Net Zero

Moving from theory to reality

Great power comes with great responsibilities, like reaching net zero carbon emissions by 2050, but how do we put our intentions into actions and results? Our green building experts have created this report to answer that question.

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About **arbnco**

arbnco is an award-winning global building performance software company. Our disruptive solutions optimise air quality and energy management to create healthy, high-performing and low-carbon buildings around the world.

Building operation & construction account for **30%** of global emissions

How achievable is the 2050 net zero target?

Net zero emissions can only be achieved by reducing carbon emissions. The building operation and construction sectors accounting for around 30% of global emissions, action within the industry must be taken now.

How can this be done? There are three key steps the building owners and operators must focus on:

1. Identify – understand your building. Establish a baseline. How does it perform compared to other buildings in its class, best practice, or other buildings in its portfolio? Would it be considered a poor performing building or an example of best practice?

2. Analyse – after understanding how your building is performing, it is now time to manage and reduce energy consumption within the building. A deeper dive into the building data allows for a more comprehensive analysis with potential recommended improvement strategies. Which energy end-use types contribute the most to its energy profile? Does it have a high base load or does it draw a lot of energy for heating and cooling? Are there opportunities to install renewable generation or energy storage?

3. Scale – the process should be repeated across regions and portfolios. By scaling on a portfolio level, poor performing buildings can be identified for further investigation. Economies of scale become possible with district wide solutions greatly reducing the cost per building.

Combining these three steps will allow the built environment to be in a stronger position on its journey to net zero, by prioritising and maintaining better building performance at the heart of each step.

Introduction

In December 2015, at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP 21), 196 countries agreed to the Paris Agreement. Its goal is to limit global warming by maintaining no more than 1.5 degrees of global temperature increase. To achieve that all countries must work towards net zero emissions by 2050 [1].

With the continuation of economic activity there will inevitably be greenhouse gases emitted. Those emissions need to be removed from the atmosphere. This can be done with natural carbon sinks such as oceans and forests or, in the future, there may be the possibility of using artificial carbon sinks if these technologies are proven at scale. The net-zero target recognises that it is through this balance of emitting greenhouse gases to and removing greenhouse gases from the atmosphere that equilibrium can be achieved. Once balance is achieved a country will be considered a net-zero emitter.

There is limited scope for expanding existing carbon sinks or developing new ones. Considering this fact, net zero emissions targets will only be achievable by reducing carbon emissions. Buildings are an important source of global carbon emissions and together with the construction sector account for around 30% of global emissions. Both building operation and construction sectors need to contribute towards the net zero target by 2050. The World Green Building Council (WorldGBC) has set two major goals in order to meet the Paris Agreement [2]:

- All new buildings must operate at net zero carbon from 2030 and
- 100% of existing buildings must operate at net zero carbon by 2050.

