also be impacted by it.

As global warming progresses, there will be a **growing risk of damage to buildings** caused by extreme weather, wildfires, flooding and rising sea levels, which threaten cities in coastal areas, especially in Asia, but also in other places*.

Extreme weather events are a concern for everyone managing buildings in areas where these frequently occur. Hurricanes, tornadoes, torrential wet seasons, and so on, will affect the operation of the building. As the probability of severe weather increases, buildings should also be conceived to be more resistant to it. In fact, many analysts are saying that by 2050 buildings may be our first defence against extreme weather events.

Climate change risks include direct costs of repair of water, wind or fire damage, but also **rising insurance costs** and **business disruption** due to shutdowns of buildings and the breakdown of essential infrastructure and supply chains. In some cases it may even lead to total loss of property.

Furthermore, there are also indirect impacts and risks related to the energy transition. **Carbon costs will gradually increase** and this will impact companies with carbon-intensive buildings. Their real estate valuations will drop if they fail to meet carbon-reduction targets and they may end up with stranded assets.

* The 2022 Sea Level Rise Technical Report, released by the National Oceanic and Atmospheric Administration's National Ocean Service, finds that "the sea level along the contiguous U.S. coastline is anticipated to rise 10 to 12 inches on average between 2020 and 2050, marking the same level of increase that occurred over the 100-year period between 1920 and 2020."

DECARBONIZING REAL ESTATE

As is the case for other aspects of climate change, there is a real urgency to reduce greenhouse gas emissions during the lifecycle of buildings. Efforts to decarbonize real estate must focus on reducing two main sources of carbon: embodied carbon and operational carbon.

Embodied carbon

Embodied carbon refers to the carbon dioxide (CO_2) emitted in constructing and maintaining a building throughout its lifecycle. It includes any CO_2 emissions during the manufacturing of building materials (extraction, transport, manufacturing), their transport to the construction site, and the construction processes. It also refers to the CO_2 produced maintaining the building and eventually demolishing it and recycling the waste.

The real estate sector is a major consumer of cement and steel, whose production is very energy-intensive and accounts for about 10% of global carbon emissions. Thanks to advances in reducing operational carbon, data from the World Green Building Council indicates that embodied carbon is becoming a larger portion of a building's overall carbon footprint. With the world's building stock expected to double by 2060, decarbonizing the manufacturing of building materials must become a key focus in order to meet net zero targets. Modular construction techniques, leveraging off-site assembly, are showing promise in terms of reducing carbon emissions, but significant further investment is needed to scale these emerging practices.

Operational carbon

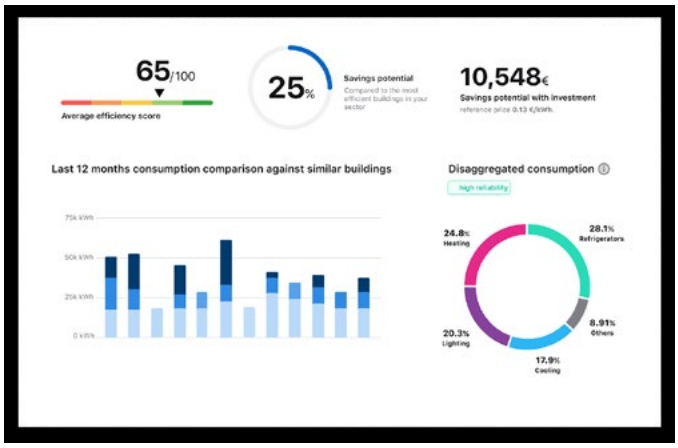
Operational carbon is distinct from embodied carbon. It refers to the carbon that is emitted in connection with operating a building – energy used for heating and cooling, lighting, running appliances, and other uses of electricity. It can be reduced through improved energy efficiency, including the use of renewable energy, insulation to limit heat losses and lower energy demand, preventive maintenance and tuning of equipment such as HVAC to run as efficiently as possible, the use of energy-efficient glazing, shading, LED lighting and daylighting, and behavioral changes.

Electrification of company fleets also contributes to reducing operational carbon, as electric vehicles emit fewer greenhouse gases than gasoline or diesel cars. And this holds up even when you take into account their production and the electricity generation to keep them running. Corporates pursuing ESG goals are currently pushing lease firms to convert to EVs faster than anticipated. Furthermore, with businesses typically replacing their fleet vehicles every 4 years, this also has an impact on the used car market where more affordable electric vehicles will become available for consumers.

