



Delivering net zero carbon

**CUNDALL**

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- Sustainable Buildings Research Centre, University of Wollongong
- Burwood Brickworks
- UKGBC London HQ

## Contact us

For more information please contact:  
Simon Wyatt - s.wyatt@cundall.com  
T +44 (0)207 438 1664

www.cundall.com  
Asia Australia Europe MENA UK & Ireland



## Introduction

As we enter this new decade, we stand at a crossroad for the future of our planet and for the first time we can clearly see what is ahead of us.

Over the past few years we have seen the horrific scientific predictions from climate change modelling come to pass. From the recent forest fires that have decimated parts of Australia, Africa, North America and Southern Europe; to the ever increasing size and frequency of extreme weather events – intense rainfall, flash flooding, record temperatures, heat waves and droughts; it is apparent that the effects of climate change are upon us. Alongside the environmental damage, these effects are also starting to have substantial financial costs to individuals and organisations.

Our current trajectory sets us on course for at least a 3°C global temperature rise, well above the targets and aspirations of the Paris Agreement, which will have profound impacts on us all. Climate scientists have for a while been accurately predicting the changes in our climate and their impacts on our ecology, environment, humanity and the economy, including the recent

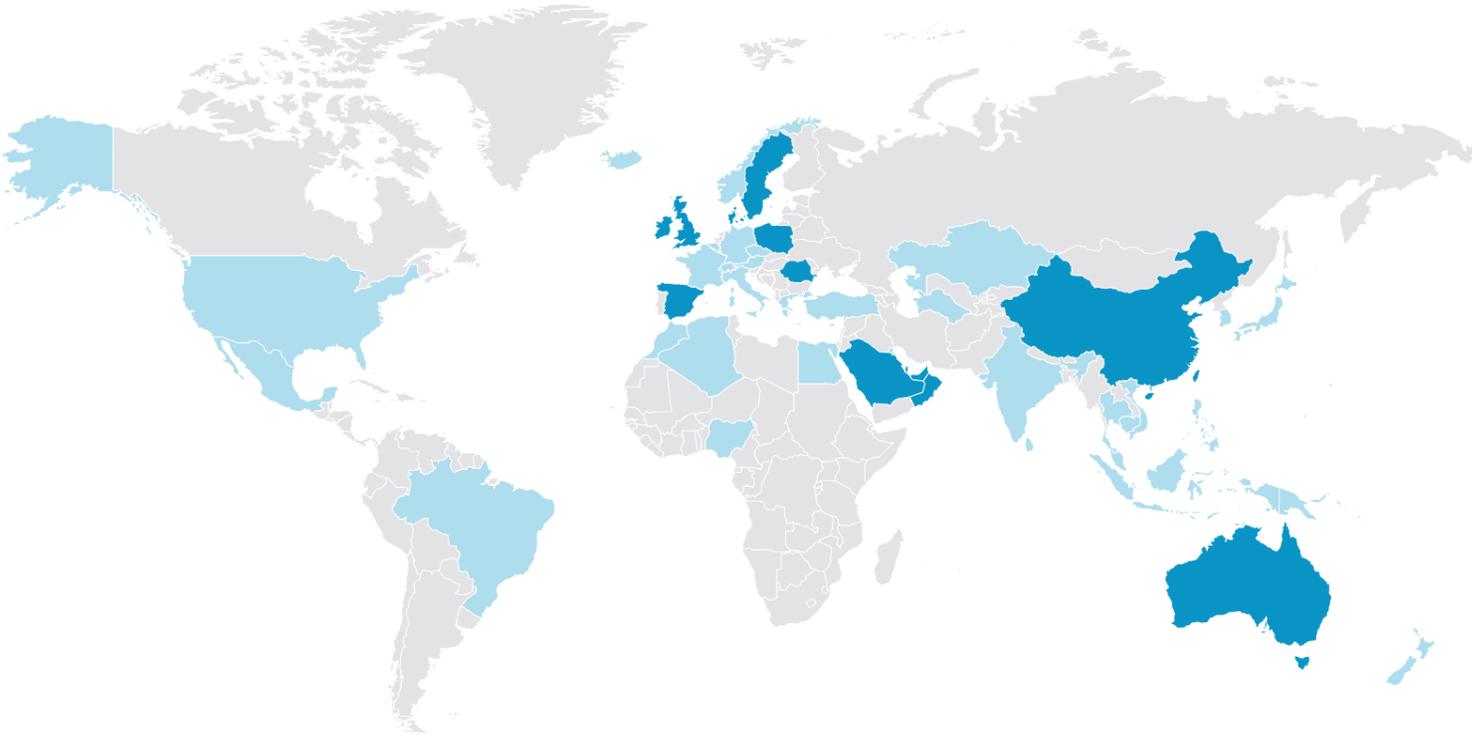
wildfires and flooding events. These same scientists are predicting massive distribution to global food production, more extreme weather events leading to mass human displacement, all of which will give rise to poverty and public health issues.

