FROM THOUSANDS TO BILLIONS

WORLD GREEN BUILDING COUNCIL

Coordinated Action towards 100% Net Zero Carbon Buildings By 2050

Authors

Jonathan Laski, World Green Building Council

Victoria Burrows, World Green Building Council

Project Sponsors

A grant has been provided in 2017 by

Cover Image: Barangaroo, Sydney © Lendlease

Note: Not all buildings appearing in this image are currently net zero carbon buildings. This image shows the Barangaroo project (see page 33 for case study) as well as the challenge ahead to make every building net zero carbon.

ACKNOWLEDGEMENTS

Green Building Councils contributing to the Report

NAME	MAIN CONTACT	WEBSITE	TWITTER
GBC Australia	Jorge Chapa	www.gbca.org.au	@gbcaus
GBC Brasil	Maira Macedo	www.gbcbrasil.org.br	@gbcbrasil
Canada GBC	Mark Hutchinson	www.cagbc.org	@CaGBC
Alliance HQE-GBC	Anne-Sophie Perrissin	www.hqegbc.org	@hqegbc
DGNB (Germany)	Anna Braune	www.dgnb.de/en	@DGNB_eV
Dutch GBC	Martin Mooij	www.dgbc.nl	@DGBCnl
India GBC	Praveen Soma	www.igbc.in	@IGBConline
GBC South Africa	Tyrel Momberg	www.gbcsa.org.za	@GBCSA
Sweden GBC	Linnea Olsson	www.sgbc.se	@SwedenGBC
USGBC	Elizabeth Beardsley	www.usgbc.org	@USGBC

Research

Elspeth Holland, World Green Building Council

Andrew Lee, Architecture 2030

Vincent Martinez, Architecture 2030

Other organisations contributing to the Report

We would also like to acknowledge the help and contributions to this project made by the following people:

Brad Liljequist, International Living Future Institute

Brian Dean and John Dulac, International Energy Agency

Shilpa Sankaran, Net Zero Energy Coalition

Ralph DiNola and Mark Frankel, New Buildings Institute

David Craven, C40 Cities

About the WorldGBC

The World Green Building Council is a global network of Green Building Councils which is transforming the places we live, work, play, heal and learn.

We believe green buildings can and must be at the centre of our lives. Our changing climate means we must reshape the way we grow and build, enabling people to thrive both today and tomorrow.

We take action - championing local and global leadership, and empowering our community to drive change. Together, we are greater than the sum of our parts, and commit to green buildings for everyone, everywhere.

Contact Information

Web www.worldgbc.org
Twitter @worldgbc
Email office@worldgbc.org

London, UK Office
% UK Green Building Council
The Building Centre
26 Store Street
London, UK
WC1E 7BT

Toronto, Canada Office
Attention: World Green Building Council
5 Shoreham Drive
Toronto, Ontario
Canada
M3N 1S4

Disclaimer

This report is written by staff from the WorldGBC, with support from Architecture 2030, and contributions from the Green Building Councils and other organisations listed. The views expressed in this report are those of WorldGBC and do not necessarily reflect the views of all other parties named.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The signing of the Paris Agreement in December 2015 was rightly hailed as a truly historic moment in the fight against climate change.

It marked the start of the most important race in our existence – the race to curb global greenhouse gas (GHG) emissions so that global temperature rise remains below 2 degrees Celsius and, ideally, below 1.5 degrees Celsius.

It also set a clear timeline for how quickly the world must change its course so that, by 2050, all major business sectors are operating in a state of essentially zero carbon emissions. In this race, each sector will identify its own goals and path.

Since the building and construction sector is responsible for around 30% of global energy consumption and the associated GHGs, this sector will play a significant role in finding the solutions.

What that means for the building and construction sector is nothing short of a dramatic and ambitious transformation towards a completely zero carbon built environment. For this reason, the World Green Building Council (WorldGBC) is calling for the dual goals of:

All new buildings must operate at net zero carbon from 2030

Net zero carbon buildings must become standard business practice as soon as possible, so we build right from the start; avoid the need for future major retrofits; and prevent the lock-in of carbon emitting systems for decades to come.

100% of buildings must operate at net zero carbon by 2050

Existing buildings require not only an acceleration of current renovation rates, but these renovations must be completed to a net zero carbon standard so that all buildings are net zero carbon in operation by 2050.

WorldGBC has worked with its Green Building Councils (GBCs) and partners to define a net zero carbon building as:

A highly energy-efficient building with all remaining operational energy use from renewable energy, preferably on-site but also off-site production, to achieve net zero carbon emissions annually in operation.

WorldGBC has adopted this definition because it clarifies the focus on carbon and enables flexibility, market-by-market, regarding details such as energy source.

The 2030 and 2050 goals are essential to combat climate change, but we have a long way to go. Current estimates suggest 500 net zero commercial buildings, and several thousand net zero homes and residential units currently exist in the world. These must become several billion net zero buildings as soon as possible. WorldGBC believes that this transformation is absolutely possible if the right actions are implemented.

As of today, ten GBCs are already working with stakeholders in their markets to: create or adopt voluntary net zero carbon building rating systems; catalyse projects; and support training. These GBCs are responding to the climate imperative and paving a new path for net zero: one focused on carbon.

And while each GBC is developing the programme that is right for their market, each will respect the following principles:

1. use carbon as the key metric; **2.** promote deep energy efficiency; **3.** establish a hierarchical preference for on-site renewable energy, off-site renewable energy, and then offsets; **4.** transparently disclose how each building achieves a carbon balance and promote continuous improvement of the building sector.

While these GBCs are setting clear directions in their own markets, WorldGBC believes that only through concerted action of three core groups of actors, can we achieve these goals; **Business, Government** and **Non-Governmental Organisations**.

Achieving the targets laid out above would help to ensure that the worst impacts of climate change are avoided, and bring about a number of other political and economic benefits. These include: future-proofing of investments; resilience against energy prices; meeting climate change obligations; market advancements such as education, technology development and innovation; creating new jobs; and enabling significant investment in new clean energy systems.

Each of the net zero buildings in existence today, and outlined here, are a testament to the technologies, design strategies and operational practices that make net zero buildings possible worldwide. If we start today, every building can be net zero tomorrow.

SUMMARY OF CALLS TO ACTION

BUSINESS

1. **Commit** to investing in, building and occupying only new projects, major renovations and existing properties that will achieve net zero carbon before 2050, with new buildings from 2030; and **implement** policies and practices to ensure assets operate at net zero carbon as soon as possible.
2. **Disclose** carbon emissions for all assets before 2030.
3. **Certify** all new assets as net zero carbon (or net zero energy if that is preferred and available in your market) from 2030; certify all assets as net zero carbon by 2050.

GOVERNMENT

1. **Commit** to developing national and/or sub-national regulations for new and existing buildings to achieve net zero carbon standards as per the outlined timeline; and implement plans, incentives & strategies to support the building market in achieving these standards.
2. **Commit** to occupying only certified net zero carbon buildings before 2030.
3. **Collaborate** with relevant stakeholders, including the business sector and NGOs, to identify and overcome the barriers preventing net zero carbon buildings.

NON-GOVERNMENTAL ORGANISATIONS (NGOs)

1. Develop **certification programmes** for net zero carbon buildings for leading businesses to adopt and to show market readiness to governments.
2. Engage and **support governments** to create roadmaps, incentives and tracking systems for the rapid development of net zero carbon buildings.
3. **Educate and train** businesses and the public on the value of net zero carbon building, including business benefits, feasibility, and necessary skills development.

OUR VISION

section one

OUR VISION

The World Green Building Council (WorldGBC) has a mission to achieve green buildings for everyone, everywhere. We and our global network of over 70 Green Building Councils believe that green buildings can help combat climate change, as well as achieve numerous other wider social, economic, environmental and health benefits[1].

It is for this reason that we introduce our net zero vision of a world in which we achieve the ambitions set out by the Paris Agreement; every building emits no carbon emissions as it operates; and major transformation starts today and accelerates tomorrow.

Our Goal

At the 2015 United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP 21), world leaders reached a major agreement to "combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future," by curbing greenhouse gas (GHG) emissions to ensure global temperature rise stays below 2 degrees, and ideally, below 1.5 degrees[2].

While the signatories of the Paris Agreement are countries, the breadth of its ambition will require action from every major sector of the global economy, including and especially buildings and construction. Buildings are responsible for around 30% of global energy consumption, 30% of GHG emissions[3] and, on average, 50% of emissions in major cities[4]. Therefore the market can and must do its part to ensure that decarbonisation happens in time to limit dangerous global temperature rise. In doing so, the world will realise tremendous benefits.

Taking action on buildings remains among the most cost-effective means of reducing global emissions[5]. Furthermore, low carbon, green buildings offer significant opportunities in terms of energy reduction, cost savings, job creation and building a more resilient economy.

It is because of these benefits, and the urgency of the action required, that the WorldGBC is calling for two major goals in order to meet the Paris Agreement:

All new buildings must operate at net zero carbon from 2030[6] and 100% of buildings must operate at net zero carbon by 2050

[1]WorldGBC 'Business Case for Green Buildings' report (2013) http://www.worldgbc.org/sites/default/files/Business_Case_For_Green_Building_Report_WEB_2013-04-11-2.pdf

[2]United Nations Framework Convention on Climate Change, 'The Paris Agreement' http://bigpicture.unfccc.int/#content-the-paris-agreemen

[3]Global Alliance for Buildings and Construction, 'Towards zero emission efficient and resilient buildings: Global Status Report 2016', November 2016

[4]C40, 'Urban Efficiency II: Seven Innovative City Programmes for Existing Building Energy efficiency', 2016

[5]McKinsey & Company, 'Pathways to a Low-Carbon Economy: Version 2 of the Global Greenhouse Gas Abatement Cost Curve' 2010

[6]At the latest; WorldGBC recognises local legislative requirements may require earlier achievement, such as the Energy Performance of Buildings Directive (EPBD) applicable to European countries requiring all new buildings to be nearly zero-energy by the end of 2020 https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings/nearly-zero-energy-buildings

Definition

To bring clarity and help galvanise the building and construction sector around our goal, the WorldGBC has adopted the following definition for a net zero carbon building[7]:

A highly energy-efficient building with all remaining operational energy use from renewable energy, preferably on-site but also off-site production, to achieve net zero carbon emissions annually in operation.

