Executive Summary

Buildings account for nearly 40% of the world's greenhouse gas emissions and there is no decarbonizing our future without decarbonizing buildings. The good news is the technologies needed to get the job done exist today. The Sustainable Buildings Taskforce has outlined best practices and recommendations to achieve a more sustainable built environment through technology adoption, supported by smart policies and innovative partnerships and incentives.

Implementing technology-based solutions

Technologies that can dramatically reduce a building's carbon emissions and energy consumption exist today. Three key technology groups that are critical to curbing carbon emissions by 2050 include energy efficiency technologies, electrifying equipment and renewables. There is a need to accelerate technology deployment, however, and it can only be achieved if the right policies and partnerships and incentives are in place, and business models are created that help carbon reduction.

Coordinated global partnerships

For the private sector to accelerate the transition to a sustainable future, coordinated global partnership and incentive structures must be leveraged. The built environment industry can organize itself to implement ambitious and creative models that include corporate-led initiatives, NGO-led initiatives, and innovative financing models.

Innovative partnership models can also better align the interests of commercial building developers, owners, and building tenants to encourage decarbonization and get agreement on conservation objectives that drive energy consumption and emission reductions. Digital technologies should be deployed that will enable real-time and real-world building performance to be known and current. Rating programs need to be live and continuous, as compared to static, to drive transparency and demand for more efficient buildings.

The SMI Sustainable Buildings Task Force recognises its role in accelerating the delivery of net zero buildings to reduce carbon emissions. Together, the Members are united by a common ambition to harness the power of technology and drive partnerships and policy decisions that enable the adoption of sustainable building technology and drive a lower carbon future. In addition to commitments to achieve Science Based targets, member companies will prioritize work on buildings, specifically committing to have at least one carbon-neutral building by 2030, while decarbonizing heat and deploying ultra-low carbon building materials.

SMI Sustainable Buildings Task Force members:

- George Oliver, Chairman & CEO at Johnson Controls, chair of the SMI Sustainable Buildings Taskforce
- Troy Rudd, CEO, AECOM
- Bob Sulentic, President & CEO, CBRE, SMI Sustainable Buildings Partnerships and Incentives Workstream Lead
- Paul Williams, CEO, Derwent London
- William Beardmore-Gray, Chair of the Group Executive Board Knight Frank
- Steve McGill, Founder and CEO, McGill and Partners
- Elliot Robertson, CEO, Robertson Group
- Dave Regnery, Chair and CEO Trane Technologies, SMI Sustainable Buildings Technology Workstream Lead
- Michael Stassinopoulos, Executive member of the Board, Viohalco

Corporations can accelerate action to decarbonize the built environment

Sustainable Buildings Task Force

Introduction

As the world faces unprecedented changes to its climate, urgent action is needed to decarbonize the built environment at all levels – by governments, corporations, organizations, and individuals - since buildings contribute to 39 % of CO_2 emissions globally Global Status Report for Buildings and Construction 2019 – Analysis - IEA

The Sustainable Markets Initiative (SMI) is among the leading initiatives to coordinate the global effort to accelerate the private sector transition to a low-carbon, sustainable future. The SMI operates under the mandate of the Terra Carta | Sustainable Markets Initiative (sustainable-markets.org) – a charter that provides a compelling set of principles to 2030 for businesses to move towards sustainable markets.

The Sustainable Buildings Task Force, one of SMI's 11 Task Forces, is comprised of global CEOs from throughout the buildings industry working together to accelerate the delivery of net zero buildings. (Read recent announcement) The Sustainable Buildings Task Force supports the overall SMI mission to speed the world's transition to a sustainable future by engaging and challenging public, private, and philanthropic sectors to bring economic value, in harmony with social and environmental sustainability.

The built environment continues to be a major contributor to global carbon emissions annually, representing 39% of global carbon emissions. Of that figure, 28% of carbon emissions come from the energy required to heat, cool and power them every day (operational carbon), and the remaining 11% of carbon emissions come from the materials used in buildings.

