

Achieving Net Zero Carbon Targets

Collaborative digital transformation across whole asset lifecycle

Mark Lenton, SRO Innovation

Professor Chris Gorse, Director of the Leeds Sustainability Institute, School of the Built Environment,
Engineering and Computing

Introduction

The U.K. will not achieve its 2050 carbon emissions targets if it continues to follow the current stuttering path. Picking off the low hanging fruit such as LED lighting, promoting electric cars, or changing energy provider are only baby steps. We need to see the necessary leaps and bounds.

The ability to be lean, flexible, and have full control of assets will bring the largest savings, ensure business survival, and help achieve net-zero carbon (NZC) goals.

Emission targets will not be achieved with a siloed approach. Digital transformation and some joined-up strategic thinking need to be embraced and adopted across the whole asset lifecycle—not just the project lifecycle.

We need to understand the key activities of what, where, and why assets, services, suppliers, and users are contributing to a growing footprint. We need metering and measuring to identify the major carbon emission factors and then a Design-to-Operate approach to force down emissions.

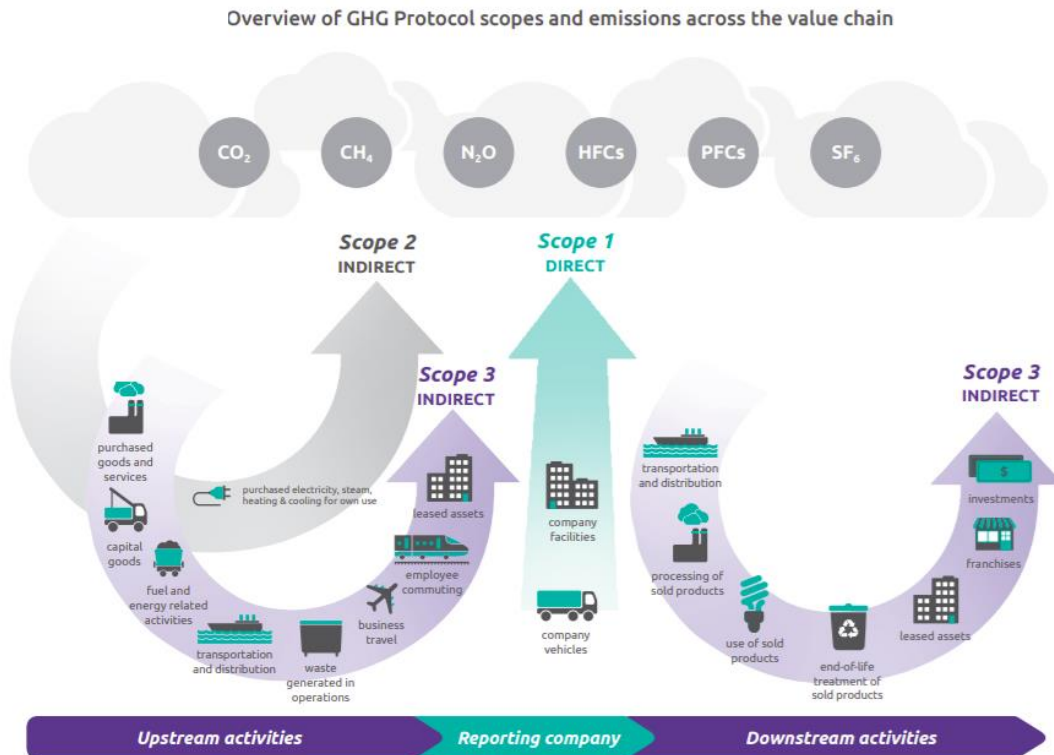
The context is the same across multiple industries. In this paper, we focus on the built environment, a sector that is universal to all companies and government. Although statistics vary by country and definitions, there seems to be a general consensus that buildings alone contribute around 40% of global carbon emissions. Typically, over 80% of the emissions are found within the operational phase of a building's lifecycle, and the remaining 20% are split across design and build phase and the decommission/end-of-life phase

The Operational phase of a built environment project — whether buildings, railways, roads, or utilities — will require assets to be operated, maintained, and repaired for possibly 50 to 100 years. This phase is where the majority of energy is demanded and also where the direct and embodied emissions manifest.