WorldGBC recognises that there are many existing definitions and that some confusion has flowed from the variety of different terms and definitions in use around the world. Each term, including 'net', 'zero', 'carbon', 'energy' and 'emissions', may include different interpretations and meanings across different sectors of the market and across countries and regions. Therefore, it is important to clarify terms used generally and within this report, including:

Operating emissions As the building is consuming energy to provide comfort conditions for its occupants and/or service its primary function, performance is verified annually by metered actual consumption and energy generation data, and emissions determined based on the energy source mix[8]; our definition of net zero carbon currently focuses on this type of emissions.

Net zero energy A building that relies on both energy efficiency and entirely on-site renewable energy production to reach its balance of energy-consumed and energy-produced[9].

Energy positive A building that produces annually more on-site energy that it requires to operate, and supplies the energy to the grid or neighbouring functions.

Carbon neutral Achieving net zero carbon emissions by balancing the amount of carbon released to meet operating energy demand, with offsetting an equivalent amount.

Embodied carbon The greenhouse gas (GHG) emissions associated with the non-operational phase of the project, that is: extraction, manufacture, transportation, assembly, maintenance, replacement, deconstruction, disposal and end of life aspects of the materials and systems of a building[10]. WorldGBC acknowledges that in time, as we progress net zero operating emissions, more emphasis will be placed on the whole lifecycle process of a building, and a definition of net zero carbon may evolve to incorporate this aspect.

[7]Architecture 2030, New Buildings Institute, Rocky Mountain Institute, 'Zero Net Carbon (ZNC) Building' 2016

[8]Whole Building Design Guide 'Net Zero Energy Buildings' https://www.wbdg.org/resources/net-zero-energy-buildings

[9]UKGBC 'Tackling Embodied Carbon in Buildings' (2015) http://www.ukgbc.org/sites/default/files/Tackling%20embodied%20carbon%20in%20buildings.pdf

[10]The scope of emissions covered will be determined by each GBC, as appropriate to their programme, with a view that Scope 1 and 2 emissions will be covered as a minimum. For more information on the difference between Scope 1, 2 and 3 please see: The Greenhouse Gas Protocol http://www.ghgprotocol.org/sites/default/files/ghgp/standards/ghg-protocol-revised.pdf

In September 2016, as part of a WorldGBC-led project called ***Advancing Net Zero***[11], ten Green Building Councils (GBCs) came together to support one another in their drive towards achieving net zero buildings in their own markets. Through this project, the national GBCs are developing their own net zero carbon certification and verification programmes.

The GBCs agreed on key principles of net zero carbon buildings, which will guide the development of their certification schemes. As they evolve their own programmes they may adopt or adapt the general net zero carbon definition, incorporating specific applications they deem necessary in their market due to specific geographic, cultural, regulatory, and climatic conditions which vary from country to country.

The key principles agreed by the Advancing Net Zero participant Green Building Councils are:

1. **Carbon is the ultimate metric to track**
   The goals of the Paris agreement make clear that we must decarbonise as quickly as possible. For this reason, carbon must be the focus so we can track progress against these goals, while some participating GBCs may certify both net zero carbon and net zero energy buildings.

2. **A minimum level of building energy efficiency should be required**
   Decarbonisation will happen faster if we reduce our demand for energy, as we will need less of it for a building to function. The percentage energy efficiency improvement will vary by GBC, as will the benchmark reference point and approaches, i.e. optimising passive systems.

3. **The balance of energy to be provided from renewable sources has a general hierarchical preference of on-site, off-site and then offset**
   GBCs believe strongly that on-site energy generation followed by off-site sources drives a closer link between a building's own energy use and the carbon it emits. Some GBCs will choose to require a minimum level of on-site renewable energy and others not. Additionally, some GBCs will allow off-site and offsets, while others will not, or will but will phase out over time. Furthermore, GBCs and WorldGBC recognise that in some circumstances neighbourhood, district and city-wide approaches to renewable energy generation will be appropriate, thereby supporting climate change goals through the decarbonisation of energy grids.

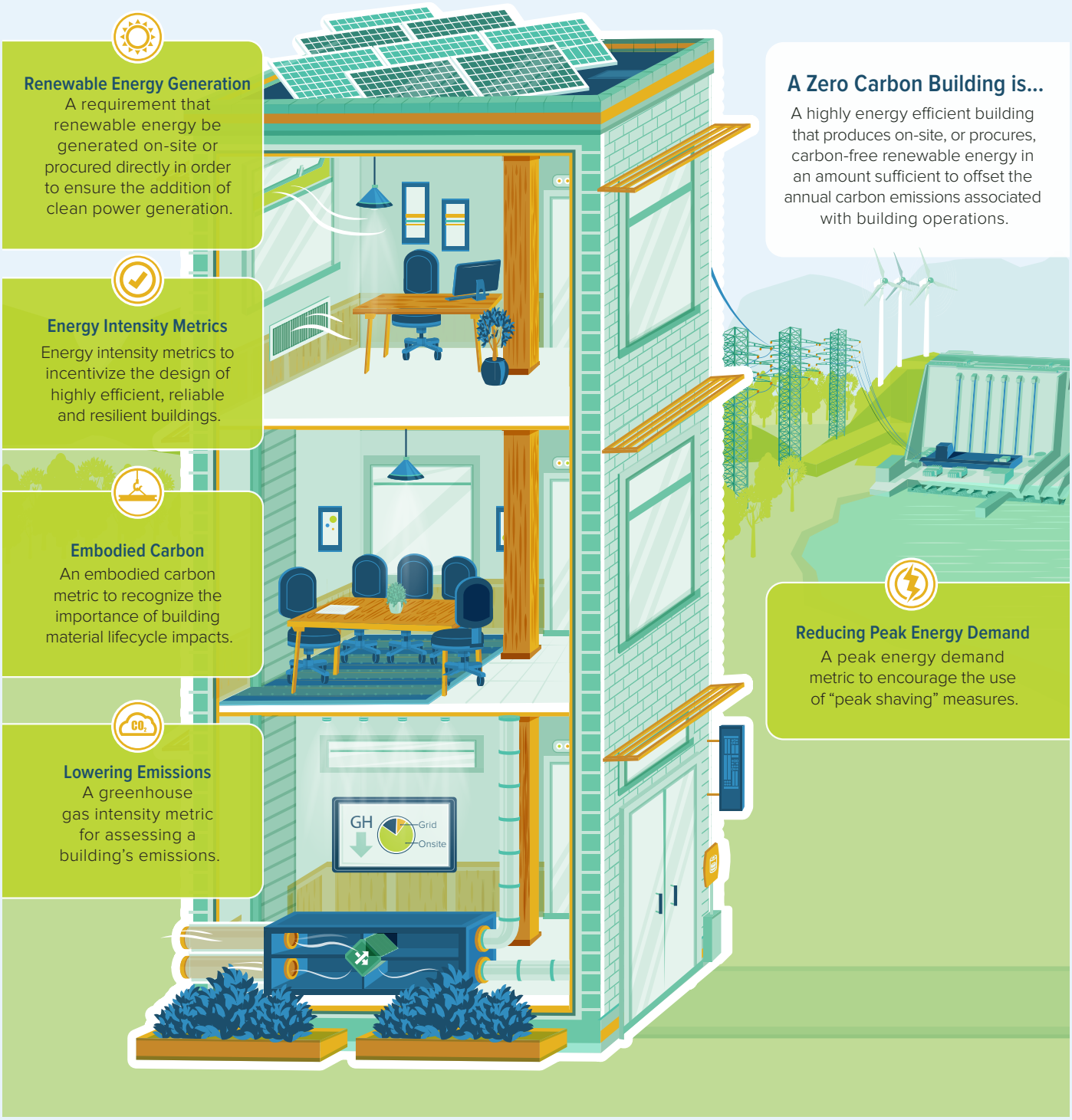
4. **Net Zero certification programmes should continually improve in terms of verification and rigour**
   All GBCs recognise the need for net zero certification to be based on performance in operation, and for transparency in standards developing over time to include, for example, lifecycle carbon calculations. Some GBCs will require or make zero carbon lifecycle an option from the outset, while others will phase in over time, recognising it is a more challenging goal to achieve initially.

[11]WorldGBC, 'Advancing Net Zero' project information available at: http://www.worldgbc.org/advancing-net-zero

What is a Net Zero Carbon Building?

As an example, here is how Canada Green Building Council describes a Zero Carbon Building under its draft Framework:

Figure 1: Five Key Components of Zero Carbon Buildings



Rate of Change

To achieve the goal of 100% of all buildings operating at net zero carbon by 2050, there must be a rapid rate of change from our current market state. In particular, we must ensure that every new building built is net zero as soon as possible, as every new building not built to these standards today will need to be retrofitted tomorrow.

Therefore, for new and existing buildings, we are setting the following milestones to ensure progress towards the 2050 goals at a global level:

From 2030, all new buildings globally must be built to net zero carbon standards, ensuring that no new carbon emissions are emitted from building operations.