Tracking and Monitoring Performance

Furthermore, an essential part of meeting any goal is tracking and monitoring performance. **Energy analytics** enables this by providing performance metrics and verified savings.

Goal setting can be based on a framework such as the Science Based Targets initiative (SBTi) which provides a standardized approach to set net zero targets that are aligned with climate science. Its Net-Zero Standard framework for corporates gives business leaders confidence that their near-term and long-term targets are aligned with what is needed to contribute to a habitable planet, and it provides clarity on business climate action to a wide range of stakeholders.

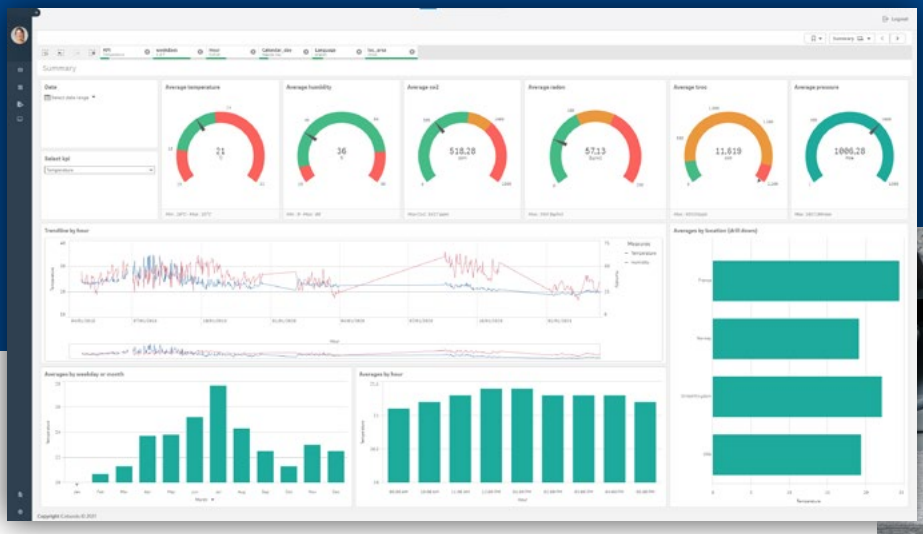


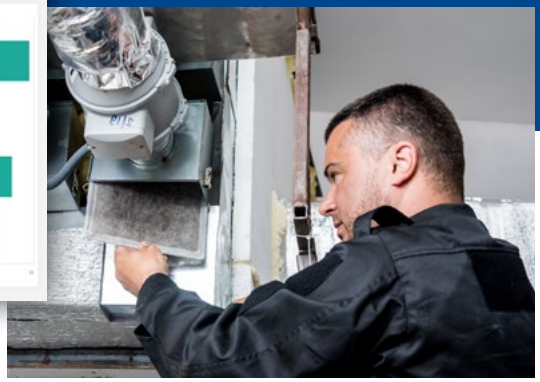
Emissions Reduction and Indoor Environmental Quality: Conflicting Objectives?

Good indoor environmental quality (IEQ) may seem at odds with high energy efficiency. For example, reducing the fresh air intake in winter to save on energy may result in higher levels of CO2 and contaminants, adversely impacting people's wellbeing and productivity.

With the growing use of the IoT, however, building managers now have better data and tools to balance energy efficiency, comfort, and air quality. IoT sensors in buildings can measure in (nearly) real time variables such as temperature, humidity, CO_2, VOCs, particulate matter, radon, etc. which are then shown on floor plans and dashboards. Often in combination with occupancy sensors to improve space efficiency and avoid wasting energy in spaces that are not being used.

Continuous monitoring of the indoor climate by sensors that are **independent of building HVAC systems** can also ensure that equipment is performing as intended. So that buildings use energy efficiently and remain healthy over time.





ENERGY ANALYTICS

Against this background, CREs are looking to integrate cost-effective digital solutions that will reduce their organization's carbon footprint while ensuring a high ROI.

There exist many solutions, but they should be driven by a strategy that makes energy management easier by applying advanced analytical models and AI to energy data to deliver insights across portfolios. Such an intelligent platform eliminates the need for manual work as it automatically imports energy data, crunches the numbers, and delivers specific and actionable insights. While also allowing you to verify the return on your projects.

Energy analytics has three essential steps:

DETECT

Detecting the most effective energy savings quickly and with the lowest possible investment thanks to a virtual energy audit. It allows you to handle the audit of a large portfolio of buildings or installations with just a few clicks, including buildings where no (real-time) monitoring data is available. This is done through benchmarking of sites based on performance data in a large database of buildings worldwide.