In other words, almost half of energy demand for buildings was used for space and water heating in 2021, leading to 2 450 Mt of direct CO_2 emissions. Heating – Analysis - IEA

Corporations are ready to play a significant role in reducing global carbon emissions. The technologies needed to decarbonize buildings are available now. We have the solutions that help meet the ambitions of the Paris Agreement, net zero targets and decarbonization policies adopted by governments around the world.

Yet while technologies exist today to dramatically reduce a building's carbon emissions, there is still much that needs to be done to help corporations accelerate deployment of these solutions, including policies that incentivize the adoption of proven technologies, coordinated global partnerships, and tools that enable the private sector to effectively use available incentives.

As the Sustainable Buildings Task Force, we have developed this white paper to deliver our recommendations for accelerating action to decarbonize the built environment.

Technology-based solutions

Managing energy consumption for the heating and cooling of buildings and industry is essential if nations are to achieve global carbon reduction goals. According to the International Energy Agency (IEA), almost a fifth of the growth in global energy use in 2018 was due to hotter summers increasing demand for cooling and cold snaps leading to higher heating needs.

A host of technical solutions exist today that can enable companies to decarbonize the built environment and help societies reach net zero by 2050. Those that are crucial to organizations striving to lower their carbon footprint can generally be split into three groups:

1. Energy efficiency technologies
2. Electrification
3. Renewables

While these routes to decarbonization are often integrated or complimentary, their general goal is to cut carbon through energy savings and/or replacement of fossil fuel energy sources, especially in heating.

* Energy efficiency technologies: Energy efficiency technologies reduce energy consumption while providing the same or a better service, leading to lower carbon emissions and reduced costs. Minimizing energy consumption ensures the optimal performance of existing resources and reduces energy waste.

Many buildings consume more energy than they require, so the ability to digitally optimize energy use offers one of the most straightforward and substantial ways to minimize a building's appetite for energy consumption.

There are several means to improve energy efficiency especially in smart building management systems.

Building owners, managers and occupants can benefit greatly from implementing digital solutions to understand where and how energy is used in the building and then using that information to make informed decisions based on the behaviors and preferences of the building's occupants. For example, decisions around heating, ventilation, and air conditioning (HVAC) can be made based on internal (occupancy) and external (weather) conditions, utility market rates and the equipment performance profile. Lighting systems and water heating can also be digitally managed and controlled based on patterns so that, for example, hot water and lighting are only provided when and where required. Energy forecasting improves energy efficiency by applying peak shaving, load shifting, and demand response and aiding in sourcing decisions. Digital technologies enable the monitoring of energy consumption, benchmarking, profiling, and forecasting to automate decisions, improve energy efficiency, decrease consumption, and reduce costs and carbon emissions, creating truly dynamic buildings.

* Electrifying equipment: Heat pumps are key to electrifying space heating. The average efficiency of a heat pump is significantly higher than that of fossil fuel powered alternatives.