It is therefore vital that we act now and act fast in the hope of alleviating the worst of the predicted outcomes. In order to achieve reduction on this scale, we need complete societal transformation to flatten the emission curves and allow our ecosystem to cope. Achieving net zero carbon must be at the heart of our response to this crisis. As the built environment is responsible for up to 40% of global carbon emissions, it is imperative that we develop scalable solutions to meet this challenge.

The good news is that the decarbonisation is possible. We've seen more action around net zero in the past year than in the entire preceding decade, and the approach is becoming clear.

Increasingly, clients are coming to us asking about net zero – what it means, what it looks like in practice and how we can help them achieve it.

# About Cundall



## Cundall projects

## Cundall offices

- |            |           |   |
|------------|-----------|---|
| Adelaide   | Perth     | <b>Associated offices</b><br>Oman<br>Saudi Arabia |
| Belfast    | Shanghai  |   |
| Birmingham | Singapore |   |
| Brisbane   | Sweden    |   |
| Bucharest  | Sydney    |   |
| Denmark    | Warsaw    |   |
| Doha       | Wrocław   |   |
| Dubai      |           |   |
| Dublin     |           |   |
| Edinburgh  |           |   |
| Hong Kong  |           |   |
| London     |           |   |
| Madrid     |           |   |
| Manchester |           |   |
| Melbourne  |           |   |
| Newcastle  |           |   |

Positioned at the forefront of sustainability in the built environment, Cundall provides professional services from business level strategy and governance through to building performance and design. Driven by the consideration of people, design, environment, economics and technology, Cundall has proven that sustainability and commercial pragmatism are not mutually exclusive but are inextricably linked.

### International experience with local knowledge

With more than 20 offices around the globe, Cundall combines international experience with local knowledge to deliver tailored solutions to support our client's individual needs.

### Specialist expertise in property and the built environment

Our sustainability team consists of multi-disciplinary professionals with specialist skills and experience across all stages of property life cycle, from planning and development through to operations and management.

### Practical, not theoretical

Cundall can not only assist with the creation of a strategy, we also know how to implement it. We will be with you for the long-term, throughout your sustainability journey, with technical staff who can execute plans and provide innovative yet practical solutions to achieve your vision.

### We practice what we preach

We are the first consultant to be endorsed as a One Planet Company by Bioregional. We therefore understand first-hand the challenges companies can face when embarking on this journey. Our other third party endorsements include:

- Carbon Neutral – certified by Australian Government
- Science Based Targets – by SBTi
- Founding Signatory of World Green Building Council's Net Zero Carbon Commitment
- ISO14001 Environmental Management System



**21**  
OFFICES GLOBALLY



**950+**  
PEOPLE WORLDWIDE



**2020**  
ZERO CARBON



**1976**  
ESTABLISHED



**50+**  
COUNTRIES PROJECTS DELIVERED IN



**35+**  
LANGUAGES



**1<sup>st</sup>**  
ONE PLANET COMPANY



**500+**  
AWARDS WON





## A climate emergency

Over the past year, we have seen a global tide of momentum with individuals, governments, local authorities and now the construction industry declaring climate emergencies and setting net zero carbon targets. This is a challenge to every part of society.