ANALYZE

Advanced energy analysis with tools to calculate KPIs or ratios, activity times, estimated consumption and costs at the end of the month or quarter, analysis of renewable sources, etc.

OPTIMIZE

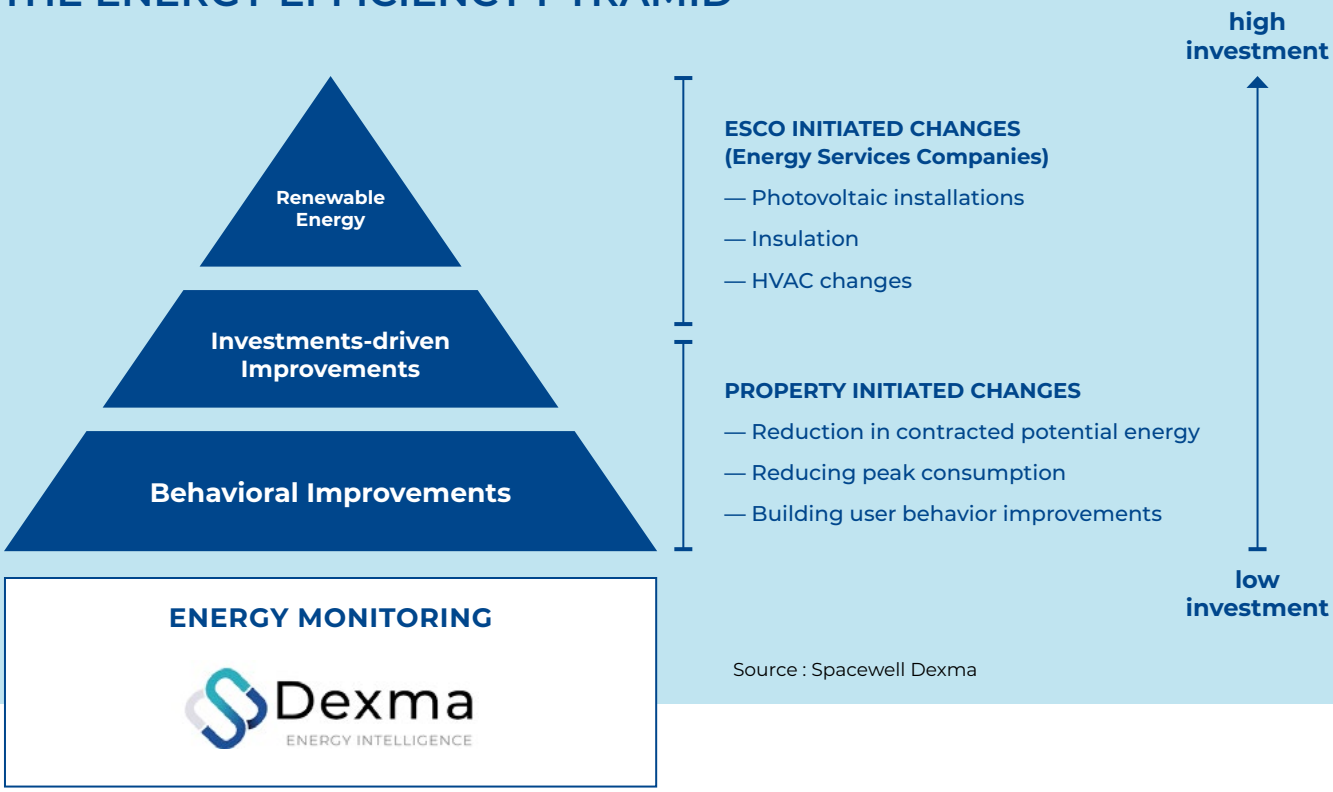
Optimizing this process to ensure anomalies are found automatically and energy-efficiency measures can be implemented across entire building portfolios in a scalable way

These three steps answer important questions when managing the energy of a portfolio of buildings:

- What is the low-hanging fruit – actions that are easy and quick to implement and require very little investment?
- Which initiatives should my energy action plan prioritize?
- Should I first focus on improving insulation, or rather install solar panels?
- Does it make sense to do this in all of my buildings?
- ...

When looking for answers to such questions, it helps to visualize the concept of:

THE ENERGY EFFICIENCY PYRAMID



Source : Spacewell Dexma

Energy projects in the top part of the pyramid will require more investment, but the return on investment will also be higher.