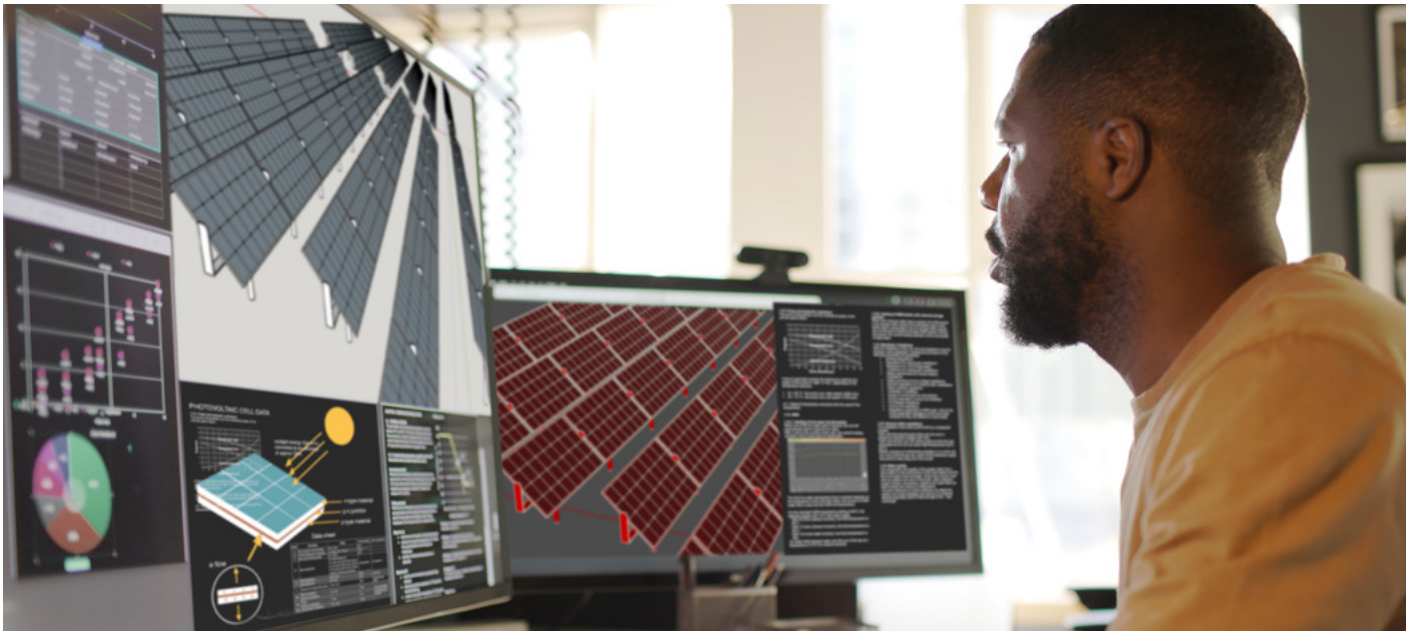
The environmental benefits of heat pumps go to an even higher level if the heat pump is powered by electricity from a renewable source, such as wind or solar. A heat pump's ability to provide heating and cooling simultaneously not only makes it well suited to commercial buildings, but also for use in data centers and industrial processes. The various types of heat pumps – water (and wastewater) source, air source, and ground source (with or without solar assist)– are mature (five-plus years) technologies and are widely available. In addition, the refrigerant used in these heat pumps has a positive impact on the climate by lowering emissions and furthering decaronization goals.

The electrification of heat through heat pumps, where the electricity to drive the heat pumps comes from renewable sources, is therefore seen as a key technology in cutting carbon emissions in the industrial sector. Their use is also an integral part of decarbonising heat in the creation of smart, sustainable cities.

The growing movement of countries towards net zero carbon emissions by 2050 is likely to accelerate the replacement of fossil fuelled boilers with heat pumps. In the net zero 2050 (NZE2050) scenario of its latest World Energy Outlook 2020, the IEA forecasts that, together with other low-carbon heat sources, heat pumps displace an additional 80 Mtoe of fossil fuels on top of the 110 Mtoe reduction that occurs in its Sustainable Development Scenario between 2019 and 2030. In total, electricity and low-carbon fuels provide around one-quarter of heat demand in industry in 2030 in the NZE2050.

Europe, which is leading the move to be carbon neutral by 2050, has already committed to at least 55 percent cuts in greenhouse gas emissions (from 1990 levels) by 2030 and is proposing to increase this ambition to 55% under the European Green Deal (EGD). More recently it has also put climate change and the energy transition at the heart of its economic recovery from the COVID-19 pandemic, providing economic incentives for the implementation of low-carbon technologies and energy efficiency. Heat pumps are an important part of the equation; a heat pump might typically have a Coefficient of Performance (COP) of 3-5 (or higher depending on the application), i.e., it can transfer 500% more energy than it consumes. Put another way, it produces 5 kW of heat for every 1 kW input of electricity. In contrast, a high-efficiency gas boiler is about 95% efficient, meaning 95% of the energy in the gas comes out as useful heat, with the other 5% being lost as heat through the flue.

