



The sustainability of modular construction

Can the industry help the UK in reaching a net zero carbon emission by 2050?



UK becomes first major economy to pass net zero emissions law. New target will require the UK to bring all greenhouse gas emissions to net zero by 2050.^[1]



INTRODUCTION

The UK is committing itself to reaching net zero emissions with all greenhouse gases (Carbon Dioxide, Methane, Nitrous Oxide, Fluorinated Gases, Other) by 2050. This commitment will require all sectors of industry and commerce to examine how they currently operate and what actions will be necessary to ensure they can contribute to meeting this target. Every industry will be looking at themselves to see how they can play their part. The construction industry is no exception. Not only is it morally the right direction to go, but it is now a legal obligation. It is an industry that will always be in demand and will not be going away anytime soon. Therefore, serious action must be taken to ensure the industry can adapt.

The industry has already started to look at ways of doing this, and there have been some significant improvements over the years including the use of renewable and recyclable materials, reducing waste, and making buildings more energy efficient. But now is the time to accelerate the progress and to consider whether a more dramatic approach to change is needed.

There is a growing consensus that modular construction provides a key part of the solution as it delivers a number of environmentally friendly advantages that traditional construction methods do not. This, along with the many other other benefits that come from adopting modular construction methods, (such as lower financial and time savings), is the reason why we are seeing the industry grow at such a dramatic rate.

How modular construction can help the UK in reaching net zero greenhouse gas emissions:

- **Recyclable materials**
- **Energy efficient**
- **Low energy waste through insulation**
- **Less material wastes**
- **Reusable**
- **Less vehicle emissions**



The modular construction market is projected to grow from \$75.89 billion in 2021 to \$114.78 billion in 2028.^[2]



[1] (Department For Business, Energy and Industrial Strategy , 2019) [2] (Fortune Business Insights, 2021)

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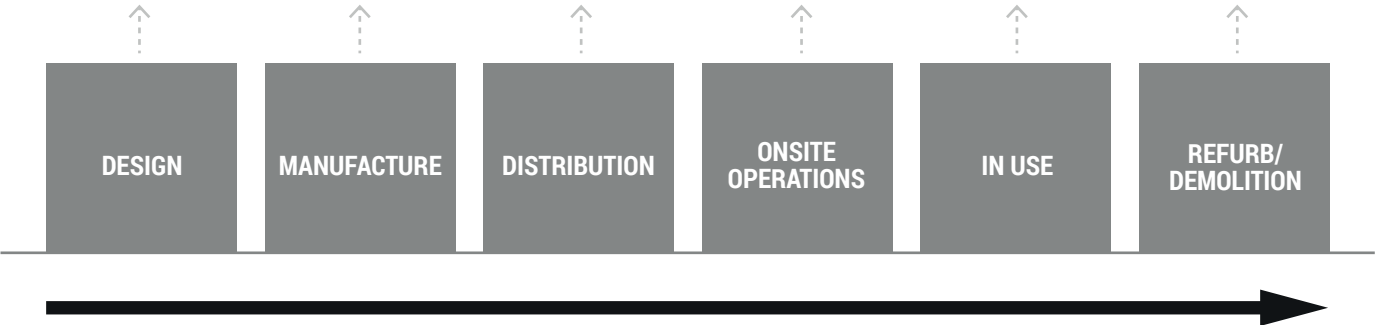
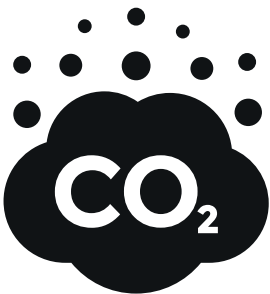
THE CONSTRUCTION INDUSTRY'S CURRENT CARBON FOOTPRINT



Building's construction and operations accounted for 36% of global final energy use and nearly 40% of energy-related carbon dioxide (CO₂) emissions in 2017.^[3]



The construction industry and buildings in general currently have a pretty negative impact on the environment. Generating a great deal of CO₂ emissions globally. These emissions can come from each stage of a building's life cycle. In areas such as waste, materials, travel, and energy consumption.



[3] (Global Alliance for Buildings and Construction, 2018)

Waste

Waste created during construction projects can consist of all types of materials, including bricks, stones, wood, and metallic waste. This waste can come from packaging, demolitions or even from surplus supplies of new stock that is no longer required for the project.

“ Construction, demolition and excavation (CD&E; including dredging) generated around three fifths (62%) of total UK waste in 2018. ^[4] ”

“ Each year, poor design and site management leads to approx 13% of all solid materials delivered to sites, some 10 million tonnes, going unused. ^[5] ”

A large amount of this waste cannot be, or is not, recycled, which would be the preferred environmental outcome. A sizeable amount of this waste will end up on land fill sites which are a big producer of methane gas. It is clear that this is a key area in which the construction industry can improve its act. Despite waste still being a key area for improvement, the industry has, nevertheless, made huge improvements in this part of their operations. The waste management sector has seen a decrease of 71% in greenhouse gas emissions between 1990 and 2019.