Always bear in mind that for any target set in your particular energy efficiency pyramid, you will need to demonstrate to company management the project's ROI (return on investment).

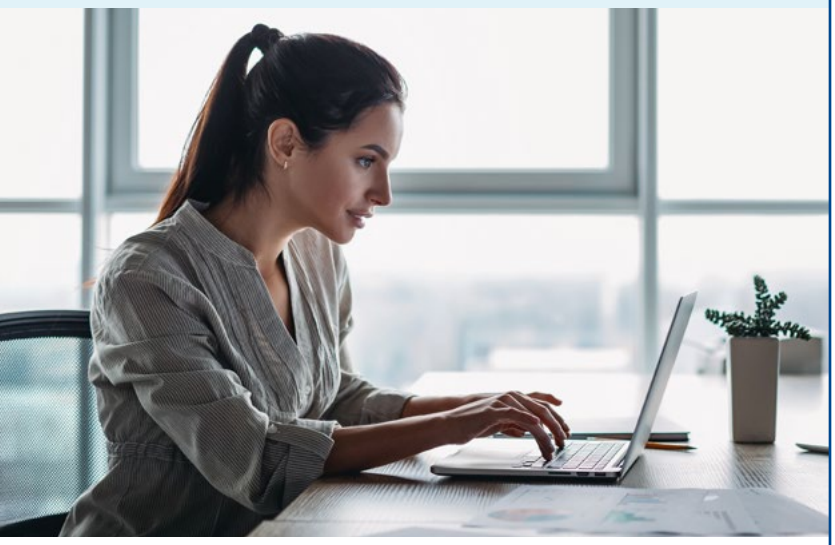
Therefore, it is vital that you have **measurement and verification tools** in your energy management system (EMS) to keep track of the performance of the energy efficiency measures you implemented and the savings they have generated.