* Renewables: Renewable energy sources such as wind and solar, combined with battery storage, can enable corporations to secure their own reliable and clean electricity supply. A growing number of organizations are also guaranteeing clean wind and solar power through the purchase of renewable energy through power purchase agreements (PPAs) with renewables electricity generators. Solar can also be combined with thermal storage to provide domestic hot water in buildings. Solar thermal is similar to solar PV (photovoltaics), but rather than turning the sun's energy into electricity, this system uses it to heat water. Another possibility is to use solar for space heating. Passive solar space heating involves the design of buildings to absorb, store, and redistribute thermal energy without the use of mechanical equipment.



Accelerating technology adoption

While the emissions reduction technologies described here are available and can be economically competitive and attractive, there is a need to accelerate their deployment if urgent emissions reduction and sustainability targets are to be met. This, however, can only be achieved if the right regulations, policies and incentives are in place, and business models can be created that make rollout easier.

Government policies and initiatives

Various policy gaps exist around the world. In a market such as the USA, there can be varying challenges from state-to-state due to different regulations. For example, trying to install solar in some areas can be very difficult, as certain utility providers do not allow installations greater than a tenant's load.

In the EU, the Energy Performance of Buildings Directive (EPBD) is the main legislative instrument aiming to promote the improvement of the energy performance of buildings within the bloc. Its most recent revision in December 2021 sets out how Europe can achieve a zero-emission and fully decarbonized building stock by 2050. The proposed measures will increase the rate of renovation, particularly for the worst-performing buildings in each Member State.

The EPBD supports better air quality, the digitalization of energy systems for buildings and the roll-out of infrastructure for sustainable mobility. Crucially, the revised directive encourages more targeted financing towards investments in the building sector.

However, driving decarbonization of heating has not been prioritized. While the EU Climate law sets a binding legal commitment to reduce 55% of the CO_2 that was emitted in 1990 by 2030, the pathway and how decarbonization of heating can contribute to the objective is not well defined.

Europe's 2016 Heating and Cooling Strategy must be updated to reflect the aim of the EU's objective to be carbon neutral by 2050 (EU Green Deal) and also reflect the current energy crisis and the EU's plan to be independent of Russian gas by 2027 (REPower EU). EU policy has the right objectives, and the EU is the only region that has a binding legal commitment to decarbonize buildings, but more needs to be done to increase adoption of technologies, such as heat pumps.

Promoting technology with policy is exemplified by the EU Solar Energy Strategy, which includes the following initiatives:

- European Solar Rooftops Initiative
- EU large-scale skills partnership for renewable energy
- EU Solar PV Industry Alliance
- Commission's permitting package (legislative proposal, recommendation and guidance).

These initiatives will introduce a legally binding EU solar rooftop obligation to ensure accelerated installation of solar panels on buildings, help create a skilled workforce necessary to produce, install and maintain solar panels, and support the EU industry in expanding the domestic production of photovoltaic panels. The installation of rooftop solar energy will be compulsory for all new public and commercial buildings with useful floor area larger than 250 m^2 by 2026, all existing public and commercial buildings with useful floor area larger than 250 m^2 by 2027, and all new residential buildings by 2029. Moreover, the Commission aims to make permitting procedures shorter and simpler through a legislative proposal, recommendation and guidance.

In the USA, the government itself has taken the lead in cutting carbon emissions from buildings. Early last year the Green Building Advisory Committee (GBAC), an advisory body to the U.S. General Services Administration (GSA), approved a series of procurement principles to enable a shift to low embodied carbon building materials and approaches.