Cundall's mission, vision and values have enabled us to be at the heart of the industry's response. Our vision is to be "Agents of change for a sustainable world" and "Construction industry thought-leaders". Our Sustainability Roadmap: 'One Planet, One Chance' commits us to address our whole carbon footprint and be a carbon neutral business by 2020 and positive by 2025. At the same time, requiring us to develop solutions for carbon positive buildings and infrastructure for our clients.

### Understanding carbon and setting targets

In terms of our own carbon footprint, we have been monitoring and reporting it since 2012, when we became the first consultancy to be endorsed as a One Planet Company. We strengthened this in 2018 by becoming the only consultant to have a science based target (SBT), formally endorsed by the science based target initiative across all three scopes of our emissions. This year we will be certified as carbon neutral across all scopes by the Carbon Trust, after a successful trial last year where our Australian offices became carbon neutral using the Australian Government's Climate Active Carbon Neutral scheme.

Having been through these processes ourselves, we have been using our experience to help a range of clients to understand their emissions, set targets (including SBT) and develop action plans for achieving them. This has given us an in-depth understanding of carbon footprint for a range of sectors across all scopes.

### Net zero carbon companies, products, events and portfolios

We work with clients to develop net zero carbon strategies and roadmaps for their organisations, companies, product, events, portfolios and individual buildings. To achieve net zero carbon, we must monitor and reduce every aspect of energy and resource consumption. Only then can we look to supply all energy from renewable sources and offset any residual emissions. This should be third party verified and disclosed on an annual basis.

### Net zero carbon buildings

Our deep rooted understanding of carbon has enabled us to be at the centre of the debate to define what net zero carbon means in the built environment.

- In 2018 Cundall became a founding signatory of the World Green Building Council's 'Net Zero Carbon Commitment'
- Off the back of this we have been working with the World and local Green Building Councils to define what a net zero carbon building is

- Helping to set operational energy intensity embodied and whole life carbon targets, with a focus on providing a flexible, adaptable, durable design solutions
- Working with the London Energy Transformation Initiative (LETI) to produce their "Climate Emergency Design Guide", which sets a range of practical solutions
- In terms of operational energy consumption, we are the original Pioneer Delivery Partner for the Building Better Partnership's Design for Performance (DfP) standard, which requires developers to accurately predict their energy consumption and then fine tune their building in use to match these predictions
- We also have several Passivhaus accredited designers who are fully committed to a fabric first approach to energy efficiency
- Cundall's specialist team has contributed to the creation of a number of global whole life and embodied carbon methodologies, including for the Royal Institution of Chartered Surveyors, the World Green Building Council, the Greater London Authority and the Construction Industry Council Hong Kong





## Our partners

We understand that we cannot achieve net zero carbon alone. We have therefore been collaborating with the wider industry on a range of programmes. Below is a brief summary of some of our recent partnerships:

### Academia

- University of Edinburgh - Research project into embodied carbon of building services and operational embodied carbon of buildings
- Newcastle & Northumbria Universities - Research project into carbon positive materials and biotechnology in the built environment
- Loughborough University - Research project into predicting the outcome of energy simulation using AI and 'deep learning' methods to optimise performance
- Loughborough University - Research project into the effects of climate change on the built environment and adaptation measures

### Industry bodies

- World Green Building Council (WGBC)
- UK Green Building Council (UKGBC)

- London Energy Transformation Initiatives (LETI)
- Better Building Partnerships (BBP)
- British Council for Offices (BCO)

### Professional institutes

- Royal Institution of Chartered Surveyors (RICS)
- Royal Institute of British Architects (RIBA)
- The Chartered Institute of Building Services Engineers (CIBSE)
- Institution of Civil Engineers (ICE)

### Local and national government

- Greater London Authority (GLA)
- Construction Industry Council (CIC) Hong Kong
- Ministry of Housing, Communities & Local Government'
- The Welsh Assembly
- Department for Education
- Department for Business Energy and Industrial Strategy

## Net zero carbon services

To support our clients on their net zero carbon journey we can provide the following services.