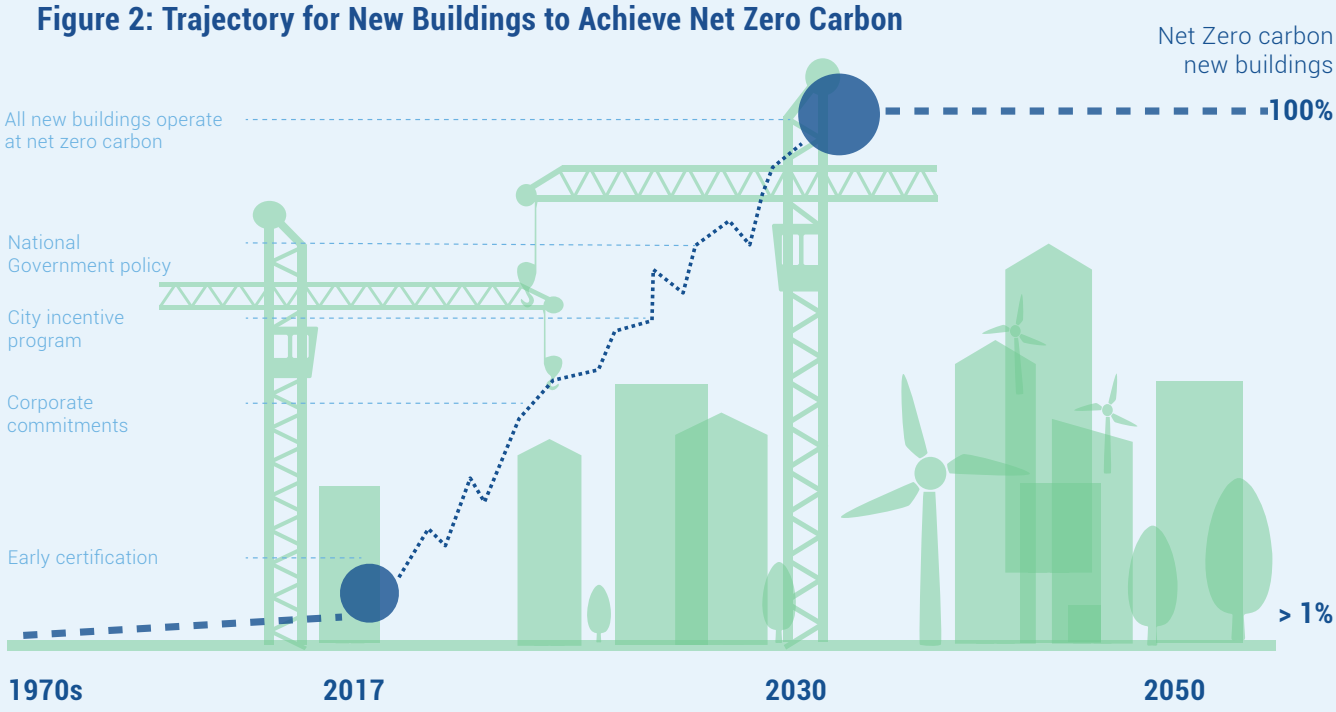
The International Energy Agency (IEA) estimates that the current global buildings stock is 223 billion square metres[12] and this will rise, on average, 5.5 billion square metres per year, resulting in a global building stock in 2050 of approximately 415 billion square metres.

So we have a choice – start now, and build this 5.5 billion square metres annually to net zero standards, or face a daunting task of retrofitting an additional 192 billion square metres on top of the 223 billion square metres we must already tackle. If we can change the way we build today, our job in the future becomes easier – and the benefits will be realised sooner.

This is why, for new buildings, WorldGBC has adopted 2030 as the year from which all new buildings must achieve net zero carbon standards, although we encourage achieving this much earlier where possible. WorldGBC also encourages buildings undertaking major energy renovations to aim for net zero carbon standards from now, to avoid additional retrofit being required later on.

While 2030 is not far off, so long as efforts are ramped up starting immediately, we believe that the next 13 years will provide sufficient time for all players in the building supply chain to move from net zero carbon demonstration projects to net zero carbon buildings as business-as-usual, portfolio-wide and in all regions of the world.

Figure 2: Trajectory for New Buildings to Achieve Net Zero Carbon



[12]Global Alliance for Buildings and Construction, "Towards zero-emission efficient and resilient buildings: Global Status Report 2016", November 2016. International Energy Agency: Energy Technology Perspectives 2016 - Towards Sustainable Urban Energy Systems http://www.iea.org/etp/

Between now and 2050, existing buildings must be renovated at an accelerated rate and to net zero carbon standards, so that all buildings operate at net zero carbon by 2050.

For existing buildings, we must ensure that every retrofit leads to a net zero carbon building. We must also accelerate renovation rates to ensure that 100% of all existing buildings are renovated to net zero carbon standards by 2050.

Renovation rates are important to monitor as they tell us the proportion of the total building stock that each year undergoes what is known as 'deep energy renovation'. In order to meet the performance goals, existing buildings must be renovated, resulting in significant energy consumption reduction through a coordinated package of cost effective measures to the building fabric and services. The Global Alliance for Buildings and Construction reports that current renovation rates generally amount to 1% or less of the existing building stock each year[13]. To achieve the 100% net zero carbon by 2050 goal, renovation rates must increase to 3% per year if we start in 2017, or higher if we start later.

The above is a global average, however, and the annual renovation rates that will be required in a particular country must be determined based on how much new building is taking place; whether buildings are being retrofitted or demolished and rebuilt[14]; and how much of the building stock is already at net zero standards. Developing countries, which tend to have more new buildings being built, must also accelerate renovation rates from their current level of 1% to 1.5% by 2025 and 2% by 2040. For developed countries, renovation rates also currently at 1% will have to reach 2% by 2025 and 3% by 2040[15].

Figure 3: Trajectory for Existing Buildings to Achieve Net Zero Carbon

[10]Global Alliance for Buildings and Construction, 'Global Roadmap towards low-GHG and resilient buildings', November 2016

[11]WorldGBC is not advocating that buildings be demolished and rebuilt, as the lifecycle carbon calculation in such an act can be very high and detrimental for the environment. However, we acknowledge that it does happen, and this will impact the calculation of renovation rates in a given country.

[12]Global Alliance for Buildings and Construction, 'Global Roadmap towards low-GHG and resilient buildings', November 2016.

STATE OF MARKET

IN 2017

section two

STATE OF MARKET IN 2017

In order to achieve our goals of net zero carbon buildings everywhere, we must understand where we are today – and how far we still have to go.

Current Market Penetration

Best estimates from building inventory studies are that there are approximately 500 net zero energy commercial buildings and 2,000 net zero energy housing units worldwide[16]. Based on what we know of the scale of the total global building stock, this is well less than 1% of all buildings – a major shortfall in the 100% we need by 2050.

In terms of geography, we estimate that the European Union has the highest number of net zero buildings, due to government-sponsored retrofit programmes and a history of progressive policies and market interest. North America is believed to have the second-largest concentration of net zero buildings, including dozens of smaller commercial buildings and many single-family homes, especially in the western and northeast states.

By building type, residential projects represent the highest number and type of net zero projects built to date. Many of these are single-family homes built as demonstration projects through renewable energy financing programmes, and sometimes through the support of publicly-sponsored home energy retrofit programmes. Since 2010, the development of net zero energy multi-family housing projects has increased as technology costs have declined and incentive policies applicable to such projects have increased.

It is estimated that commercial office projects represent the second largest quantity of net zero projects worldwide. Development of commercial net zero projects has steadily increased in the last decade, the majority of which are publicly-owned properties[17]. However, a growing number of privately-owned properties have been built or converted to net zero in the last five years, reflecting new commercial interests and attention.

The last five years have also seen the expansion of net zero energy buildings in new sectors. The education sector has made the most notable progress through net zero primary schools and university campus buildings[17].

[15]WorldGBC and Architecture 2030 arrived at this estimate based on desktop research and consultation with GBCs and partners, such as International Living Future Institute and New Buildings Institute. To be counted, a building must have been certified or audited as operating at net zero energy or carbon. 'Nearly zero' or 'net zero-ready' building did not count for the purpose of this statistic, though WorldGBC is very supportive of such high performing buildings.

[16]New Buildings Institute, '2016 List of Zero Net Energy Buildings' (2016); International Energy Agency, 'Towards Net Zero Energy Solar Buildings' (2013)

[17]New Buildings Institute, '2016 List of Zero Net Energy Buildings' (2016)

Since 2010 the scale of the largest net zero projects has increased significantly. As the case studies presented later in this report show, public-sector projects in India, South Africa, and the United States greater than 30,000 square metres have been built to net zero standards. Despite these impressive large projects, as of today, the majority of both new and existing net zero projects worldwide continue to be under 900 square metres[18].

While this data shows there has been progress towards net zero building, we must move from individual isolated projects to mass market uptake – from thousands of net zero buildings to billions – as soon as possible.

Barriers to Uptake

It is essential to understand why progress over the past decade or two towards net zero carbon buildings has been slow, in order to effectively target the actions and strategies that will lead to wider uptake. We believe there are three main, interrelated reasons for the limited adoption of net zero buildings:

Perceptual Since high-performing net zero buildings have not been embraced as business-as-usual, assumptions spread that these buildings must be technically difficult and not solid financial investments. Ambiguity and uncertainty – as to whether the goal of such projects should be focused on carbon or energy, zero or nearly zero, what technologies should be deployed, the requirements and parameters for energy efficiency and renewable energy – persist in the market. These valid points of discussion result in market confusion that has stalled momentum.

Technical Net zero carbon buildings are high-performing buildings and, therefore, require expertise, client demand and technical know-how to deliver a building that actually achieves net zero carbon emissions in operation. The technical skills needed throughout the building design and operation process are not necessarily widespread, even in more established markets.

Financial While there is evidence that net zero buildings currently have a higher up-front cost than other green buildings and non-green buildings, most of the research and evidence has focused on net zero energy buildings – which is much harder and likely more expensive to achieve than net zero carbon buildings. For example, a 2013 report by International Living Future Institute, New Buildings Institute and Skanska stated that the average cost premium for three net zero energy buildings in the District of Columbia, USA was between 5-12%[tbc]. Investor and owner return on investment in a net zero building can differ greatly depending on the market in which the building is built, taking into account energy costs, incentive programmes, and climate policies, such as a tax on carbon.

While these barriers are real, WorldGBC believes these barriers can and will be overcome. Concerted and targeted action from three key sectors the world over will result in greater clarity and understanding as to how to achieve net zero carbon buildings, lead to the development of the technical know-how required, and will result in a reduction of the cost premium as building net zero carbon becomes business-as-usual.

[18] Net Zero and Living Building Challenge Financial Study: A Cost Comparison Report for Buildings in the District of Columbia', 2013 https://living-future.org/wp-content/uploads/2016/11/NZEB_LBC_-DC_Financial_Study.pdf

[19] New Buildings Institute, '2016 List of Zero Net Energy Buildings' (2016); International Energy Agency, 'Towards Net Zero Energy Solar Buildings' (2013)

OUR THEORY OF CHANGE

section three

OUR THEORY OF CHANGE

Led initially by the work of our Green Building Councils, along with innovative companies, governments and NGOs, the barriers to net zero will be overcome through ongoing, concerted and coordinated efforts from these three groups. Proven by past success of certifications, and action from industry and government, the resulting building and construction activity will be both good for the environment and the economy, resulting in reduced energy consumption and many, high-quality jobs in markets around the world.

A Market Transformation to Overcome Net Zero Barriers

WorldGBC believes that it is possible to collectively propel the market from the under 1% of all buildings achieving net zero carbon to the 100% needed by 2050, by introducing voluntary net zero certification and through coordinating efforts from three major groups – business, government and NGOs.