Materials

It is not just the waste of materials but the materials themselves that can be damaging towards the environment. It is said that building and construction consume 40% of raw materials globally each year (which is around 3 Billion tonnes).^[7] There are a few areas where these materials can negatively affect the environment. This can include the extraction of these materials from the earth as well as their manufacturing stage, both of which cause pollution. How recyclable these materials are also determines how long-lasting the polluting effects are. If they are unable to be reused/repurposed it will once again lead to more waste and more materials having to be used..

Travel

On any given construction site there is a lot of transportation involved. This is from bringing materials, equipment, labour, and waste to and from site. All of this travel produces CO2 emissions. The industry could help to combat this in a number of ways. For example, they could encourage employees to travel together, use electric vehicles and even plan more efficiently to ensure as much equipment and materials are coming together to avoid unnecessary journeys.

Energy Consumption

Construction uses a lot of energy through all stages of its life cycle. At one point accounting for around 42% of total energy consumption in the EU.^[8] But a big area where energy is being wasted is through the final products and the living buildings. The ongoing operating of these buildings can cause high amounts of energy waste with the buildings not being built as energy efficiently as possible. This energy usage comes in areas such as lighting, heating, and cooling using electricity and gas. This is also an area where the construction industry has started to make changes, a key issue is the number of buildings already out there consuming this energy. Through their lack of insulation, natural lighting, or ventilation.

[4] (Department for Environment Food & Rural Affairs, 2021) [5] (Udeaja, 2013)
[6] (Department for Business, Energy & Industrial Strategy, 2021) [7] (DBERR, 2007) [8] (COMMISSION OF THE EUROPEAN COMMUNITIES, 2007)



BENEFITS OF MODULAR CONSTRUCTION ON THE ENVIRONMENT

The construction industry has been making a conscious effort to reduce its greenhouse gas emissions by improving on all of the areas mentioned on the previous page. However, in order to make the target of net zero by 2050 more drastic changes may need to take place. A change to the way the whole industry operates may be needed. A switch to modular construction using prefabricated units could be a solution.

It is possible that a lot of the big environmental issues that the construction industry causes can be mitigated, or at least reduced, by the benefits of modular construction. Many of these benefits come from the process of modular construction. With the buildings being constructed off site in factory like settings, following uniform designs.

Less waste

As mentioned, the amount of waste that is being produced by the construction industry is excessive and needs to be controlled. Most of this waste comes from working on site, a problem which modular construction does not have. Modular construction does not have as big an issue with waste, as it produces very little.

The units are constructed using the same standardised materials following uniformed designs. Meaning every material has a set place, thereby eliminating potential waste. Furthermore, the issue of surplus unused supplies going to land-fill does not occur with the modular methodology. Any spare materials will simply be used on another modular unit due to them following the same blueprints. If any waste is created such as off cuts this is usually made from recyclable materials so will also be reused eventually.

Reports have suggested that off-site construction compared to traditional construction sites can cut waste generated by up to 90%.^[9] This is the sort of big change that could actually have a significant effect and help towards reaching the 2050 target.

Material

The majority of the material used in modular construction is sustainably sourced. Furthermore, steel, a key material used in modular construction is 100% recyclable.^[10] They are designed in a more efficient manner, using less materials.

Travel

Traditional building and construction involve multiple trips to and from sites bringing materials, equipment, and labour. With modular construction all being produce on site this reduces many of these trips, travelling back and forth to site, thus cutting down on the overall vehicle emissions produced.

It should be noted that the travel of modular units is still a big a carbon producer. It is a key area for the modular construction industry to focus on when trying to further improve its carbon footprint.^[11] A way of doing this for example could be switching to electric vehicles.

Energy

The energy produced during modular construction is less than that of traditional construction due to it being in a controlled factory. This controlled environment allows there to be less energy wastage. The potential for energy saving in a modular building's life cycle is also higher. The buildings are energy efficient, wasting very little with them being well insulated, ventilated and lit. This meaning over their life span they will produce less greenhouse gas emissions.

Re-usability

Because demolition is not required at the end of a modular building's life cycle there is no waste, nor is there the potential for the spreading of hazardous materials or the generation of pollutants that often arise from the demolition process. When a modular building is no longer needed it can be simply taken apart and its materials recycled. Alternatively, the building itself can be repurposed, transported, and used for another purpose. Once a customer is finished with their modular building it will not be the end of its life. They are able to be reused, repurposed, and recycled without going to waste. No matter the age of the building whether it is 2 or 20 years old. They are easily transported to a new destination. This meaning the new owner will not need to have a brand new one commissioned in turn helping out the environment.