### Corporate strategy and reporting

- Carbon foot printing and reduction strategies
- Science based targets
- Carbon neutral certification
  - The carbon trust
  - Climate active
- Supply chain charters and procurement strategies
- Carbon offsetting strategies
- Climate change risk reporting
  - Global real estate sustainability benchmark (GRESB)
  - Carbon risk real estate monitor (CRREM)
  - Task force on climate-related financial disclosures (TCFD)
  - Carbon disclosure project (CDP)

### Portfolio strategies and roadmaps

- NZC strategies and roadmaps
- NZC roadmaps for decarbonising existing assets

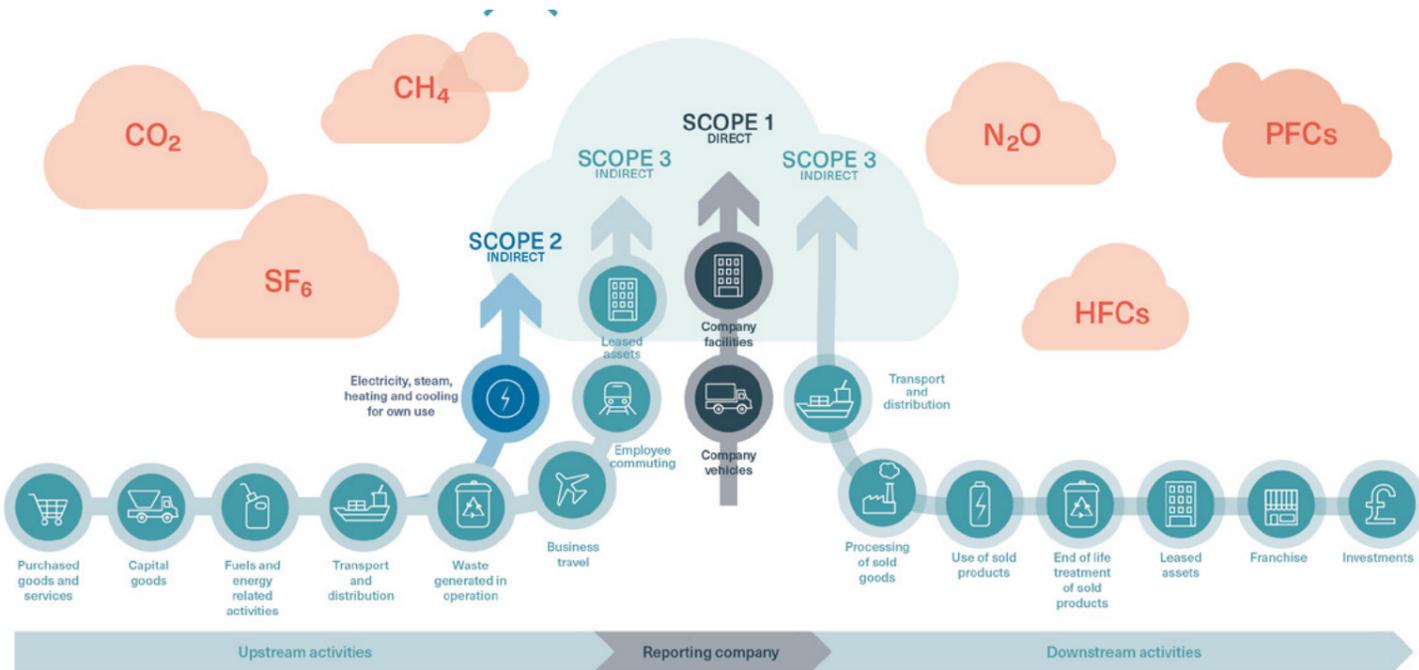
### Net zero carbon buildings (NZCB)

- NZCB strategies
- Passivhaus accreditation and certification
- Design for performance
- Upfront embodied carbon assessments
- Whole life-cycle carbon assessment



Sustainable Buildings Research Centre (SBRC)  
University of Wollongong © Richard Glover