To kick-start these efforts, we believe that voluntary net zero certification can set, accelerate or make more ambitious the trajectory for the market. It can stimulate further market transformation through business commitments that lead to action, government policy and programmes, and technological change. This has been proven by the success of green building certification to date. So far, around the globe, WorldGBC member Green Building Councils have certified more than 1 billion square metres of green building space[20]. We know, anecdotally, that these certified buildings have stimulated growth in the market for green buildings; and we have seen evidence in certain markets that initial certification can create greater market demand for further certification and, crucially, a focus on operational performance.

[20]WorldGBC Annual Report, page 6; http://www.worldgbc.org/sites/default/files/P578%20WGBC%20Annual%20Report_LR4.pdf

The Rapid Growth of Green Buildings through Certification, and its Impacts on Industry

Australia

Green building certification schemes promote holistic approaches to sustainable development beyond energy performance (i.e. water, waste, ecology, materials etc.) and increase global awareness. In Australia, this has been proven via the growth of the green building market over the past 15 years, including through the introduction of rating tools. Green Star has provided a common language for the property and construction industry to use when describing best practice. Now, 30% of Australia's Central Business District (CBD) office space has Green Star certification, up from 23% at the end of 2014[21] and, on average, certified buildings produce 62% fewer greenhouse gas emissions than average Australian buildings[22].

Canada

In 2014, Canada's green building industry generated $23.5 billion in GDP and directly employed 297,890 people, representing more than the forestry, oil and gas, and mining industries combined[23].

Germany

Between 2015 and 2016 in Germany investment in green buildings rose by 8% despite a slight decrease in overall commercial property investment. These results show that green buildings have been making a steadily growing contribution to total turnover across the country. As of the end of 2016, there are 1,250 certified green commercial buildings with a transaction value in 2016 of 7.4 billion EU and year-over-year growth was approximately 16%[24].

South Africa

In 2009, GBC South Africa certified the first Green Star building in the county. Each year since, the number of certified buildings has increased, building momentum in the market and recognition of the importance of green building. In the first three years, certifications grew 2000% percent. In the second three year-period, 471%. By 2018, South Africa GBC expects to certify the 370th green building and sees this growth trajectory remaining steady[25].

United States

In the U.S., the Leadership on Energy and Environmental Design (LEED) system has grown exponentially since its introduction in 2000. With more than 46,600 certified projects and 121,900 certified residential units[26], there is recognition of opportunity to the construction industry and the increasingly solid business case. According to a report commissioned by the United States Green Building Council (USGBC), green construction is projected to generate an additional $303.4 billion in GDP, 3.9 million jobs, and $268.4 billion in labour earnings between 2015-2018. In the same period, LEED specifically is projected to contribute an additional $108.8 billion in GDP, 1.4 million jobs, and $95.7 billion in labour earnings[27].

[21]Green Building Council South Africa (GBCSA) internal data

[22]Green Building Council Australia 'Penetration of Green Star - Australia's Office Market' report, April 2016

[23]Green Building Council Australia 'The Value of Green Star - A Decade of Environmental Benefits', 2013
http://www.gbca.org.au/uploads/194/34754/The_Value_of_Green_Star_A_Decade_of_Environmental_Benefits.pdf

[24]BNP Paribas Real Estate 'Market Focus 2016: Investment Market Green Buildings', 2016
https://www.realestate.bnpparibas.de/upload/docs/application/pdf/2017-03/2016-q4_green_building_investment_eng_final.pdf?id=p_1681422&hreflang=en

[25]As of April 2017, combined total of certified projects: http://www.usgbc.org/articles/usgbc-statistics

[26]USGBC '2015 Green Building Economic Impact Study': http://go.usgbc.org/2015-Green-Building-Economic-Impact-Study.html

[27]Canada Green Building Council & Delphi Group 'Green Building in Canada: Assessing the Market Impacts and Opportunities'

WorldGBC believes that net zero certification and verification programmes will be a catalyst to market transformation. Overall, the coordinated efforts of the three sectors will bring about the groundswell needed to achieve both the 2030 and 2050 goals. The path towards these goals will be specific to each market but will include some of the same characteristics, including:

> Voluntary action by businesses recognising the market leadership opportunities: These businesses will be the ones to certify under net zero certification and verification programmes;
>
> An active and interested role from all levels of government at the outset, including a willingness to lead by example by requiring public buildings to be net zero carbon and through the creation of incentive programmes and policy to support the transition to net zero carbon buildings; and
>
> Market development, training and recognition opportunities offered by GBCs and other NGO subject-matter experts, including licensing and trade associations.

The way these sectors inter-relate and work together will differ from market to market. In some markets, the net zero certification will be the first coordinated move to introduce net zero buildings. In other markets, strong government plans or strong market interest will predate net zero certification; certification will serve to accelerate and galvanise momentum, as well as drive more ambitious goals.

In Germany, for example, progressive governments at a local, regional and national level are currently crafting, debating and implementing policies and programmes to incentivise and, in some cases, regulate net zero buildings. The DGNB (German Sustainable Building Council) is consulting with its members, scientific institutions and other initiatives on the development of a recognition programme for buildings that achieve a net zero carbon balance for operation and other lifecycle related emissions.

L'Alliance HQE-GBC in France has been collaborating with the government to develop a methodology and building label called E+C- for energy positive and low-carbon buildings, to forecast the future environmental regulation for new buildings. Launched in November 2016, the ambitions behind this initiative are to forecast the 2018-2020 environmental building regulation and to push stakeholders towards better practice. It is also a shift from energy efficiency to overall performance including energy, environmental and cost criteria.

In Sweden, early adoption of net zero building concepts has actually predated certification. The Sweden Green Building Council (Sweden GBC) is using certification to draw together early adopters and governments around common approaches to foster market clarity.

By inspiring and enabling industry to meet demand, we believe that the key barriers to net zero can be overcome in the following ways:

Perceptual barriers will be overcome as GBCs and others work to clarify definitions, simplify pathways and increase overall education and recognition for net zero carbon buildings. As the technical and financial barriers are also addressed, proof of the perceived and real value of net zero carbon buildings will emerge and be reinforcing in every market. With every new net zero carbon building certified and recognised will come greater understanding that net zero carbon building is achievable.

Technical barriers will be overcome through education and training that GBCs and other organisations deliver in the coming years. All segments of the building value chain will require resources – from educating investors about the business case[28] for net zero carbon buildings through to the designers, consultants and facility managers who will want clear support tools towards managing the systems that help buildings achieve net zero carbon in the operational phase of their lifecycle. The ripple effect of increased demand will require the industry to develop bespoke and innovative solutions, and as more projects are developed, the technical challenges will diminish.

Financial barriers will be overcome as the price of technology decreases, as expertise on net zero carbon building design and delivery becomes more widespread, and as governments engage further with incentive programmes for net zero carbon buildings. The emergence of financial tools, such as 'green mortgages' and 'energy efficient mortgages'[29] – offering preferential financing for not only green but net zero carbon buildings – will provide invaluable support to this movement. Finally, the financial barrier will be eroded through education, communication and the sharing of experiences which help prove the business case for green buildings. The WorldGBC and the GBCs participating in the Advancing Net Zero project have made a commitment to this educational mandate, along with many of our partners.

Overcoming Incremental Cost: An Example from India

In 2008-09, India GBC found that the incremental cost of highly efficient residential projects was 6-8%. As the number of green homes certified increased, it became clear that the cost premium decreased. More recent studies indicate the cost differential is now only 1-2%[30]. For barely any extra cost, these green homes are seeing energy savings of 30-40% and water savings of 20-30%. India GBC expects that within a year or two, such energy and water saving benefits will come at zero extra cost – and the process will replicate itself for net zero carbon buildings over time.

[28] WorldGBC 'Business Case for Green Buildings' report, 2013
http://www.worldgbc.org/sites/default/files/Business_Case_For_Green_Building_Report_WEB_2013-04-11-2.pdf

[29] For example, see the European Mortgage Federation, 'EMF-ECBC Energy Efficient Mortgages Initiative'
http://www.hypo.org/Content/Default.asp?PageID=615

[30] Terri Wills, 'A Green Homes Revolution is happening around the world: Terri Wills, World Green Building Council' Climate Group Blog
https://www.theclimategroup.org/news/green-homes-revolution-happening-around-world-terri-wills-world-green-building-council

WorldGBC believes that as each of the groups we have identified recognise the rationale and opportunities available in embracing a net zero carbon built environment, the market will be stimulated to respond to demand and increase supply, thereby achieving our theory of change (Figure 4). Each sector takes action and builds upon the momentum generated by the others, inspiring to adapt and develop mechanisms to continuously improve. This will create the perfect conditions for the net zero carbon market to thrive, through increasing skills and capacity, inspiring innovation, ensuring deep energy efficiency, decarbonising grid systems, increasing new jobs and boosting the economy.

Figure 4: Theory of Change

RATIONALE

Achieve Paris Agreement commitments for GHG emissions reduction

Achieve climate agenda at national, city and regional scale

RATIONALE

Assets of high quality & value

Long-term resiliency to mitigate carbon risks

Strong CSR position, market recognition

Reduced operating costs, good ROI

Attract high quality tenants

RATIONALE

Increased education and awareness

Develop outputs, i.e. certification schemes

Promote advocacy & innovation

Our Action: the WorldGBC Advancing Net Zero Project

WorldGBC has already begun to take major action in implementing this theory of change. In 2015, at the first ever Buildings Day at COP21, three GBCs committed to introduce a net zero certification programme in order to support the goals of the Paris Agreement. Recognising the importance and potential of these actions, in 2016, WorldGBC formed and launched the Advancing Net Zero project. With the support of the project, ten GBCs have now committed to introducing a net zero carbon certification system for their market by early 2018, as well as setting and tracking targets on implementing pilot projects and training the sector towards net zero carbon.

Global and Local Coordination

The WorldGBC project is supporting and coordinating the efforts of GBCs to ensure they are robust and as aligned as possible, while also recognising that the role to be played by GBCs and voluntary certification programmes will vary by jurisdiction in reflection of local conditions.

Within the WorldGBC network, we are encouraging agreement amongst GBCs around key principles, such as the importance of focusing on carbon. Where GBCs do not agree on a specific programme detail we are working to make the differences as transparent as possible to advise, for example, multinational companies with portfolios across multiple markets. While encouraging coordination, we also respect the autonomy and experience of our member GBCs to work with the stakeholders in their market, including other net zero certification providers, to develop the programmes that will bring about impact in their markets.