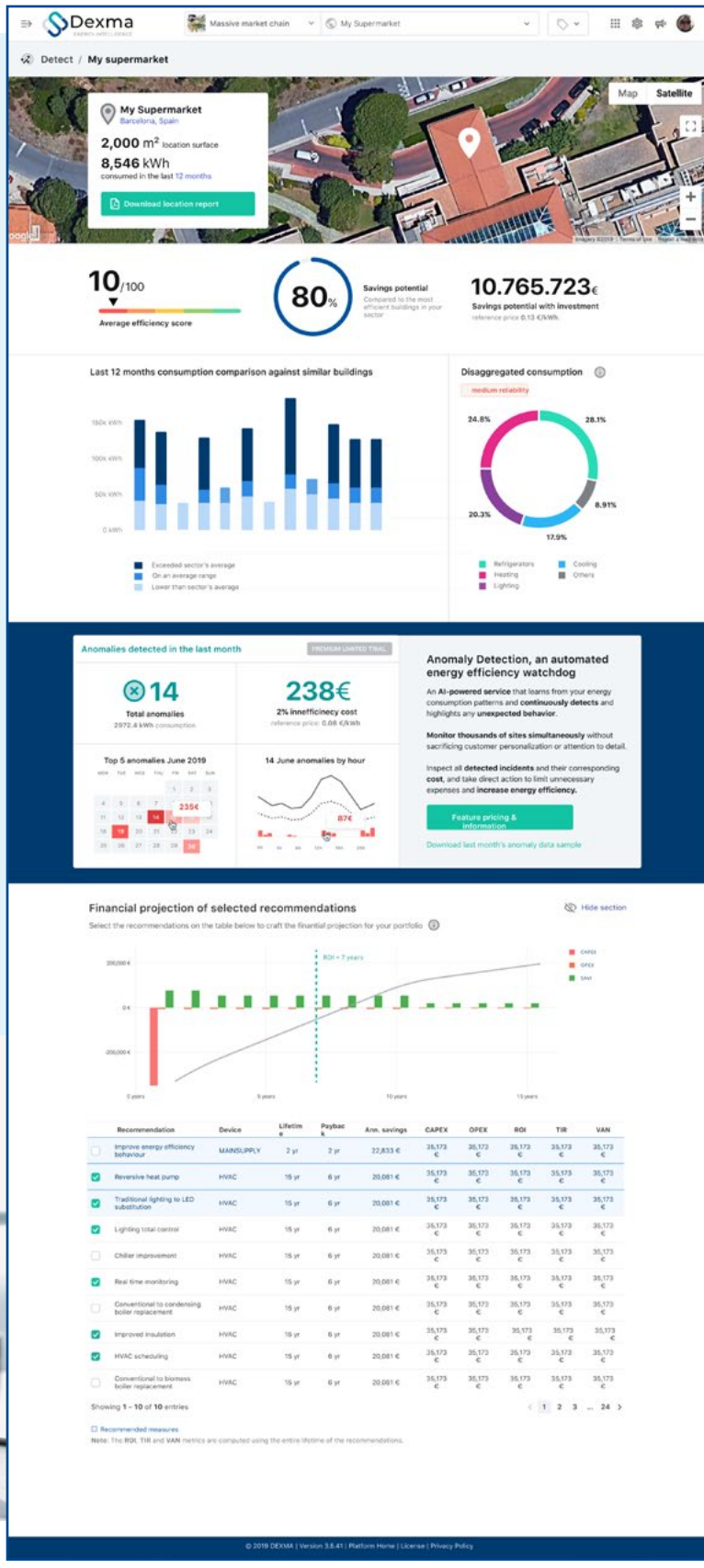
DETECTING POTENTIAL SAVINGS IN BUILDING PORTFOLIOS WITH MINIMUM INVESTMENT

Until recently, the **process for detecting potential energy savings was lengthy and costly**. Energy audits were carried out building by building, to see what was happening and where improvements could be made. A process that could take from a couple of weeks to up to 6 months' time, with costs typically between $0.5 to $1 per square meter analyzed.

With the arrival of **Big Data and digital technologies** in the world of energy management, **there are now faster and cheaper ways to detect potential energy savings in building portfolios.** And to then identify the energy measures to be taken in the different portfolio assets. A virtual energy audit, based on a large database of buildings worldwide, enables CREs to handle the energy audit of any building portfolio in an inobtrusive way, with just a few clicks.

On the face of it, the mountains of available energy and sustainability data from IoT devices, such as submeters, sensors, and other smart assets add complexity to energy management. But with the right big data analytics platforms and **artificial intelligence algorithms**, it actually becomes a lot easier. These tools speed up the detection process, scanning the entire portfolio all at once, **reducing costs by 90%** compared to traditional audits, and **detecting improvements in just 24-48 hours**. The best thing is that for pre-diagnosing savings they can even work with just the monthly data from energy bills.





ADVANCED ENERGY ANALYSIS TOOLS: 10 KEY CAPABILITIES

What EMS capabilities are essential to unlock value for your organization? To illustrate these capabilities, we'll refer to the Dexma Energy Intelligence platform.

1. Analysis of multiple energy sources

To gain reliable insights into your energy performance, your EMS must take into account ALL energy sources that are consumed and produced in your buildings.

If you choose a tool that is limited solely to the analysis of electricity you won't be able to track and minimize consumption and costs of:

- Water
- Natural gas
- Thermal energy
- Fuel oil tanks
- Biomass (this article explains what biomass is and how you can analyze it)

Neither will you be able to include in your analysis the **impact of renewable energy generators**, which is an issue if your building portfolio has solar panels or geothermal technology, for example.

2. Easy Reporting

Energy reporting is key to show your project progress with automated reporting and alerts. You should be able to create automated reports and personalize the way you show energy management outcomes with different stakeholders and at different organizational levels.

An effective system lets you generate aggregated figures as well as single-site ones. Data can come from multiple sources, such as invoices, a BMS, IoT sensors and databases. It enables you to detect worst performing buildings and uncover saving opportunities. Furthermore, you can perform tenant billing and reporting at scale, effortlessly.

Ease of use is important in general: energy management technology should save you time, not make life difficult for you.