CORPORATE STRATEGY AND REPORTING

## Carbon foot printing and reduction strategies

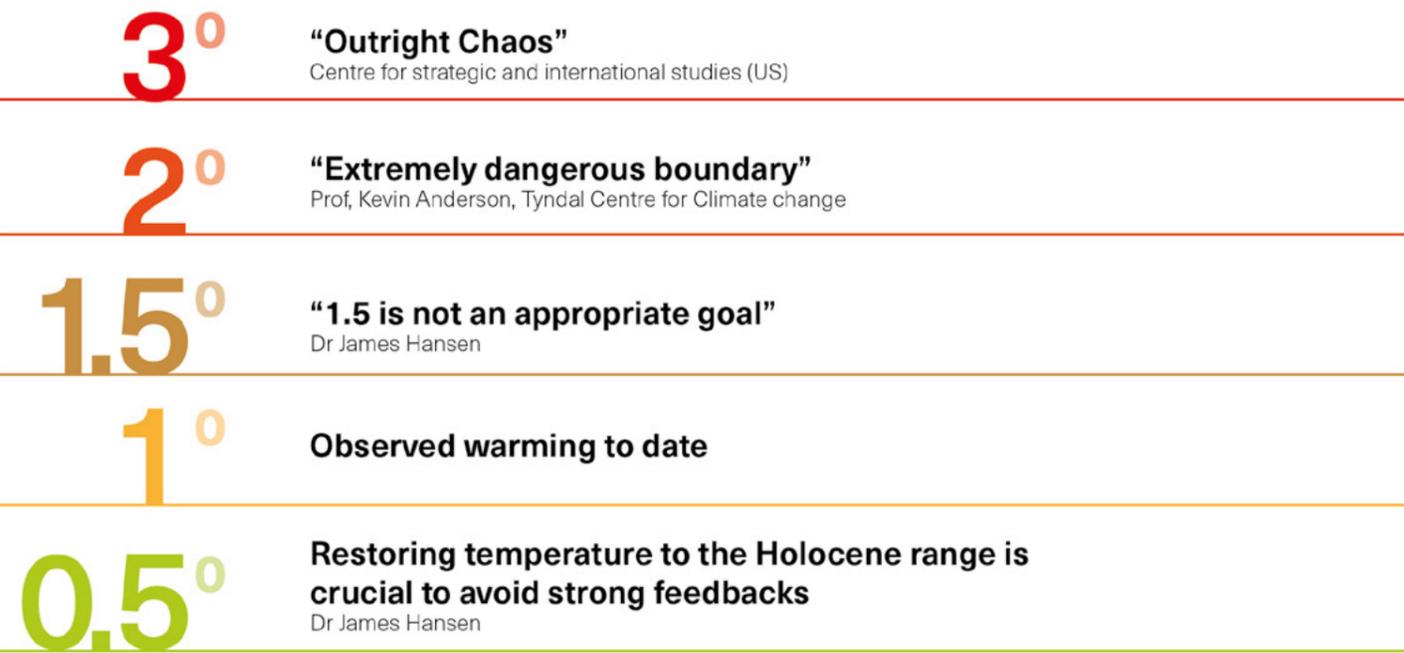
Cundall is helping to drive corporate sustainability across the world, partnering with businesses to set science-based targets, reduce climate impact and transition to a low carbon economy.

The starting point for this is to understand your total carbon footprint:

- Scope 1 - direct emission from fossil fuels
- Scope 2 - indirect emission from purchased electricity
- Scope 3 - all other emissions from supply chain, products and services

Based on this, we can help establish greenhouse gas reduction targets in line with climate science. Providing the following services:

1. Carbon foot printing
2. Carbon mitigation and reduction plans
3. Set science-based targets and net zero carbon roadmaps
4. Reporting, offsetting and disclosure strategies