Furthermore, WorldGBC also recognises leadership being shown by GBCs who are aligning their efforts with other existing programme providers and initiatives. For example, in April 2017, GBC Australia and the International Living Future Institute released a guidance document for buildings pursuing both Green Star As-Built and Living Building Challenge[31], which was one of the first net zero certification programmes introduced into the market. Such efforts provide market clarity and strengthen both systems.

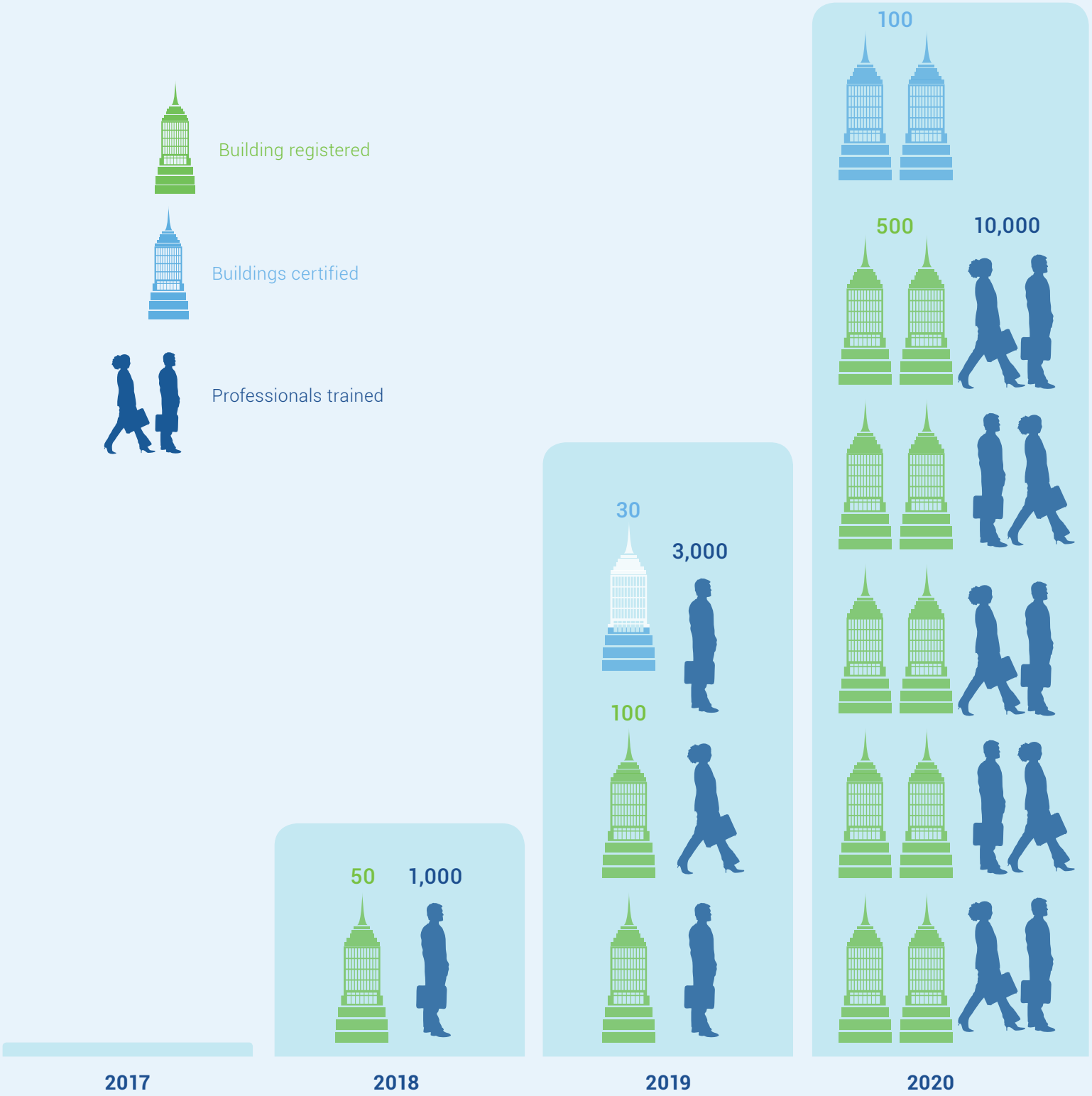
Setting and Tracking Targets

Critically, as well as the global and local coordination, the WorldGBC Advancing Net Zero project is also working with participating GBCs to make commitments on key milestones – and in future will track progress and provide interim reporting against these.

This will be critical to assess progress against the 2030 and 2050 goals as well as to evaluate whether our theory of change is correct. GBCs participating in our project have committed to yearly reporting on the number of buildings registered and certified in their markets and the impacts of those buildings operating at net zero carbon compared to a lower, business-as-usual performance standard. WorldGBC will collect and report on this data to demonstrate and assess performance against our targets.

[31]International Living Future Institute's Living Building Challenge https://living-future.org/lbc/

Figure 5: Cumulative GBC Commitments to 2020



As demonstrated, the commitments by these GBCs are significant – but they are not enough to bring us to the billions of net zero buildings we need. For this, WorldGBC needs the support of business, government and other NGOs the world over.

CALLS TO ACTION

section four

CALLS TO ACTION

It is now time to act, and advance net zero building. WorldGBC calls on business, government, and the NGO sector to take immediate action, and do their part to create a new way of building to achieve the Paris Agreement. We outline the most transformative actions that each sector can take, based on sound rationale and strategic benefits. We also present real-world examples from those already demonstrating leadership in the market. Action on net zero is possible, is proven, and is beneficial to all those involved.

BUSINESS

- INVESTORS
- DEVELOPERS, OWNERS & MANAGERS
- BUSINESSES AS TENANTS

GOVERNMENT

- NATIONAL GOVERNMENT
- SUB-NATIONAL GOVERNMENT

NON-GOVERNMENTAL ORGANISATIONS (NGOs)

- GREEN BUILDING COUNCILS
- OTHER NGOs

Business

No business is the same, and each business has a specific role to play in achieving a net zero transformation. We call on investors, developers, owners and managers, and businesses as tenants to take actions specific to their role in buildings and construction.

INVESTORS

Divest from fossil fuel-emitting assets and reinvest in net zero assets

Calls to Action

1. **Commit** to investing in only net zero carbon projects (from 2030 for new buildings, and 2050 for all properties).
2. **Disclose** carbon emissions for all portfolio assets before 2030.
3. **Certify**[32] all new assets as net zero carbon[33] from 2030; certify all assets as net zero carbon by 2050.

Benefits to and Rationale for Investors

Asset Value As the real estate investment market responds to the call to combat climate change, net zero carbon assets will have the lowest operating costs and be the most de-risked and, therefore, highest-quality assets.

Resilience Low or zero carbon investments are increasingly seen as the leadership path for many businesses, which signals prioritisation of long-term resiliency and is attractive to investors. Through the Dow Jones Sustainability Index[34], for example, investors have the tools to rate companies on their action to mitigate carbon risks.

Corporate Social Responsibility Of the world's 250 largest companies, 93% are already engaged in corporate sustainability reporting and over 82% report their carbon emissions, according to KPMG[35].

[32]Note: Use of the word 'certify' here and throughout the report means achieve asset certification and/or verification so that there is some certainty, through a third-party, that an asset is achieving a net zero carbon level of operation (and eventually in lifecycle).

[33]Note: In this section we include a call to action for various businesses to certify their properties to net zero carbon standard. If certification to a net zero energy standard is available and preferred, we consider that to be equally good.

[34]Dow Jones Sustainability Index: http://www.sustainability-indices.com/

[35]KPMG International, 'The KPMG Survey of Corporate Responsibility Reporting 2015', 2015 https://www.kpmg.com/CN/en/IssuesAndInsights/ArticlesPublications/Documents/kpmg-survey-of-corporate-responsibility-reporting-2015-O-201511.pdf

Market Leadership Examples

We Mean Business Coalition

We Mean Business[36] is a coalition of more than 700 companies, including investors managing $27 trillion in assets around the world who have made at least one climate change-related commitment. As of April 2017, this coalition includes the following investor commitments:

> 117 investors have signed the Montreal Carbon Pledge[37] to measure and publicly disclose the carbon footprint of their investment portfolios;
>
> 28 investors have joined the Portfolio Decarbonization Coalition[38], thereby pledging to publicly disclose a plan the exposure of their portfolio exposure to GHG emissions;
>
> 54 investors have reported their investment in low carbon assets, including buildings, through the Low Carbon Investment Registry[39].

Individual investor actions include the following

AustralianSuper In April 2016, Australia's largest superannuation fund announced that it would begin offering an option to restrict investments in companies with fossil fuel reserves. The decision spurred the dumping of over $235 million worth of fossil fuel stocks[40].

Allianz SE In November 2015, Allianz announced it would stop financing companies that derive more than 30% of revenue from coal mining or generate over 30% of their energy from coal. Over 225 million euros in equities were divested while 3.9 billion euros in bonds expired[41].

PFZW In November 2015, the Dutch pension fund announced that it would not sell investments in high carbon emitting companies, including complete divestment from coal-related companies by 2020 and a 30% reduction of investments in fossil fuel companies. This represented over 1.7 billion euros in divestment[42].

[36]We Mean Business Coalition https://www.wemeanbusinesscoalition.org/

[37]United Nations Environment Programme Finance Initiative http://montrealpledge.org/

[38]United Nations Environment Programme Finance Initiative http://unepfi.org/pdc/about/

[39]Global Investor Coalition on Climate Change http://globalinvestorcoalition.org/

[40]News article: RenewEconomy 15th April 2016 http://reneweconomy.com.au/australias-biggest-super-fund-makes-start-on-fossil-fuel-divestment-35481/

[41]News article: Allianz, 24th November 2015 https://www.allianz.com/en/press/news/financials/stakes_investments/151123_allianz-is-phasing-out-coal/

[42]News article: Reuters, 15th November 2015 http://www.reuters.com/article/netherlands-pension-fund-emissions-idUSL8N13C1DU20151117

DEVELOPERS, OWNERS & MANAGERS

Build, own, and operate only net zero carbon buildings

Calls to Action

1. **Commit** to developing, owning and/or managing assets that are net zero carbon by the key milestones; **Implement** policies and practices, both internally and with tenants, to ensure assets operate at net zero carbon as soon as possible.
2. **Disclose** carbon emissions for all assets before 2030.
3. **Certify** all new assets as net zero carbon from 2030; certify all assets as net zero carbon by 2050.