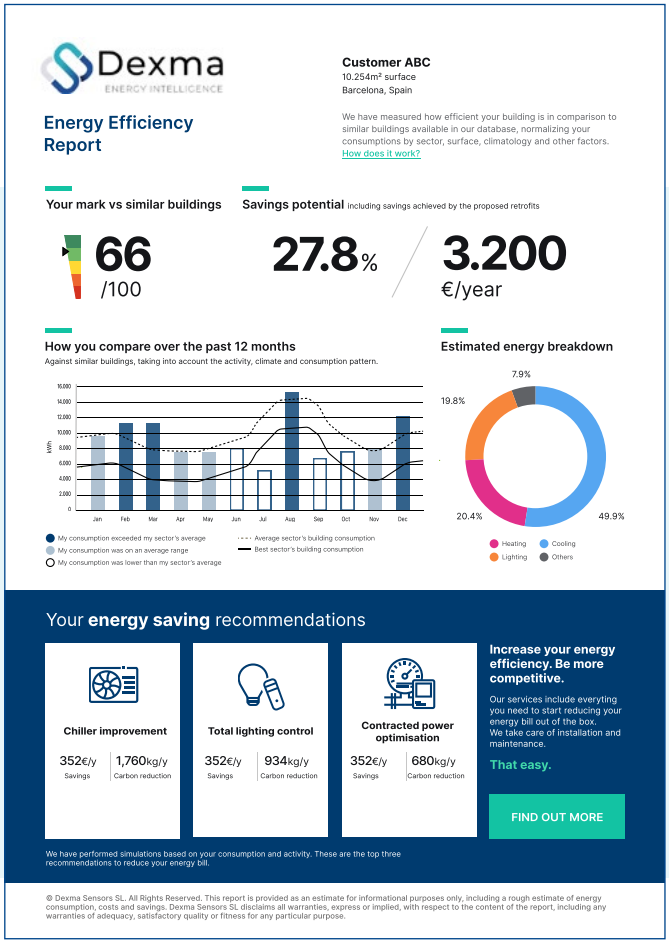
3. Cost Allocation, Benchmarking & Audit

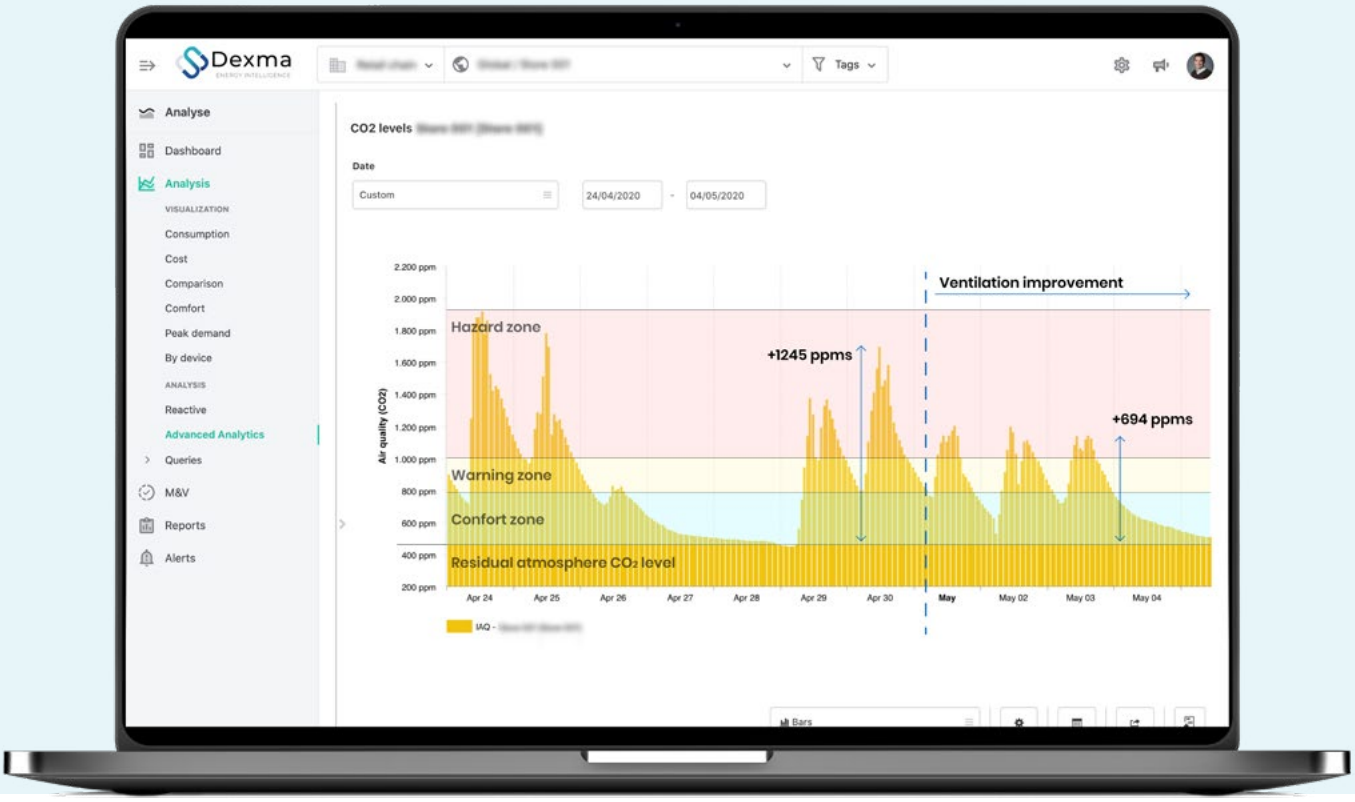
An effective EMS reveals the true cost of energy usage based on time-of-use tariffs, which can be a powerful tool on the path to energy transition and an effective instrument to balance electricity demand.