If we take the example of a hospital, then from an operational perspective, many different asset fields contribute to its overall carbon footprint. They include catering, waste management, cleaning, transport, heating/cooling, lighting, fridges, and medical equipment, which are spread across the physical hospital footprint of buildings, wings, floors, rooms, and theatres. These assets, services and locations all contribute to the different scopes of emissions:

- Scope 1: Direct into the atmosphere (e.g., the burning of waste and transport emissions)
- Scope 2: The consumption of energy (e.g., power and water consumption)

- Scope 3: The indirect emissions (emissions from the operational supply chain, including commuting)



Reference: <https://ghgprotocol.org>

In the case of the NHS, it is estimated that over 60% of its carbon footprint is within Scope 3, supply chain and partners. Although carbon emission figures may differ for other organisations, trends are generally similar, so our area of focus should be clear: the operational phase. We must also focus on ensuring that primary assets and services, as well as their supply chain, is appropriately measured, managed, controlled, and improved.

Foundation for Success

Collaboration, interoperable technology, and data, data, data!

Access to the right data and information is needed to gain control and attain optimal efficiency. Owner-operators need to ensure that the necessary data to achieve outcomes is created, made available, structured, and shared between systems so that its use can be maximised throughout the whole asset lifecycle – from design to build and, most importantly, throughout the operate phase. The data requirement may be static data, such as asset name, supplier, dimensions, as well as real-time active and dynamic data such as temperature, occupancy, and energy usage.

For new build capital projects, static data is usually held in CAD, BIM, CDEs (common data environment), and asset management (CAFM, CMMS) solutions. Active data usually comes from sources, such as IoT sensing, BMS, and SCADA solutions – predominately found once the asset is in use in the operational phase.

All too often, static and active data from disjointed processes and disparate unconnected solutions are kept in silos or not maintained throughout the whole lifecycle. This disconnect prevents data from being maximised to produce insights, trend analysis, and used for continuous improvement.

For capital projects, static data gathered throughout the design and build phase needs to be transitioned across to operational phase, where it can be merged with active and dynamic data from the monitoring and metering of assets and services. By then aggregating this data with other sources, it is possible to design and justify appropriate change plans to formulate your path towards net zero.

Asking the right questions about your data

Sharing and merging data from different solutions is critical. For example, why heat and light a room if it's not being used? This scenario requires static data—such as room, dimensions, and location—and active data—such as temperature, energy consumption, and occupancy. The positive impact on NZC targets would be hugely significant if owner-operators and engineering, architect, and construction (AEC) partners adopted open interoperable solutions. A 'golden thread' of 'single source of truth' data could be fed from system to system and used to reduce direct and indirect energy consumption and emissions through smarter operations and facilities management (FM). Other examples may include:

1. Occupancy data merged with energy consumption to reduce waste, with the same data over time to provide insights for space optimization, rationalization, or re-purposing
2. Remote metering and increased remote interventions to reduce the need for travel
3. Measuring and monitoring of energy-hungry assets to improve performance, efficiency, reliability, and longevity
4. Geo-location data and assets data would quickly locate equipment and ensure asset usage maximized
5. Measure trends, anomalies, and peaks/troughs to move from reactive maintenance to predictive and preventive maintenance, i.e., fix only when needed and reduce the need for spares, replacements and avoid disruption
6. Integrate supply chain data for procurement of spares and replacements for just-in-time inventory and order the right product at right time and from the right supplier, e.g., eco-friendly products from local suppliers
7. Apply data-driven insights from active and static assets and location data for continuous improvement of smart FM, e.g., clean, empty, and change interventions based on number of uses or determined end-of-life
8. Smart contracts based on service and asset SLAs connected to sustainability targets
9. Evidence-based 'fit-for-purpose' data to avoid unnecessary procurement, building, or redevelopment
10. Add in other data sources—such as weather, socioeconomic, or transport—to further optimize scheduling, asset, location, or people efficiency, as well as to avoid waste

Data-driven decision-making opens up countless possibilities to reducing a carbon footprint. Static and active data need to form part of smart sustainability algorithms targeted to reduce direct and indirect emissions. The right questions of who, why, when, and how assets and locations are being used must

be asked and applied to merged data sources to obtain insights and drive actions and continuous improvement.