Another more recent initiative, launched in late September by the US Department of Energy's Energy Earthshots Initiative™, is the Industrial Heat Shot™. This latest effort is aimed at dramatically reducing the cost, energy use, and carbon emissions associated with the heat used to make everything from food to cement and steel. The goal is to develop cost-competitive solutions for industrial heat with at least 85% lower greenhouse gas emissions by 2035. If this target is achieved, the American industrial sector will be on course to reduce its carbon equivalent emissions by 575 million metric tons by 2050, roughly equal to the annual emissions generated by all passenger cars currently on the road.

It is often noted that interests among commercial building developers, owners, and occupiers/tenants are not always aligned. Developers and owners may be focused on minimizing upfront and operational costs; occupiers/tenants may be focused on the features of a space that maximize their productivity and ensure a delightful experience for their customers or employees. As it relates to ensuring decarbonization is a priority in commercial spaces, several initiatives are helping to bridge the gap. In "green leases" for example, owners and occupiers can agree on conservation objectives and economics that drive energy consumption and emission reductions. Moreover, digital technology can enable owners and occupiers/tenants to have clear visibility to how energy is being consumed and understand the measures that can be taken to cut consumption and cost.

Finally, the US federal government, along with states and municipalities, are addressing carbon emissions in existing buildings through the pursuit of Building Performance Standards (BPS). These policies set mandatory energy intensity thresholds that existing buildings must meet each year, thereby establishing a trajectory to achieve emissions reduction targets for buildings in a given jurisdiction. In 2022 the White House Council on Environmental Quality (CEQ) announced the Building Performance Standards Coalition, a group of 33 states, counties, and cities committed to adopt BPS by Earth Day 2024. Collectively, these jurisdictions represent roughly 19 million square feet of commercial floorspace. CEQ is also working with GSA to establish BPS for the federal buildings portfolio.

Policy enables the private sector to take action to accelerate building decarbonization. Policy and incentives for solar technologies have greatly accelerated their adoption. Heat pumps and digital technologies are proven to significantly decarbonize a building's heating. Therefore, regulators should enact policy and incentives for low carbon heat sources in order to incentivize their adoption.

Corporate-led initiatives

In the face of the climate change, corporations are taking action. Many organizations have already set challenging sustainability goals and commitments to reduce carbon output under the auspices of various business-led pledges and programs.

Already some key initiatives are having significant impact:

- The Science Based Targets initiative (SBTi) drives ambitious climate action in the private sector by enabling organizations to set science-based emissions reduction targets. Through SBTi, more than 3800 companies have committed to taking action and more than 1800 have set a science-based target.
- The Climate Pledge is an environmental protection initiative co-founded by Amazon and Global Optimism, where signatories commit to reaching net zero carbon emissions by 2040, ten years ahead of the goal set out in the Paris Climate Agreement.
- RE100 is bringing together the world's most influential businesses committed to using 100% renewable electricity by 2050 at the latest. Led by the Climate Group and in partnership with CDP, RE100's 370+ members have already driven over 390 TWh/y of renewable electricity production.

NGO-led initiatives

The World Green Building Council's Net Zero Carbon Buildings Commitment calls on the building and construction sector to take action to decarbonize the built environment, inspire others to take similar action, and to remove barriers to implementation. The Commitment considers the whole lifecycle impact of buildings and builds on WGBC's Whole Life Carbon Vision and best practice principles for implementation.

The Commitment requires that by 2030:

- Existing buildings reduce their energy consumption and eliminate emissions from energy and refrigerants removing fossil fuel use as fast as practicable (where applicable). Where necessary, compensate for residual emissions.
- New developments and major renovations are built to be highly efficient, powered by renewables, with a maximum reduction in embodied carbon and compensation of all residual upfront emissions.

Green financing & Business models

Financing and access to funds is imperative for organizations to build working business models around environmental and sustainability technology. Innovation in business models can enable more individuals, organizations, and companies to accelerate their decarbonization journey.