Benefits To and Rationale for Developers, Owners, Managers

Developers Net zero carbon developments will become increasingly attractive to both investors and to tenants, and will result in significantly reduced operating costs, therefore generating good return on investment (ROI);

Owners and managers Net zero carbon developments will attract higher-quality tenants at increased rental rates (given the savings tenants will realise in reduced energy costs). These will increase asset values and provide market recognition opportunities, especially amongst the first owners and developers to provide such assets.

Owners and managers Remain ahead of the regulation curve in countries updating to more stringent building energy efficiency requirements.

Market Leadership Examples

See the following pages for case studies:

LENDLEASE, BARANGAROO

Aims to be world's first high-density carbon neutral development in operation

Commercial buildings achieved 6-Star Green Star – Office Design v3

Participant in the Climate Positive Development Program

Name:
Barangaroo

Size:
600,000 m^2

Location:
Sydney, Australia

Year Built:
2015-2020

Strategies towards net zero carbon:

Chilled water and harbour cooling system

On-site solar energy generation

Off-site renewable energy facility and carbon offset projects utilised to offset residual onsite carbon emissions

© Integral Group

DPR CONSTRUCTION REGIONAL OFFICE

Net zero energy office refurbishment

First ILFI certified net zero energy building in San Francisco

Winner of International Project of the Year, CIBSE Building Performance Awards 2017

Name:
DPR Construction

Size:
2,043 m^2

Location:
San Francisco, California, USA

Year Built:
2014

Strategies towards net zero carbon:

118 kW roof mounted photovoltaic array

VRF system to provide efficient heating and cooling with heat recovery

Maximized daylight via solar light tubes and dynamic glazing

Zero on-site combustion

Generates more renewable energy than it consumes.

AKTIV-STADTHAUS

Multi-unit energy positive housing development

Winner of European Solar Prize 2015; Among Top 3 of "DGNB Prize Sustainable Building" 2016

Name:
Aktiv-Stadthaus

Size:
11,700 m^2

Location:
Frankfurt, Germany

Year Built:
2015

Strategies towards net zero carbon:

Highly efficient envelope system

Sewer connected heat exchanger and heat pump system

Roof and façade mounted photovoltaic panels combined with battery system

First and largest inner city multiple home residential building to receive the federal energy-efficiency-plus certificate, meaning it generates more energy than its residents consume[43].

[43]News article: HHS, 23rd November 2015
http://www.hhs.ag/european-solar-prize-2015-goes-to-aktiv-stadthaus-frankfurt-am-main.en.html

BUSINESSES AS TENANTS

Commit to renting only net zero properties

Calls to Action

1. **Commit** to renting the lowest carbon properties available in your market as soon as possible (determined through building certifications).
2. Set and **disclose** corporate policies with year (before 2050) by when you will only occupy net zero carbon properties.
3. For existing properties, work with each owner/manager to **implement** and achieve net zero carbon operations by 2050.

Rationale for Tenants

Reputation Companies of all kinds, in all industries, are positioning themselves as leaders battling climate change. A key way for interested companies to do this is to commit that their own operations, including offices, are carbon neutral.

Cost efficiency Companies who pay their utility costs are extremely motivated to reduce these costs. While for some businesses, energy costs may be a small percentage of overall costs, this is not the case both for smaller businesses and energy-intensive businesses, including light industry and data centres.

Market Leadership Examples

As far as WorldGBC is aware, no companies have yet pledged to tenant only net zero buildings. Despite this opening for a market leadership position, a few developments in the area of building tenancy raise the expectation that this leadership is forthcoming.

Green Leases Leaders Programme

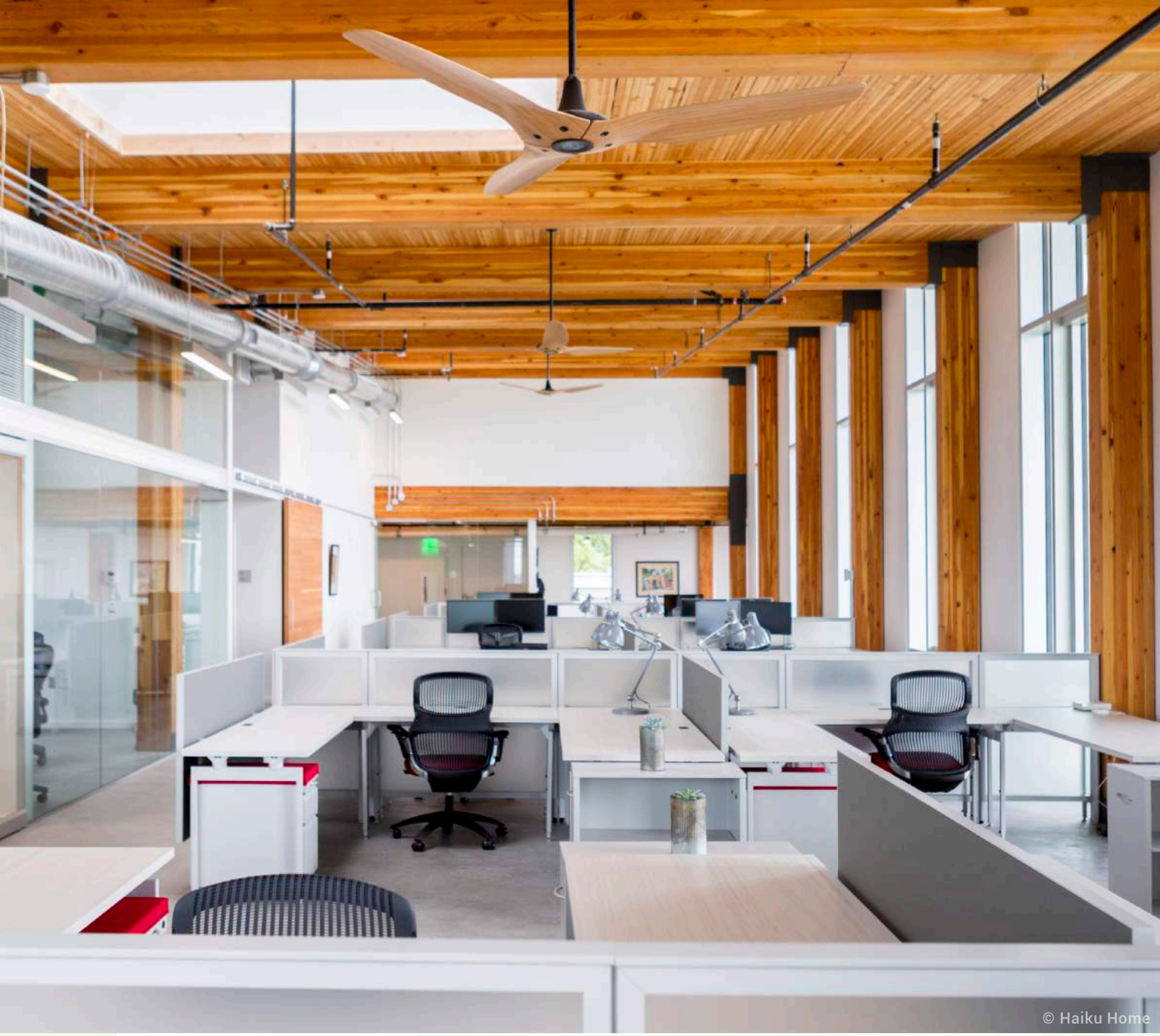
The Institute for Market Transformation (IMT) in the United States runs a programme recognising landlords and tenants who are working to reduce their energy consumption and GHG emissions. To be recognized, tenants must commit to conditions such as:

> Agreeing to disclose their utility data for the purpose of building energy benchmarking;
>
> Encouraging energy efficiency improvements to be implemented;
>
> Implement a corporate policy preferring to work with agents and brokers with sustainability training or certification; and
>
> Agreeing to purchase power generated on-site if provided by landlord and competitively priced[44].

See the following pages for case studies:

Bullitt Center Page 37

[44]Green Lease Leaders, 'Tenant Lease Requirements' http://www.greenleaselibrary.com/program-requirements.html#Tenant



BULLITT CENTER

Net zero energy and net zero carbon tenanted building

Living Building Challenge certified

Name:
Bullitt Center

Size:
4,646 m^2

Location:
Seattle, Washington, USA

Year Built:
2013

Strategies towards net zero carbon:

Tenants under lease are allotted an energy target to meet for their space.

Responsible for the energy bill only if they exceed their energy use budget; requiring consideration of light fittings selection and plug loads from electronic equipment[45].

This provides a financial incentive to operate efficiently, and ensure the building's energy requirements are controlled.

[45] 'The Power of Zero: Learning from the World's Leading Net Zero Energy Buildings', Brad Liljequist, ILFI, 2016

Government

We call on national governments and sub-national governments to take actions specific to their role in achieving a net zero building stock:

NATIONAL GOVERNMENTS

Commit to reducing national greenhouse gas (GHG) emissions through reductions in emissions from public and private-sector buildings

Calls to Action

1. **Commit** to developing national regulations for new buildings (all building types) to be net zero carbon from 2030 or earlier and for all buildings to be net zero carbon by 2050 or earlier, including implementing plans, incentives and strategies to support the building market in achieving the above standards.
2. **Commit** to occupying only certified net zero carbon buildings before 2030.
3. **Collaborate** with stakeholders, including the business sector and NGOs, to identify and overcome the barriers preventing net zero carbon buildings. This includes working with GBCs who are developing certification programmes, training professionals and educating the public.

SUB-NATIONAL GOVERNMENTS - CITIES, STATES AND REGIONS

Commit to reducing sub-national GHG emissions through reductions on emissions from public and private-sector buildings

Calls to Action

1. **Commit** to developing sub-national regulations for building types as outlined above at cities, state and regional level.
2. **Commit** to occupying only certified net zero buildings before 2030.
3. **Collaborate** with stakeholders as outlined above.

Rationale for Government

National governments Taking action to reduce GHG emissions from public and private-sector buildings of all types provides a cost-effective and economically beneficial means to mitigate the impacts of climate change and achieve Paris Agreement commitments.

Sub-national (i.e. local and regional) governments Similar benefits are on offer. Rather than achieve the Paris Agreement, to which sub-national governments are not parties, reducing GHG emissions from buildings will help cities and regions achieve their own climate agenda and help avoid the impacts of climate change which impact individuals, often first at the city-level.