CORPORATE STRATEGY AND REPORTING

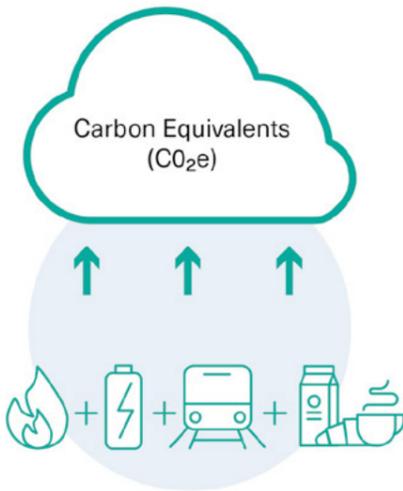
## Science based targets

Science based targets (SBT) have become one of the globally recognised standards for companies setting carbon reduction targets across all three emission scopes. SBT are carbon emission targets based on limiting global temperature rises to well below two degrees centigrade in line with the Paris Agreement.

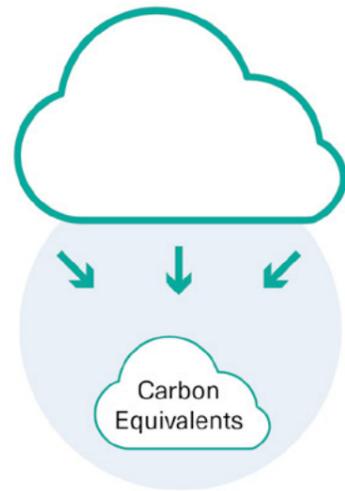
Cundall has been through this process, setting ourselves targets which have been formally endorsed by the science based target initiative. Using our experience, we are working with a range of clients to understand their emissions, setting targets and developing action plans for achieving them.



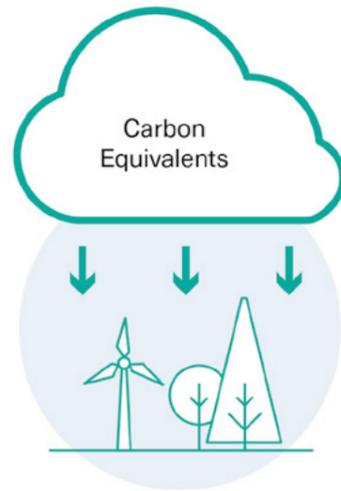
1. Calculate your carbon footprint



2. Reduce your carbon footprint



3. Offset



4. Report

CORPORATE STRATEGY AND REPORTING

## Carbon neutral certification

In 2020, Cundall's global business was certified carbon neutral using a combination of energy saving targets and ethical offsetting. Now we apply our own experience to help others, assisting them to achieve carbon neutral certification for their organisations, companies, products and events.

The key steps to deliver carbon neutral certification are:

- **Step 1** – Define and measure the annual carbon footprint (Scope 1, 2 and 3 GHG emissions)
- **Step 2** – Prepare an energy, resources and emissions reduction and implementation plan
- **Step 3** – Prepare a strategy to phase out use of fossil fuels (optional)
- **Step 4** – Generate and / or procure renewable energy (optional)
- **Step 5** – Purchase and retire offsets for all remaining carbon emissions
- **Step 6** – Undertake an independent audit
- **Step 7** – Obtain Carbon Neutral certification through an accredited scheme

A potential future strategy to purchase carbon offsets can be carefully considered to ensure that these offsets also align with a business's other environmental and/or social priorities and values. Maximising the co-benefits of carbon offsets can form part of a broader sustainability strategy.

Cundall work to the Greenhouse Gas Protocol and can provide certification to all the main international standards including:



**Carbon Trust**

Founded in 2001, the Carbon Trust was the world's first carbon footprint label, allowing companies to provide third party assurance of carbon measurement, reduction and neutrality claims. It has played a central role in establishing the standards and measures for carbon emissions reductions that are in use by thousands of companies and organisations today.