For example, providing heating-and-cooling-as-a-service – where organizations could make monthly payments as opposed to investing upfront capital to update technology and achieve emission reductions--could be an impactful model. In this model, the upfront capital cost can be paid for by securitizing the stream of energy cost savings to be achieved by the upgrade

Another innovative business model could see solar companies rent out solar-panelled roofs, for example, and sell electricity back to the building owner. This type of scheme has been demonstrated in the Netherlands through TU Delft's Façade Leasing project. An interdisciplinary research team within Faculty of Architecture and the Built Environment is developing a circular business model based on the use of multifunctional façades as performance-delivering tools. Under this scheme, the client is no longer the owner of the building envelope and its integrated building services, but instead leases them from a service provider through a long-term performance contract. Rather than purchase the façade panels as a product, the client hires the energy performance and user comfort services delivered to his building by this new façade system.

Early results indicated that the Department of Civil Engineering at TU Delft façade renovation has been a great success. Primary energy use has fallen by around 75 per cent, from 189 kWh/m2 to 48 kWh/m2, saving between €35,000 and €40,000 a year.

Innovative strategies like these are needed to support the renovation and construction of high-performance building envelopes. Action is needed as the current pace of building upgrade in the world is very slow and the inefficiency of buildings is very high. Moreover, depending on country and region, 70% plus of the current building stock is expected to still be standing in 2050, underscoring the importance of decarbonizing buildings if the goals of the Paris Treaty are to be realized.

While there are various grants and government incentives available for green projects, more efforts like those described here are needed. Expert analysis suggests that some $3-$4 trillion per year of additional climate friendly investment is needed to keep temperatures below 1.5°C by 2050 as scientists urge is necessary to avoid the worst consequences of climate change.

Financial instruments such as green bonds and sustainability loans – for which investor appetite is strong – and ESG-tied loans can drive emission reductions across all sectors. They are not only a vehicle for one-off green projects, but also helpfully bring greater corporate accountability and transparency with respect to carbon emissions data and the carbon impact of green bond and loan proceeds. From a corporate viewpoint, tying green financing to the bottom line is also one of the most meaningful decisions a company can make.

And promotion of these instruments is particularly relevant to the job of decarbonizing the built environment since some financial institutions indicate that more than a third and nearly half of green bond proceeds have been dedicated to decarbonizing buildings.

Coordinated global partnerships

For the private sector to accelerate the transition to a sustainable future, coordinated global partnership and incentive structures must be leveraged.

Successful partnership and incentive models

By understanding the characteristics of successful partnership and incentive models in other industries, the built environment industry can organize itself to implement ambitious and creative models. Examples of successful partnership and incentive models include:

Net Zero Asset Owners Alliance: The UN-led Net Zero Asset Owners Alliance has developed a series of commitments that are phased to enable funders to develop decarbonization pathways and implements over the next decade. Many major funders have joined this commitment and, as a result, are requiring their property managers to deliver decarbonization plans and implement initial changes by the end of 2023 with plans for the next phase to be in place by the end of 2028. This approach is driving a staged approach to decarbonization across portfolios. It allows for some poor performing assets to be offset by better performing assets, which means that it enables investment in historic buildings. Measurement of performance is against the CRREM Carbon Risk Real Estate Monitor pathways, which cover most major economies and their pathway to their Paris Agreement commitments with guidance on how to apply to other geographies.

Canadian Infrastructure Bank (CIB): This partnership & incentive model between an Energy Services Company (ESCo) and banking organization aims to encourage private sector decarbonization projects through offering interest incentives and offsetting a customer's operating risk. Offering an affordable, risk-transfer financial mechanism supports private sector deep building retrofit programs that enable customers to modernize their facilities while reducing greenhouse gas emissions. This deal structure is intended to encourage long term deep retrofit projects that might otherwise not be considered based upon the associated risk profile. In a typical deep retrofit project, the CIB would provide 80% of the funds via debt financing; the remaining 20% would then come from an equity partner to satisfy the risk profile requirements of the proposed deal structure.