Market Leadership Examples

Regulation requiring nearly net zero energy buildings *Energy Performance of Buildings Directive*

Directive 2010/31/EU requires all EU member states to define nearly zero energy performance in building standards and to ensure that all new buildings occupied and owned by public authorities are nearly zero energy after December 31, 2018 and all new buildings are nearly zero energy by December 31, 2020[46].

National recognition of building sector potential *Government of India*

Among the Nationally Determined Contributions (NDCs) submitted to the UNFCCC in advance of COP21, the Government of India's submission[47] stood out in particular to experts as recognising the potential that buildings could play in helping the country achieve its national emission reduction targets. Specifically, the submission referenced India's Energy Conservation Building Code, including plans to eventually mandate net zero for new construction and major renovations. The submission also references the 200 million square metres of floor area certified green across 3,000 projects and the growth potential.

<50% of countries recognise the potential of buildings in their NDCs

Out of 193 NDCs submitted to the UNFCCC, slightly less than 50% include building sector action as a key strategy to achieve targets that will keep global temperature rise below two degrees[48].

As a related 'call to action', WorldGBC calls upon all national governments to recognise that building sector action provides one of the most cost-effective strategies to achieve climate targets and to, therefore, include building sector action in the next and all subsequent NDCs.

[46]European Parliament and Council on Energy Efficiency of Buildings, 'Directive on Energy Performance of Buildings (Directive 2002/91/EC)' December 2002, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:001:0065:0071:EN:PDF

[47]UNFCCC website http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf

[48]Global Alliance for Buildings and Construction, 'Global Roadmap towards low-GHG and resilient buildings', November 2016

Collaboration to promote net zero carbon buildings *Government of Australia, Department of the Environment and Energy and Green Building Council Australia*

The Australian Department of the Environment and Energy has collaborated with the Green Building Council of Australia to develop a voluntary recognition standard for net zero carbon buildings and precincts. The National Carbon Offset Standards (NCOS) for Buildings and for Precincts are currently being finalised following an extensive consultation phase. This label, for buildings achieving carbon neutrality in operation, provides a common framework for investors, developers, owners, managers and tenants to recognise market leading buildings and precincts. The draft programme permits the purchase of renewable energy credits and offsets as a strategy designed to increase investment in Australia's renewable energy sources.

Innovative net zero energy retrofit programme *Energiesprong*

Originating as an initiative of the Dutch government, this programme is a whole house refurbishment and funding approach which results in net zero energy homes. Energy performance contracts are used to guarantee the performance of the improvements over a long-term (minimum 30-year) period. This provides financial security to the property owner as they know that it will perform at the expected level, and protects the tenant against rising energy prices[49]. Now active in the Netherlands, and being introduced into France, Germany, the United Kingdom and the U.S. (New York State), the programme has delivered more than 800 net zero energy homes (as of February 2017)[50].

City & Regional Leadership in tracking, reporting and reducing GHG emissions

Today, more than 500 major cities are reporting carbon emissions, an increase of more than 70% since the signing of the Paris Agreement.

Over 190 major cities have developed specific climate action plans with firm carbon targets. WorldGBC plans to work with like-minded partners to encourage that, just as national strategies should focus on net zero buildings, all city-level action plans should specifically address building policy (regulation, incentives, etc.) as key strategies to meet the cities' targets.

[49]Energiesprong http://energiesprong.eu/wp-content/uploads/2016/12/NL-long_version.pdf

[50]News article: National Energy Foundation, 10th February 2016 http://www.nef.org.uk/about-us/press-releases/dutch-energiesprong-housing-innovation-to-come-to-the-uk

State-wide net zero energy policy *California, United States*

In 2007, California adopted the goal that all new residential construction would be net zero energy by 2020 and all new commercial construction would be net zero energy by 2030. In 2008, the state's Public Utilities Commission adopted a Long-Term Energy Efficiency Strategic Plan, which reiterated this commitment[51]. By 2015, the state launched its Zero Net Energy Action Plan to ensure that all new homes will be net zero energy by 2020[52].

Province-wide net zero carbon residential plan *Ontario, Canada*

In July 2016, the province of Ontario, Canada revised its five-year Climate Change Action Plan and included specific plans for net zero carbon homes, including rebates to individuals who purchase or build net zero homes[53].

City-level net zero carbon buildings plans

Cities are taking a lead in implementing strategies to significantly reduce emissions within their jurisdictions. For example, **The City of Vancouver, Canada** will require all buildings constructed from 2020 onwards to be carbon neutral in operations[54]. Similarly, **Melbourne, Australia**, has committed to being a carbon neutral city by 2020[55]. As of October 1, 2016, the **Greater London Authority, United Kingdom**, requires all new residential development to achieve a 'zero carbon standard', though based on modelled data and not including plug loads. Housing Supplementary Planning Guidance explains that this standard must be achieved first through a 35% reduction in regulated carbon dioxide emissions, beyond Part L of Building Regulations. The remaining regulated carbon dioxide emissions are "to be off-set through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere"[56].

See the following pages for case studies:

Ministry of Environment & Forest	Page 42
Department of Environmental Affairs	Page 43
National Renewable Energy Lab	Page 44
Mineirão Stadium	Page 45
Maison Île de France	Page 46

[51]http://www.californiaznehomes.com/about

[52]News article: Greentech Media, 10th June 2015 https://www.greentechmedia.com/articles/read/California-Wants-All-New-Homes-to-be-Net-Zero-in-2020

[53]Ontario, 'Climate Change Action Plan' https://www.ontario.ca/page/climate-change-action-plan#section-5

[54]http://vancouver.ca/green-vancouver/green-buildings.aspx

[55]http://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/zero-net-emissions-strategy.aspx

[56]Greater London Authority, 'Energy Planning – GLA Guidance on preparing energy assessments' https://www.london.gov.uk/what-we-do/planning/planning-applications-and-decisions/pre-planning-application-meeting-service-0

MINISTRY OF ENVIRONMENT AND FOREST BUILDING

Large net zero energy government office

India GBC Platinum rating

1,001 tons of CO_2 emissions reduction per year

Name
Indira Paryavaran Bhawan, Ministry of Environment and Forests

Location
New Delhi, India

Size
31,400 m^2

Year Built
2014

Architect
CPWD, New Delhi

Strategies towards net zero carbon/energy

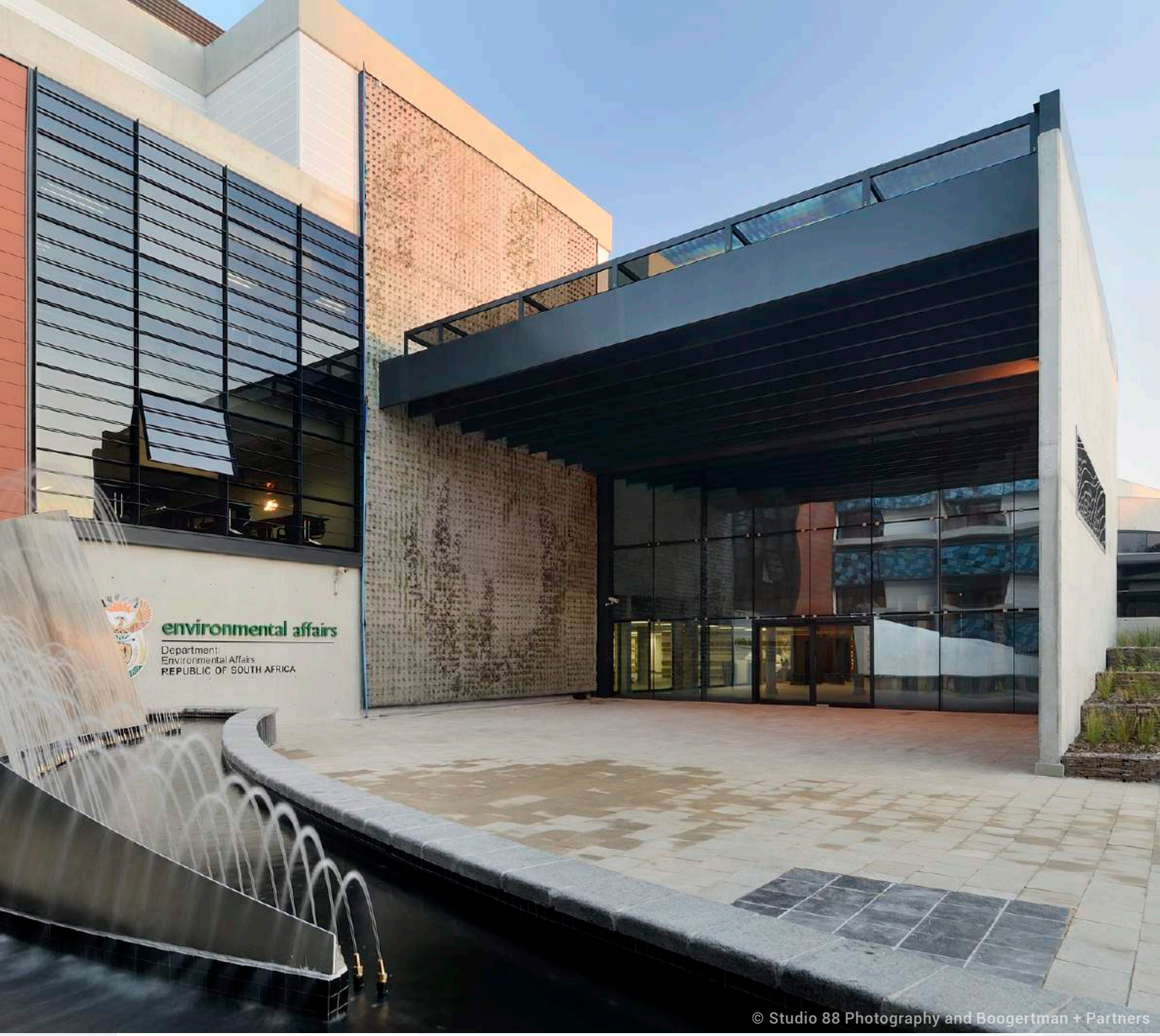
High-performance envelope

Daylighting and LED lighting

Chilled beam system and geothermal cooling

930 kW solar system

40% energy savings using passive strategies



© Studio 88 Photography and Boogertman + Partners

DEPARTMENT OF ENVIRONMENTAL AFFAIRS BUILDING

Government office building with positive energy balance for base building loads

6 Star Green Star certification

Name
Department of Environmental Affairs

Location
Pretoria, South Africa

Size
30,654 m^2

Year Built
2014

Strategies towards net zero carbon/energy

Optimised orientation, shading and building envelope

Full energy monitoring and control through a central Building Management System

High-efficiency electric lighting with occupancy detection

On-site PV and solar thermal systems

NATIONAL RENEWABLE ENERGY LAB (NREL)

Largest net zero energy building in North America

LEED Platinum certified

Name
Research Support Facility, NREL

Location
Colorado, USA

Size
33,445 m^2

Year Built
2010

Strategies towards net zero carbon/energy

Transpired solar collectors deliver heat to thermal labyrinth acting as heat storage and thermal sink

Super-efficient data center uses evaporative cooling, outside air ventilation, waste heat capture

2.5 MW rooftop PV system

92% of building is naturally daylit

Produced more energy than it consumed between April 2013 and April 2014[57].