Simon Roberts, managing director at Mercateo UK & Ireland: “The digitally integrated approach we have developed with SRO and eco-partners is a potential game changer for sustainability within the built environment. Through proper use of data collected and exploited throughout the whole asset lifecycle, we can now bring together smart asset management and e-procurement solutions to automate the supply chain process from ‘need identified’ using IoT on the asset, through to ordering parts from selected sustainable suppliers, to managing the maintenance work-orders.”

If you can’t measure it, you can’t manage it and can’t improve it

If you can’t measure the performance of an asset or location, then how will you manage it and know what good or bad looks like, trigger events and alerts, or record data over time for trends and insights? For new build projects, and as part of the early stages of design, it is important to consider a smart metering and monitoring strategy and how these feed into a smart building and FM and operation strategy, and how it fits into an overarching digital strategy. This joined-up strategic approach needs to include owner-operator operations and FM, AEC suppliers, and IT, as well as should help remove silos and instil whole asset lifecycle thinking. Moreover, it should also bring to life the importance of a golden thread of re-usable data from interoperable solutions.

Operations and FM will be key in delivering the sustainability savings once the project is in the post-handover phase. Therefore, they need to be heavily involved at the beginning of the project in determining NZC outcomes and goals, remaining close to project throughout design and build phase as “sustainability guardians” to ensure that initial requirements are not watered down and corners are not cut by AEC suppliers.

Collaboration and skill sets

Different software and subject matter experts (SMEs) are needed throughout an asset’s’ lifecycle. Bringing together different companies and their respective software/hardware and services and accessing their data can prove challenging. Often, their skillset is only in one domain (e.g., design or build) and does not widen to consider the much larger operational impacts that a true smart sustainable building must conform to.

Today’s digital world requires skills and expertise in a lot of different areas. Some of them include IoT, BMS, network protocols, CDEs, asset management, cloud and edge computing, big data analytics, digital twins, e-procurement and supply chain, BIM, FM and operations, and space management and techniques. It is almost certain that all these skills will be required at some point to deliver appropriate infrastructure and solutions to achieve desired business outcomes — including NZC.

Addressing interoperability using open standards (not closed proprietary to mitigate the risk of vendor lock-in) of key solutions used across the whole asset lifecycle will ensure data is not lost or duplicated, as well as can be augmented and shared as the project moves through the design to build to operational phases.

The “who” and “how” is explained in more detail in the Build Back Better...Smarter paper (Mark Lenton, SRO Innovate). In summary, it ideally requires an ecosystem of SMEs who can advise and integrate smart buildings, operations, and FM.

Using an ecosystem of organizations, each specializing in the different solutions needed across the whole asset lifecycle of a built environment project, ensures modular open interoperable solutions and that helps the client avoid the risk of falling into a closed, proprietary solution where they risk vendor lock-in. Interoperability enables “best in class” solutions that can be easily swapped in or out if deemed no longer fit for purpose.

Design – Build – Operate is applicable for new build projects, but what about the built environment already in place that will still be active in 2050?

It is estimated that over 90% of the built environment that will be in use in 2050 has already been built, therefore possible that data from the initial design and build project phases is no longer relevant. It also could mean that it is only available in a proprietary format that can’t be shared with other platforms, or simply that the owner-operator does not actually own the data; rather, the solution provider does.

Digitalisation to extract necessary data to achieve outcomes needs to be considered in parallel with processes and people, integrated as part of the organisation’s wider digital strategy. Unlike a new build capital project where cross-team collaboration should be the norm, trying to get a similar level of buy-in from operations and FM, IT, and staff and users to review and improve the incumbent will not be easy. Instead, what will be needed is a compelling business case with clear objectives and goals on how to achieve NZC.

The complexity and costs of retrofitting could become high, hence why it is important to get it right during the new build capital project, as processes and technology are being defined and digital strategies open for change.

The digitalisation to obtain necessary static and active data is possible using the techniques such as laser scanning or photogrammetry, retrofit of BMS/SCADA connectivity and interfacing, and IoT sensing to convert dumb assets to smart. It is also possible to interface standalone systems or else define a migration roadmap to more modern systems better suited to an interoperable and “best in class” smart building environment.