^[9] (Wrap) ^[10] (Recycle More, n.d.) ^[11] (Kawecki, 2010)



OTHER BENEFITS OF MODULAR CONSTRUCTION

Whilst modular constructions have many environmental advantages over traditional construction methods, there are other areas in which the modular construction process can provide huge benefits. These factors, outlined below, all help towards the growth in the industry. They show that sacrifices will not have to be made in other areas just to produce less greenhouse gas emissions.

Health and safety factors

During 2020/2021 the UK construction industry had more fatalities (39) than any other industry.^[12] This is clearly an area that the industry should be working to improve. Modular construction can help reduce risks and can offer a safer working environment, with controlled factory conditions making it easier to ensure safety rules and regulations are monitored and enforced.

Versatility

Modular construction brings with it the benefit of huge flexibility. The fact they can be transported anywhere is a huge bonus. The numerous customisation opportunities, together with the variety of styles, shapes and colours available, combine to ensure that the modular solution will always be capable of delivering whatever the project requires.

Time

It has been reported that up to 50% of construction time savings can be made through modular construction over traditional construction.^[13] This is one of the industry's biggest draws. Especially for when projects need to be constructed as soon as possible. Again, most of these time savings are down to the construction taking place off-site in a factory.

Financial savings

Modular construction can also come with financial savings, up to 20%.^[14] These savings come from the factory settings, uniformed designs, less waste, and less labour needed. These savings can lead to the buildings themselves being cheaper which is a positive for customers and suppliers.

[12] (HSE, 2021) [13] (Nick Berman, 2019) [14] (Nick Berman, 2019)



ALTERNATIVE WAYS THE CONSTRUCTION INDUSTRY CAN REDUCE ITS EMISSIONS

Switching to modular is an effective way for the construction industry to reduce its emissions. It is not however the only solution. There are several other areas in which the industry can, and should, continue to develop. This is in all stages of a building's life cycle, from the design, to the production, and, ultimately, how it is used and then eventually reused.

More efficient designs

When designing any new construction project this net zero target should always be in mind. This means all materials, energy options and waste should be examined to make sure they are all efficient and not producing harmful, and unnecessary, amounts of greenhouse gas emissions. As mentioned earlier an alarming amount of surplus material currently ends up as waste. With more thoughtful planning and designs this can be avoided.

Passive designs

Passive designs should be utilised, constructing buildings to work with and take advantage of the landscape in which it is installed. These are buildings that are designed to take advantage of the environment to maximise heating, cooling, ventilation, and lighting.^[15] This is in order to reduce the amount of energy needed to perform these various tasks.

Renewable energy

Newer buildings should be built with energy efficient, saving measures in mind. Utilising renewable energy solutions such as solar, wind or hydrogen power energy. In both the construction and the ongoing life of these buildings.

Encourage energy saving behaviour

Features and fixtures can be installed to encourage the users of these buildings to be more conscious about saving energy. For example, installing timers on lighting, heating, and cooling appliances to make sure they are not in use unnecessarily.

[15] (Home Quality Mark Delivered by BRE)

IN CONCLUSION

This paper has examined how modular construction can play a huge role in meeting the Government's environmental targets as they relate to the construction industry. It is clear that modular construction could be a successful alternative to the traditional construction industry because of the many environmental benefits the system has the potential to provide. If the whole construction industry adopted a modular approach it looks as if it would help to reduce the UK's emissions to Net Zero by 2050. We have seen that a Net Zero modular building can be possible with a few recent examples such as a school being built in Hampshire.^[16]

The industry is growing at a fast rate globally, so it is clear this method of construction does have the potential to replace the traditional industry. The issue is whether it is easier said than done! To completely change the way in which an industry operates is a massive task and sanctions or incentives may have to be put in place by the government to ensure that companies are encouraged to turn to modular. However, it is not just the government that needs to play its part, all areas of the industry, including developers, architects, engineers, contractors, and suppliers need to contribute towards meeting the ambitious targets the Government has set, and to examine the role that modular construction can play in the process.

Finally, one of the biggest issues to address is combating the poor reputation the modular industry has gained over the years. The perception is that they are only temporary, they are cheap, and they are weak. Despite the huge advances in modular construction it would seem the public perception has not necessarily caught up with the reality of the industry. In a YouGov poll for example, 52% of people surveyed said they would not live in a modular home.^[17] It is clear that more work needs to be done in improving the reputation of the industry, showing people the many benefits that modular construction can bring.

The modular construction industry could indeed be a solution and help the UK reach NET ZERO carbon emission by 2050.

[16] (Golding, 2021) [17] (Henderson, 2018)



We here at Maxi Space are modular experts. We are one of the UK's leading suppliers of modular solutions. We have experience in working on a wide range of projects helping our customers in taking advantage of all modular construction has to offer. If you have any further questions regarding the industry or are interested in our products/services be sure to get in contact with us.

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