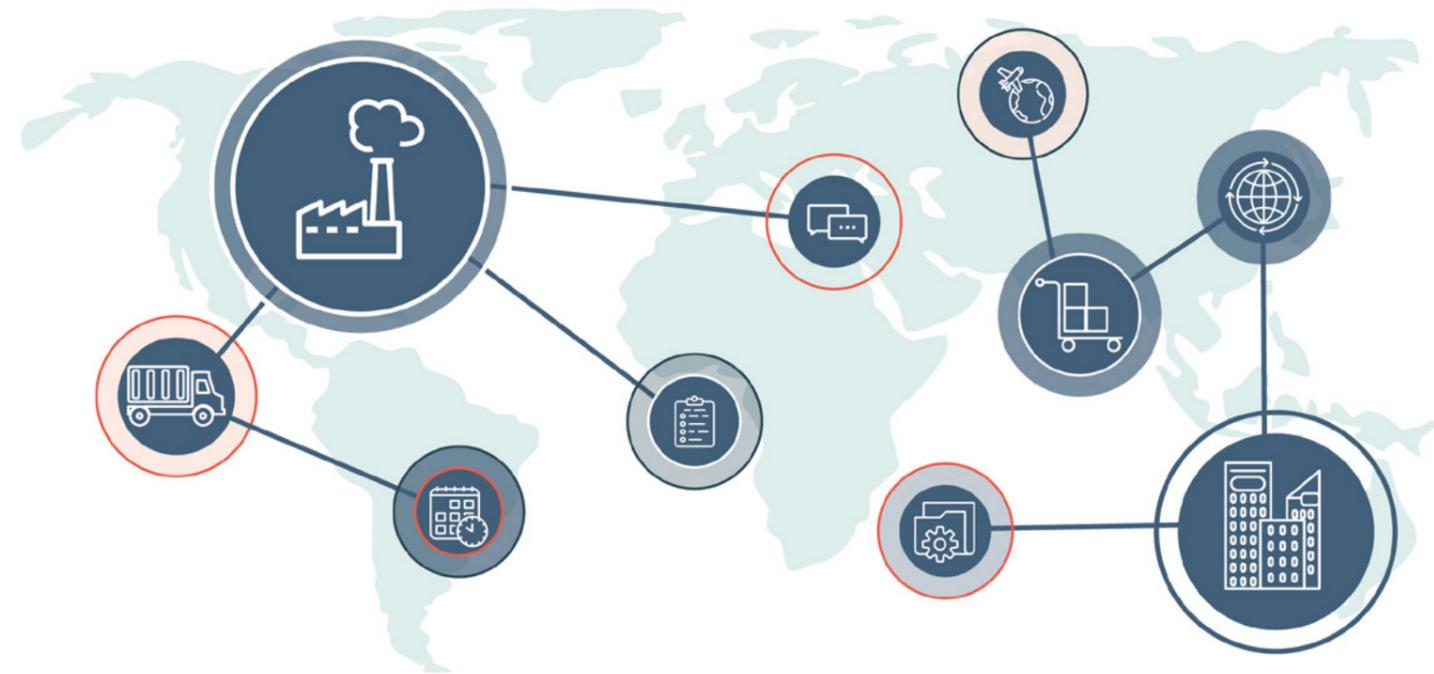
It also supports the development of technologies and programmes that are leading the way with the global response to climate change.



**Climate Active**

The carbon neutral certification through Climate Active is one of the most rigorous in the world and has been recognised by the European Union Commission and the World Bank as a mature and effective model to help organisations to define, measure and minimise their whole carbon footprint, then purchase carbon offset units to eliminate the remaining greenhouse gas emissions.

The Climate Active carbon accounting principles are based on those outlined in the GHG Protocol – Corporate Standard (WBCSD and WRI, 2004) and international standards, including the AS ISO 14064 and ISO 14040 series and include the assessment of a holistic range of emission sources, including energy, water, waste and travel.



CORPORATE STRATEGY AND REPORTING

## Supply chain charters and procurement strategies

We cannot achieve net zero carbon alone. We must collaborate with the wider industry to have the greatest impact. Key to this will be engagement with supply chains and suppliers.

Cundall's can help produce bespoke supply chain charters and procurement strategies. Empowering our clients to work closely with their supply chain to deliver lasting environmental, commercial and social benefits, while promoting the values of respect, trust and integrity.