It also allows you to bill and benchmark tenants, analyze the evolution of energy supply costs month by month, and perform simulations to decide whether changing suppliers or using a different price structure is a good idea.

Benchmarking involves comparing a facility's energy use to similar facilities. The ability to benchmark against any industry standard is important to discover your energy savings potential and assess opportunities for improvement.

Expect an EMS to be able to compare your site's consumption pattern levels, weather and geographic data with similar buildings in its database, providing accurate insights into which measures are most effective for each location. It must also enable CREs with complex portfolios to perform massive energy efficiency virtual audits with one click.





4. Carbon Footprint Calculation

As ESG pressures on the real estate industry increase and the push for more transparency and quantitative disclosures continues, it's important that your energy software enables you to demonstrate compliance.

To achieve your decarbonization goals faster and more efficiently, your energy management software should be able to help you to:

- Convert the energy consumed into greenhouse gas emissions
- Propose emissions reduction targets and track them in real time
- Generate reports on carbon emissions automatically (reports that you can customize by building or stakeholder)

5. Real-Time Monitoring

Real-time energy usage data is a key metric for energy management. It enables energy managers to identify and manage spikes throughout the day, assess trends and isolate energy eaters.

As opposed to weekly or monthly data providing only an idea of overall consumption, real-time usage data gives you granular, up-to-date information needed to plan actionable goals and calculate ROI on energy improvement projects.

An effective EMS must

- Centralize all the information on energy consumption, costs, air quality, GHG emissions, etc., that your organization needs for decision-making.
- Enable you to see all this data on intuitive, easy-to-use dashboards, that you can share with other stakeholders showing the information that's relevant to them
- Allow you to see at a glance the status of all projects in your organization, and quickly identify opportunities for improvement on your energy efficiency journey.

6. Energy savings verification with IPMPV

When investing in energy saving initiatives, it's essential that you can verify your actual savings. This is even more critical if you offer energy management services because typically remuneration is linked to results, i.e. the savings you deliver.

To establish the value of the savings that you have generated, the IPMVP protocol is very useful. These initials stand for the International Performance Measurement and Verification Protocol, developed by the Efficiency Valuation Organization (EVO)