Ideally, a gap analysis is required to better understand incumbent technology, people and processes, creating a roadmap to deploy and integrating a suitable smart building environment that is better equipped to achieving NZC outcomes. The gap analysis scope should cover disciplines such as smart asset management, IT, smart FM and operations, space optimisation, and IoT-BMS/SCADA

connectivity. It should also be supported by an ecosystem of SMEs for these disciplines that share the same vision and objective of an interoperable environment generating re-usable data for the clients desired business outcomes.

Amanda Gomersall, General Manager, Corporate Services and Real Estate at Leeds Teaching Hospital Trust: "The Trust's Estate and Facilities Management (E&FM) Team have been working with the Innovation Team at SRO Solutions on a new build and legacy project that will ensure alignment of data against the Trust's operational needs. The Design and Build Capital Project Team, E&FM and other internal stakeholders are working collaboratively and feeding into a roadmap that will bring together data from new build and legacy systems, within 3 to 5 years. By having access to the right data and information, we can attain optimal efficiencies, which will help us achieve our net-zero targets and become carbon neutral by 2040."

Gordon Mitchell, key FM, chief information officer, and ISO convenor at ISO/TC 267 – WG6 – Technology in Facility Management: "Whole life thinking across the full life cycle is critical now to the built environment playing its part in the U.K. and international net zero plans. Collaboration and interoperable practices facilitated by subject matter experts position an organisation to connect and make the best of today' and tomorrow's standards, technologies and data leading to a complete ecosystem of digital places, space and experiences".

Professor Chris Gorse, Leeds Beckett University: "As we are called to Build Back Greener with the UK Governments Net Zero Strategy, the integration of digital assets and resources throughout the whole asset lifecycle is essential. The luxury of assuming buildings operate as designed is insufficient. The lack of consistent and recognized metrics is prohibiting clients to invest due to inability to justify or prove business case. As such, Leeds Beckett University will be creating an 'exemplar' environment capable of identifying, measuring and promoting opportunities and innovation in CO2 emission reductions and clinical health care outcomes."

Whether for a new build project of a retrofit of legacy, the approach and SME skillset to obtain necessary data to achieve outcomes using interoperable systems and technology are similar—albeit more complex when retrofitting to try to get it right for future new builds.

Conclusion

Achieving net-zero emissions targets in a post-pandemic economy is going to be challenging for all asset intensive organizations. There is no silver bullet or easy fix, and the owner-operators and wider AEC industry need to take leaps and bounds or else fail for their organizations and the planet. Whether for new build capital projects or retrofit of legacy, there are five key areas in which a change in mindset is needed to support these leaps and bounds:

- Owner-operators and AEC suppliers need to recognise the endgame is not design to project handover but rather design to operate, with "operate" looking at the next 50 to 100 years. Look at the total carbon foot and total cost of ownership over the whole asset lifecycle, not just short-term financial gain.

- Collaboration across whole asset lifecycle to remove technology, process, and people silos. Any digital strategy needs to blend in IT, smart building, and smart operations and FM strategies using SMEs, all focused on the delivery of desired outcomes — with NZC embedded throughout
- Traditional skillsets within E&FM, AEC suppliers, and owner-operators are insufficient. If open, interoperable, smart buildings and assets are needed to deliver NZC from best in class solutions, then call in SME expertise that can support enabling technology such as IoT, BMS, big data analytics, e-procurement, digital twins, smart asset management, and smart FM.
- If E&FM and operators are going to support the delivery NZC, then they need to be involved at beginning of the new build project or influencing and driving the agenda for legacy retrofit projects.
- *It's all about the data!* That is, joined-up, re-usable data from interoperable solutions. Maximise the use of static and active data from assets, locations, people (staff, users, or visitors) and external sources (weather, transport, or socioeconomic) for smarter planning, design and build, operations, and decommissioning, whilst improving sustainability by reducing waste, energy consumption, productivity, and efficiency, and enabling data-driven decision-making and continuous improvement

Innovation isn't just about technology. It's also about how the technology, people, and process are applied to a problem. NZC goals by 2050 are feasible—we have all the necessary technology and other pieces of the puzzle available to us. We just need to collaborate more and assemble them in the right order, and NZC should be the one unifying outcome that everyone can get behind and collaborate on