[57]http://plus.usgbc.org/mission-accomplished/

MINEIRÃO STADIUM

Net positive stadium, powering adjacent community

LEED NC Platinum

Public-Private Partnership (PPP)

Name
Mineirão Stadium

Size
348,900 m^2

Location
Belo Horizonte, Brazil

Year Built/Renovated
1965/2014

Strategies towards net zero carbon/energy

6,000 panel 1.4 MW solar PV array

Only 10% of energy generated required to power stadium – remaining 90% distributed to surrounding community: the solar photovoltaic power plant generated more than 300 MWh in two months of operation, supplying energy to about 1,200 houses[58]

[58]News article: Arch Daily Mineirão Stadium / BCMF Arquitetos, 7th June 2013 http://www.archdaily.com/383430/mineirao-stadium-bcmf-arquitetos

MAISON ÎLE DE FRANCE, STUDENT RESIDENCE

100% solar energy strategy, collaborative design process

Région Île de France project demonstrating leadership in future energy regulation: to be positive-energy in France by 2020

Name
Maison Île de France

Size
5,000m²

Location
Paris, France

Year Built
2017

Strategies towards net zero carbon/energy

Designed with a fully-collaborative approach, between the engineering firm (DEERNS France) and the architect (ANMA)

100% solar-energy strategy, covering all the energy needs

Fully natural ventilation strategy, no cooling installations

Technology will inform occupiers in real-time about their actual consumption

NGO SECTOR

Provide direction, education and tools to support the implementation of market transformation

Calls to Action

1. **Develop** net zero carbon building certification programmes as soon as possible for leading businesses to voluntarily adopt and to show market readiness to governments.
2. **Engage** with governments to create roadmaps, incentive programmes and tracking systems for the rapid development of net zero carbon buildings.
3. **Educate, train and mobilise** businesses and the public on the commercial benefits, feasibility and skills necessary to deliver net zero carbon buildings.

Rationale for NGOs

Green Building Councils and other NGOs are well positioned to lead a net zero carbon transformation of the building stock due to the innovation, advocacy and partnerships they have developed through their networks over many years of delivering green buildings to market. Voluntary green building rating systems, offered by GBCs and others, have succeeded in catalysing the early adoption of high performance buildings while driving a broader and long-term transformation of the marketplace. Now, GBCs and others are adapting this model to drive the next wave of innovation towards net zero carbon buildings.

Market Leadership Examples

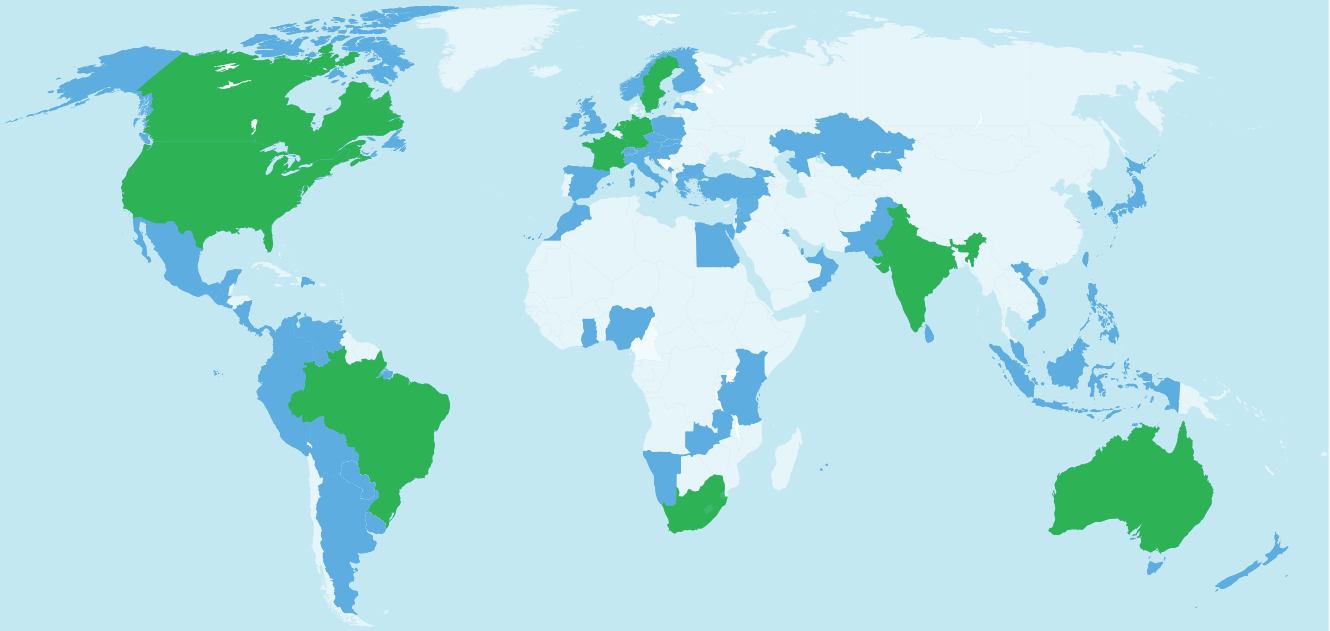
Green Building Councils

Ten Green Building Councils have already publicly committed to creating or adopting net zero carbon certification programmes by early 2018. Several others plan to do the same before 2020. In working through the WorldGBC network, GBCs will be encouraged to, where appropriate, adopt consistent definitions and programme rules so that global businesses with properties in multiple markets can make portfolio commitments.

GBCs participating in our Advancing Net Zero Project (as of May 2017)

GBC Member Country

GBC currently creating a net zero certification/verifcation programme



The GBC Global Network

1
World Green Building Council

5
Regional Networks

914
full and part time employees

76
Green Building Councils

32,000
member companies

Millions
of lives changed

Architecture 2030

Architecture 2030 is a U.S.-based think tank dedicated to rapidly transforming the global building sector to zero carbon by 2050. It co-defined the term 'Zero Net Carbon' (ZNC) and has set a path for all new buildings to be designed ZNC by 2030. Currently it supports cities in reaching their carbon reduction commitments through both private sector leadership and a robust public policy framework. It has also pioneered embodied carbon emissions reductions in the building sector and collaborated with both Chinese and international design and planning communities to drive the current shift to ZNC in the built environment.

International Living Future Institute (ILFI) Living Building Challenge

The ILFI is an international NGO aiming, among others things, to recreate civilisation to thrive without fossil fuels. Through its core Living Building Challenge programme, the organisation has been certifying zero energy performance for over a decade. The ILFI also has stand alone Zero Energy Building and Zero Energy Community Certifications, as well as a building energy performance label, 'Reveal'. In addition to its certifications and labels, the ILFI helps to lead the zero energy movement through education, conferences, targeted advocacy, consulting, and the coaching of project teams.

C40 Cities Climate Leadership Group (C40)

C40 connects over 90 of the world's greatest cities, representing 600 million people and one quarter of the global economy, with the aim of progressing urgent climate action. Reducing emissions from energy and buildings is a vital part of C40's work, consisting of several city networks and a technical assistance program covering building codes and standards, reporting building energy performance data, energy efficiency/ retrofit measures, and clean energy generation.

C40 also runs the 'Climate Positive Development Program' supporting the creation of large-scale urban communities that seek to meet a "climate positive" target of net-negative operational greenhouse gas emissions. The program is currently working with 19 projects globally that, once completed, will impact nearly one million people. Over 40 C40 member cities have developed climate action plans with firm carbon targets[59], and to date over 2000 buildings sector climate actions have been reported by over 60 C40 cities[60].

International Union of Architects

In 2014, this global network organisation passed a 'Declaration 2050 Imperative' pledging to "plan and design cities…and new buildings to be carbon neutral" and to "plan and design sustainable, resilient, inclusive and low-carbon/zero-carbon built environments"[61].

There are many other NGOs working specifically on the topic of reducing emissions from buildings, including:

- Compact of Mayors
- Covenant of Mayors
- Carbon Neutral Cities Alliance
- New Buildings Institute
- Net Zero Energy Coalition

[59] http://www.c40.org/programmes/compact-of-mayors

[60] 'Climate Action in Megacities 3.0', 2015 http://www.cam3.c40.org/images/C40ClimateActionInMegacities3.pdf

[61] UIA World Congress, 'Declaration 2050 Imperative', 2014 http://www.uia.archi/sites/default/files/EN_Declaration_Durban.pdf


JOIN US

section five

JOIN US

The WorldGBC's Advancing Net Zero project was launched in 2016 to ensure that our organisation and member Green Building Councils work towards a global net zero carbon building stock, to help win the battle against climate change by keeping global temperature rise in line with the goals of the Paris Agreement.

100% net zero carbon buildings by 2050 is possible if all partners and sectors of the building and construction industry work together, with multiple and signficiant benefits to the market. But we must start today.

This report has outlined how we see business, government and NGOs, including GBCs, working together to move net zero carbon buildings from market-leading projects to business-as-usual.

We invite you to join us

WorldGBC invites everyone in the real estate sector, whether an investor, developer, owner, manager, architect, designer or consultant, and representatives of national government, states and cities, to work with their local GBCs, us and our partners to ensure that all our buildings, everywhere, are net zero carbon before 2050. These actions will ensure sustained change towards achieving the targets set out in this report long beyond 2050, in order to realise the full impact.

We hope you will contact your local GBC or the WorldGBC to join us on this important journey.

WORLD
GREEN
BUILDING
COUNCIL