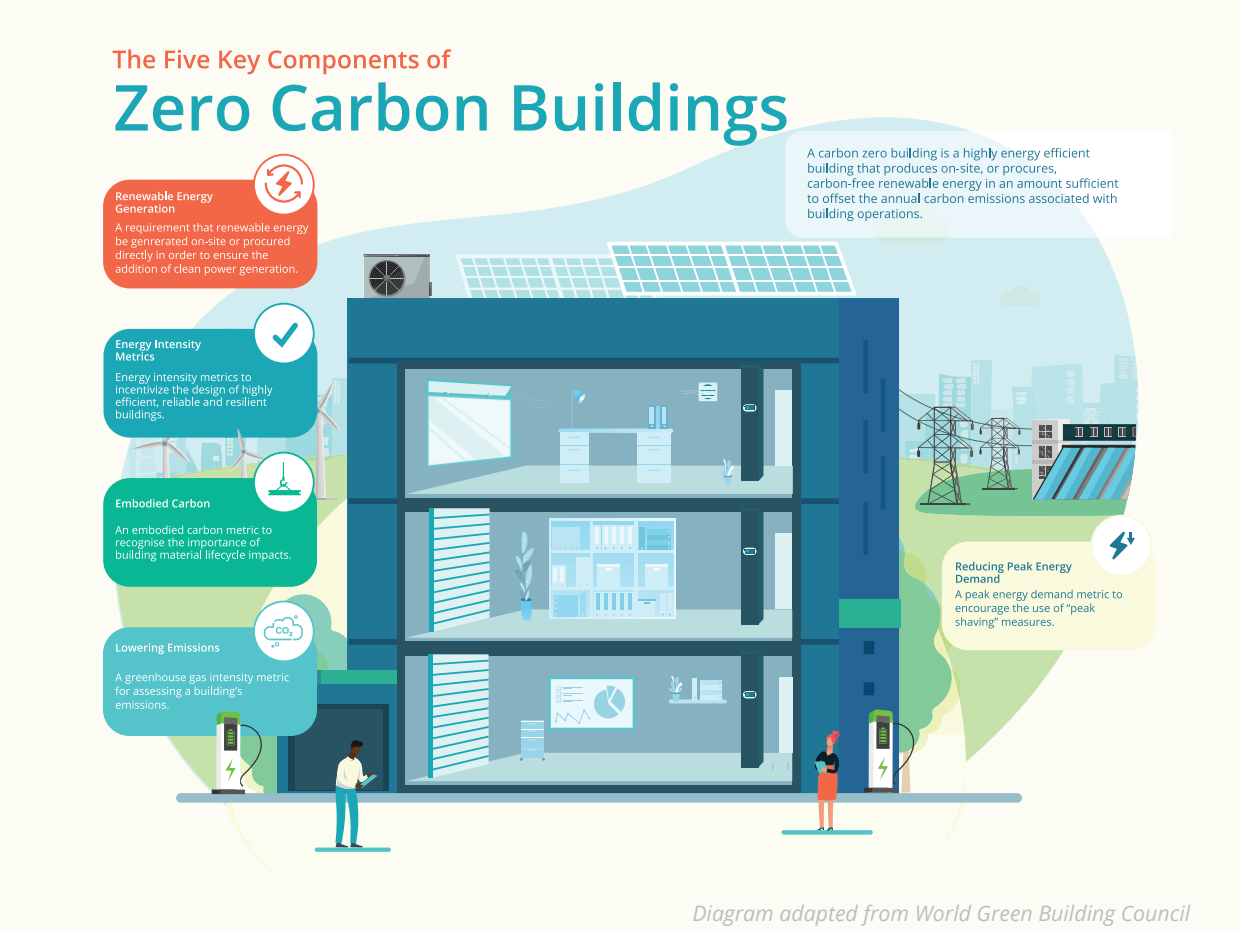


Diagram adapted from World Green Building Council

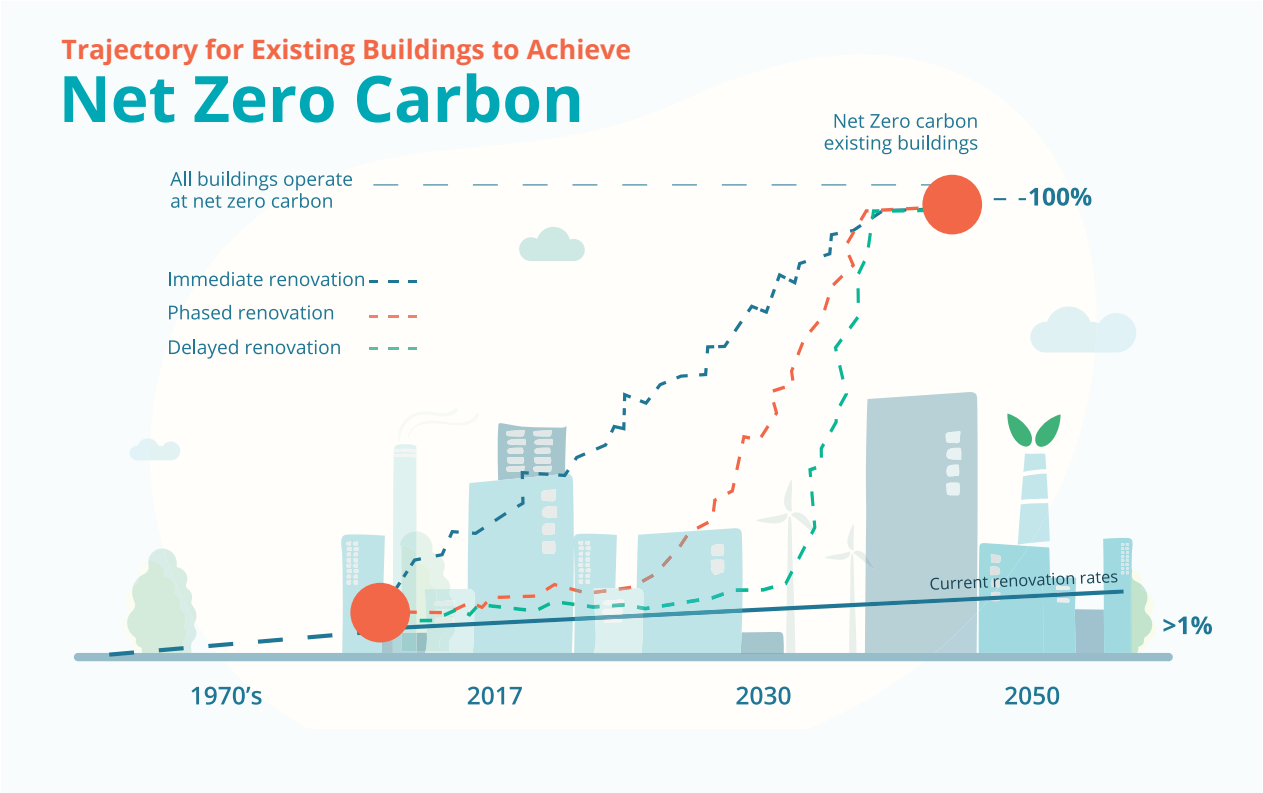
Where are we now?

More than 80% of buildings that will be in operation in 2050 have already been built [3]. How likely is it that these buildings can achieve net zero emissions by 2050?

The International Energy Agency (IEA) identifies key areas in the built environment that require new strategies and technologies in order to meet net zero targets [4]:

	BUILDING OPERATORS	PORTFOLIO MANAGERS	CONSTRUCTION	STATE AND REGIONAL LEGISLATORS
Establish existing building performance	X			
Use building operations tools for performance, disclosure and management	X			
Install energy efficient appliances and systems	X			
Reduction on the reliance on fossil fuels for energy	X	X		X
More data and awareness needed on the impact and options of the embedded carbon of materials			X	X
More planning for resilience against natural disasters or changing climate needed			X	X
Integration themes for urban planning decisions and strategies			X	X
New building codes and minimum energy requirements				X

Diagram adapted from World Green Building Council



Where are we going?

What does a net zero building look like?

- Compliant with building codes.
- Known energy performance, measured and verified.
- Fully electric systems.
- Efficient fabric, maximising passive design as much as possible.

Can every building reach net zero?

For a single building the goal is simple: align with best practice and reduce energy consumption. The World Green Building Council target is clear: 100% of existing buildings must operate at net zero emissions by 2050 [2]. This is an important goal to strive for.

When it comes to net zero the "net" can be cast wider than a single building while, at the same time, understanding that a single poor performer can undo an entire portfolio's work in achieving carbon neutrality.

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The aim on a national or regional level should be to reduce energy consumption where possible, install renewable generation where the resources are available and achieve net zero at a portfolio on a grid scale. This has to start with identifying which assets are the greatest contributors to our collective energy demand and targeting them for retrofit. Older buildings in urban environments will most likely be net emitters. There is simply not the space to install enough renewable generation on every building, particularly those with a larger carbon footprint. That said, a poor performing building reducing its emissions by 20% can have a much larger impact on overall emissions than an already efficient building halving its emissions.