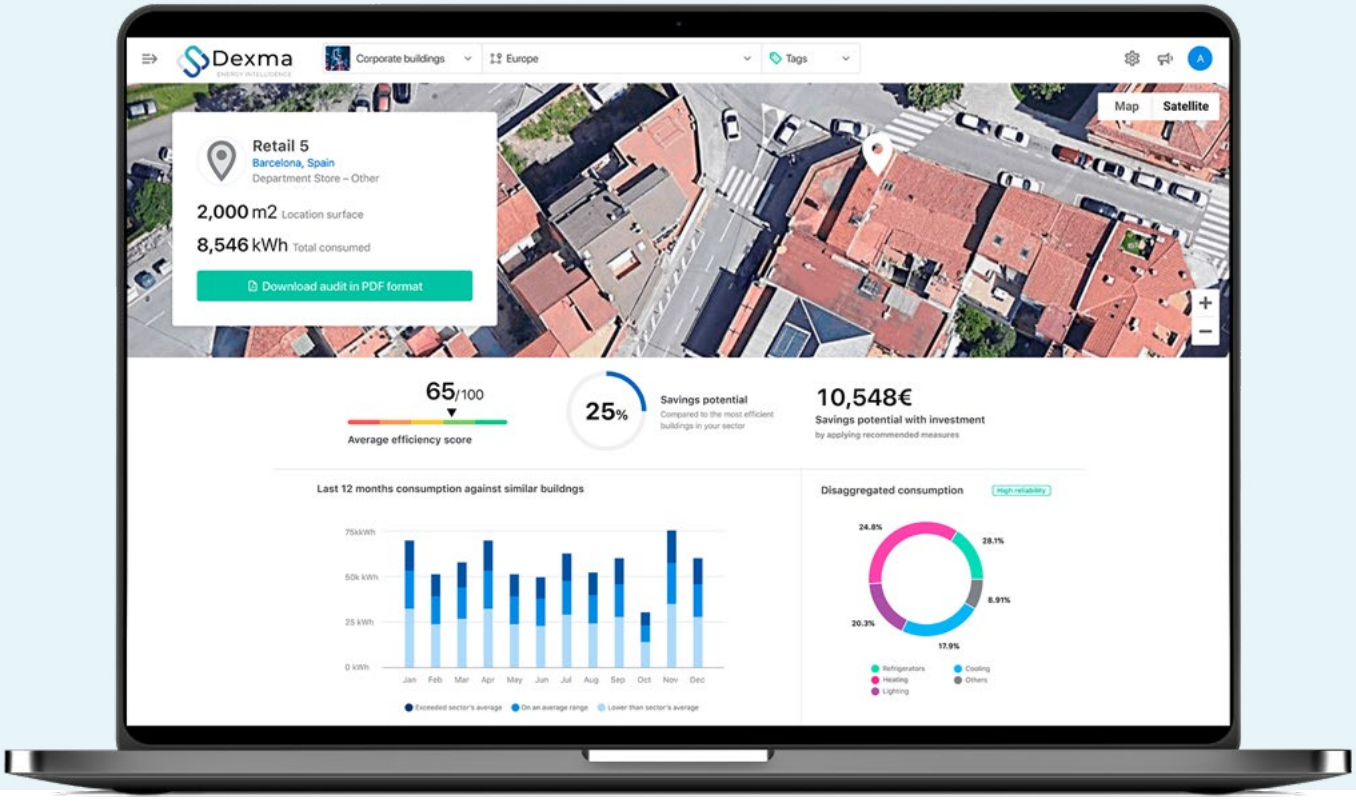
IPMVP is a protocol to calculate baselines and verify project savings. This can be done for different energy saving measures, individually. For example, you have simultaneously invested in a solar energy project and a new HVAC system. You can then keep track of savings separately, by project, at a great level of detail. Conversely, you can also calculate savings organization-wide, by creating consumption baselines for your entire portfolio.

7. AI-Based Anomaly Detection

With submeters and smart sensors in buildings producing huge amounts of data every single day, anomaly detection through Artificial Intelligence is becoming the energy manager's virtual assistant.

For humans to detect anomalies 24/7 would be a hard, time-consuming and extremely boring task – AI is much better at it. AI-based anomaly detection ensures that every building is on track without missing any incidents. It prevents small problems from getting much bigger and aids in better decision-making.

Introducing AI assistance in energy management has a double positive effect. The first benefit is that it saves the energy manager time on repetitive tasks such as analyzing the data. The second one is that AI finds every anomaly, not permitting any energy anomaly leakage.



8. Interoperability

Few EMS platforms offer the possibility of being able to integrate a new building (or 10, 100, 1,000) automatically and without losing data. Or, without having to invest thousands of euros again in meters.

This occurs because many technologies are “tied” to the meters of a specific manufacturer. That means that if you purchase a new building for your portfolio that does not have these meters, you cannot integrate it.

Another key challenge is interoperability with building control systems such as BMS, or perhaps SCADA in industrial environments. Ensure that your EMS can communicate seamlessly with a BMS natively or through an open API.

Open APIs also let you connect your EMS with other enterprise software such as ERPs. Furthermore, they provide you with the opportunity to expand your energy-saving capabilities by giving you easy access to the energy apps marketplace. This enables you to develop your unique solution to match your business needs and create your own roadmap on top of a standard EMS platform.

9. Scalability

Scalability is essential when managing a building portfolio. You may grow tomorrow and want to add new users to the energy management plan. Or, add new buildings or new energy measurement variables. That is scalability. Can the EMS platform you have support this? If the answer is no, you may have a problem with data loss, synchronization, etc.

When you manage 10s, 100s or 1,000s of properties, energy management is an important investment. Scalability is key in order to be able to start with a number of buildings whose cost you can afford and then, as you recover the money from the investment through energy savings, you can add new properties to your energy management plan.

10. Information Security

In a world of pervasive technology, cybersecurity has become a strategic priority for organizations across all sectors. ISO 27001 is a leading international certification, providing requirements for an information security management system (ISMS).

Vendors such as Dexma who are ISO 27001 certified:

- Manage data securely in accordance with international best practices
- Systematically reduce data-related risks
- Are at the forefront of ever-tightening regulations including GDPR and other legislation on cybersecurity.

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