Accelerating end user demand for low carbon buildings

Information is powerful and can drive action. Currently there is not easy, clear visibility to carbon and energy performance is not acessible. One tactic, therefore that can be employed to accelerate end user demand for low carbon buildings and encourage the broader market to uptake is to make energy consumption data visible to consumers.

While considerable demand for high performing buildings already exists in high-end office space, this demand is often based on sustainable building certifications acquired at the time of construction. The disconnect between building energy performance modelled in the design and construction phase and actual building energy performance in its operational phase is very real. As a result, actual building operational performance needs to be communicated in ways in which 'the average consumer' understands. This underscores the importance of digital technologies that will enable real time and real-world performance to be known and current. Rating programs need to be live and continuous, as compared to static, to drive transparency and demand for more efficient buildings.

Simplifying the understanding of regulations and incentives

With regulations and incentives varying at the country, state, and local level, it can be incredibly challenging for the private sector to understand how to best leverage available incentives and take action at a broad scale. A tool that explains building decarbonization policy differences and provides a path to taking advantage of incentives being offered in jurisdictions globally would accelerate decarbonization actions by the private sector.

Coordinated global partnerships are key to providing an environment for the private sector to accelerate its action toward building decarbonization. With regard to partnerships, the Task Force recommends three areas of focus:

1. Global promotion of partnership and incentive models that have already proven successful to accelerate decarbonization in the built environment so that corporations can learn about and adopt them.
2. Global campaigns with consumers in mind so that the carbon impact of the buildings we all live in, work in or visit is transparent and readily understood.
3. Development and dissemination of a Global Legislation Mapping Tool that provides regulatory frameworks, standards & reporting from across the globe so that the private sector has the information they need to accelerate action.

The Task Force believes this mapping tool is critical for professionals in the private sector to understand everything from simple terminology to complex policy differences across the globe. The Task Force believes that a global organization could develop and maintain such a tool for the private sector to understand what initiatives can be leveraged to decarbonize the built environment. Examples of global organizations that could develop and host this model include Group of Seven (G7), Organization for Economic Co-operation and Development (OECD), World Business Council for Sustainable Development (WBCSD), and World Economic Forum (WEF). The Task Force commits to holding a dialogue with at least three global organizations to discuss how they may contribute to a tool of this nature.

The Sustainable Buildings Task Force of the SMI is calling for significant action on the decarbonization of buildings.

We commit that every member of our Task Force will have at least one carbon-neutral building by 2030, while decarbonizing heat and deploying ultra-low carbon building materials.

About the Sustainable Markets Initiative and Terra Carta

Sustainable Markets Initiative

In his former role as His Royal Highness The Prince of Wales, His Majesty King Charles III launched the Sustainable Markets Initiative (SMI) at Davos in January 2020. The SMI is a network of global CEOs across industries working together to build prosperous and sustainable economies that generate long-term value through the balanced integration of natural, social, human, and financial capital. These global CEOs see themselves as the 'Coalition of the Willing' helping to lead their industries onto a more ambitious, accelerated, and sustainable trajectory. Read more: **www.sustainable-markets.org**

Terra Carta

Launched by His Majesty King Charles III in his former role as His Royal Highness The Prince of Wales at the One Planet Summit in January 2021, the Terra Carta serves as the mandate for the SMI and provides a practical roadmap for acceleration towards an ambitious and sustainable future; one that will harness the power of Nature combined with the transformative power, innovation, and resources of the private sector. Currently there are over 500 CEO-level supporters, including the first C40 city of Athens, Greece. The Terra Carta has served as the inspiration for the Terra Carta Design Lab. The Terra Carta is a roadmap for public, private, and philanthropic collaboration and open to all countries, cities, companies, organizations, and schools who wish to support it. Read more: **www.sustainable-markets.org/terra-carta**