When considering the challenge of reducing energy consumption for buildings, especially poorer performers amongst existing building stock, there is a temptation to rely on grid decarbonisation to reach net zero emissions. If the carbon intensity of the electricity grid approaches zero then a building can theoretically use as much energy as it wants without a dramatic increase in emissions. While this is an appealing notion it ignores the wider challenge of sustainable energy use. A key piece of every national net zero roadmap is demand reduction. We simply cannot install enough renewable storage and generation without first reshaping our energy demands to respond to a changing energy supply mix.

How do we get there?

The first step to reduce energy use in the buildings is informing the building occupants about their consumption patterns. Behavioural changes of building occupants and managers, resulted by providing a continuous monitoring and tracking of energy consumption, could considerably reduce the energy demand in buildings. Based on previous studies the energy use in identical buildings with similar appliances and inhabitants from similar demographics can vary by two or three times [5]. This considerable difference is related to differences in behaviour. Solutions like those provided by arbnco help to raise awareness of energy consumption among users and providing feedback informs the users to adjust their behaviour. Result of a study shows that 83% of participants reported that when energy consumption data was made available to them, their consumption behaviour changed [6]. An indication of energy waste and further investigation of the energy being used on times when not expected enables identification of faulty devices. For instance, when appliances fail to go to sleep or set back condition this anomaly could be identified, and the settings could be changed. Studies have found that a 39% energy demand reduction could be achieved by changing the sleep setting of multi-function devices [5].

80%
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Full decarbonisation of the building sector by 2050 requires highly ambitious measures in every area of the building sector.

Five targeted areas for building sector [2]:

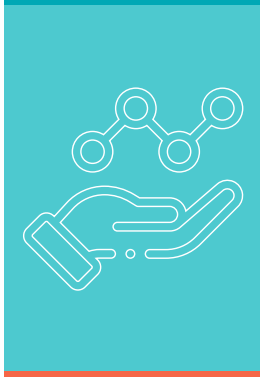
1. Building envelope: Improvement of the building envelope of existing and new buildings to reduce energy demand for heating and cooling. Building envelope measures also lead to an increase of embedded emissions due to the use of materials.
2. Heating and Cooling: Decarbonisation of remaining heating and cooling demand by switching to or using zero-carbon energy carriers (renewable electricity, district heating and zero-carbon gas).
3. Appliance efficiency: Replacement of electrical appliances with more efficient ones.
4. Renewable electricity: Decarbonisation of remaining electricity use by switching to 100% renewable power.
5. Decarbonised materials: Use of recycled and zero-carbon materials in construction and renovation and switch to 100% decarbonised industry.

	BUILDING ENVELOPE	HEATING & COOLING	APPLIANCES	ELECTRICITY	BUILDING MATERIALS
Existing Policy	Performance requirements for new buildings and major rennovations	Efficiency requirement for appliances	Efficiency requirement for new appliances	Cap on emissions	Cap on emissions
Gaps / Additional requirements	Existing buildings: performance requirements	Cap on emissions. Ban on fossil fuels in new constructions	--	--	Lifecycle emissions requirements

Identify

Before improving a building's performance it is essential to establish a baseline. Smart metering enables detailed insights into a building's operation. Energy use can be tracked at a high resolution in real time. Solutions, such as arbnco's building performance software platform, uses state-of-the-art algorithms to assess a building's energy consumption and shows key parameters for tracking, benchmarking, and screening for action.

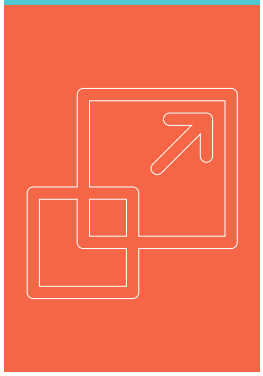
Once an energy baseline has been calculated the building can be compared to its peers across databases covering climate zones, building use types, building area or any other metric deemed relevant. Using this strategy, poor performing buildings can be identified for further investigation.



Analyse

Identifying poor performers leads to understanding why those buildings are consuming more than their peers. Excessive conditioning, faulty systems, high baseloads or extended operating hours can all contribute to a building consuming more energy than its peers. In some cases a higher than typical energy consumption will be expected, for example a building with 24 hour operation for businesses that work in international time zones.

Deep-dive interactive performance analysis, such as provided by the arbnco platform, provide engaged building owners with sophisticated planning tools to evaluate which capital improvement projects yield the greatest return. This can range from simple low-cost projects like an energy audit to deep retrofits of building fabric or installing renewable energy generation.



Scale

Assessing a single building can identify solutions for that single entity. Scaling the search for energy efficient retrofits across an entire portfolio or region allows for projects that would otherwise be unaffordable or technically undesirable to realise their full potential. Economies of scale can be leveraged to reduce cost. A site may have more potential for renewable energy development than it could use to cover its own energy demand but when assessed in the broader context of a district it can share this excess generation with its neighbours at a local level. A building can be analysed within the context of a managed portfolio as well as compared to building performance standards at a regional or national scale. The power of data management tools becomes much more apparent when applied at scale. The same toolset that can identify a building drifting off its own baseline can be utilised to identify when a portfolio's performance changes.

It is the scaling of technologies, the aggregate effect of the diagnostic tools currently available across a wide range of products and platforms, that will deliver the promise of a net zero future.

The business case for energy efficiency

A single expensive technology with relatively low energy efficiency potential can make for a very poor business case. Deeper retrofits commonly run into this problem. However, bundling the expensive retrofits (fabric or system upgrades) with the low cost, high savings interventions (weather optimisation or lighting upgrades) can cross-subsidise technologies into positive savings that would otherwise struggle to pay back within a desirable timeframe. Packaging retrofits across portfolios allows lower cost buildings to make their high-cost neighbours financially competitive.

Is focusing on the energy savings of these technologies missing the point? Increasingly, building owners, portfolio managers and tenants are recognising the relationship between energy efficiency and occupant satisfaction. A well-executed efficiency retrofit should make a building a more pleasant and healthy space to occupy. This makes the asset more desirable to be in and a more productive space to work. On the owner side this can translate to a higher yield from rent. For the tenant, a small increase in productivity can result in a much greater increase in business outcomes than the savings on an energy bill would reflect.

Tangible targets

Nuveen Real Estate, one of the largest real estate investment managers globally, has announced an ambitious commitment to make its global property portfolio operationally net zero by 2040, exceeding the commitment, by a decade, that the World Green Building Council states is necessary in accordance with the Paris Agreement. It aims to get there by, among other things, assessing the current state of their stock, improving their tenant data capture, reducing their reliance on fossil fuels and increasing their rollout of renewable technologies [7].

M&G Investments has committed to supporting the goal of net zero greenhouse gas emissions by 2050 or sooner. They are also committed to supporting investing aligned with net zero emissions by 2050 or sooner. M&G Investments has announced its commitment to reduce operational carbon emissions to net zero by 2030, at the latest. Their plan includes a review every 5 years minimum with an aim of increasing the proportion of Assets Under Management covered until 100% of assets are included [8].

By setting clear goals and deadlines these organisations have made themselves accountable to delivering real change instead of waiting for policy to force their hand. Increasingly, the benefits of making carbon efficiency a priority are being realised by organisations who are willing to take the leap.

Conclusion

The commitments set out in the Paris Agreement are clear: we need to reduce our reliance on fossil fuels. The built environment contributes significantly to humanity's energy use. To reduce buildings' emissions there needs to be both a reduction in energy use and an increase in renewable generation. To achieve this: identify which buildings are the poor performers; analyse what are the most appropriate measures to reduce emissions; scale solutions across all buildings.

The goals will be challenging to achieve but in pursuing them there are opportunities for greater value for building owners and operators beyond just energy efficiency and environmental benefits. In order to realise these benefits it is essential that coherent targets are set. Building owners and operators must be proactive and hold themselves accountable.

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