Supply chain charters are a sustainable vision to provide direction to supply chains to help realise environmental, social, and governance (ESG) strategies and commitments.

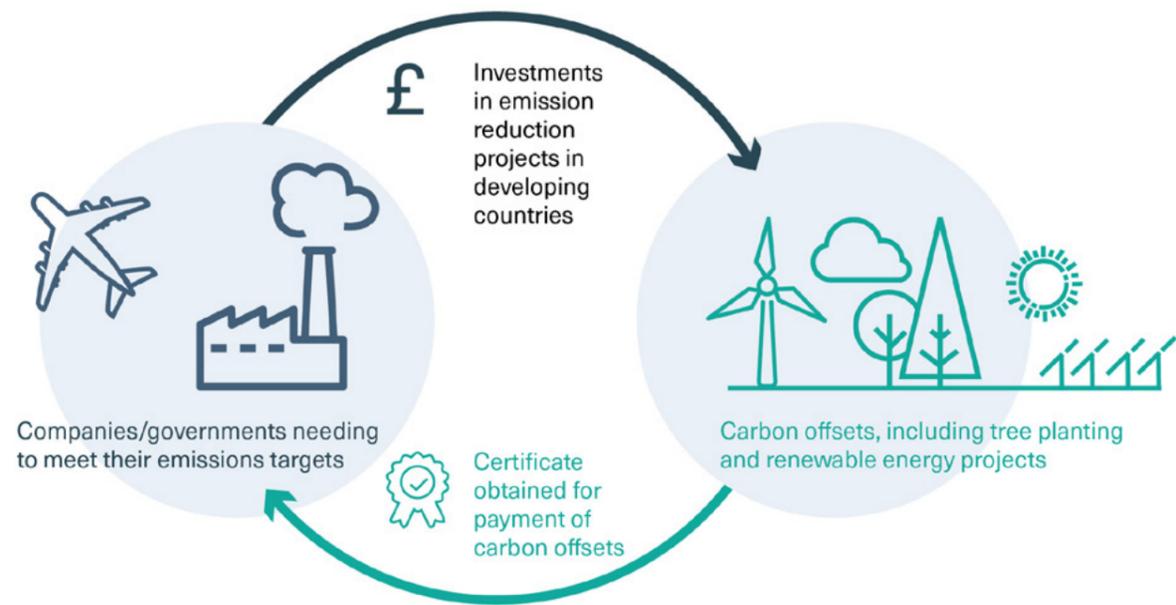
We help set sustainable procurement goals, targets and objectives that are aligned with business needs and establish clear roles and responsibilities for effectively preventing and addressing adverse social and environmental impacts.

In order to achieve the agreed aspirations and targets we develop strategies which cover:

1. Catering and hospitality
2. Cleaning products
3. Office stationery
4. Office selection and procurement
5. Electricity procurement
6. Business travel
7. Staff commuting
8. Professional services

Each of the above will be considered against their impact on goals and targets, including:

1. Eliminating waste
2. Reducing the use of single use plastics
3. Reducing water use
4. Reducing carbon and energy emissions
5. Improving biodiversity
6. Reducing any environmental impacts
7. Eliminate toxic chemicals
8. Improving health and wellbeing of employees and the wider community
9. Supporting inclusivity
10. Supporting the local economy and community



## Carbon offsetting strategies

To reach carbon neutrality the purchase of carbon offsets should be viewed as a last resort and only considered after the adoption of improvement actions and the purchase of renewable energy. Carbon offsetting is a short-term fix not a long-term solution.

The annual residual carbon footprint should be offset annually as part of an overall carbon neutral strategy. Cundall can help you through this process to find the offsetting strategy that works best for your organisation. Selection criteria and details of potential schemes follow.

### Selection criteria

A carbon offset is a reduction in emissions of carbon dioxide or other greenhouse gases made in order to compensate for emissions made elsewhere. Offsets are measured in tonnes of carbon dioxide-equivalent (CO<sub>2</sub>e). One tonne of carbon offset represents the reduction of one tonne of carbon dioxide or its equivalent in other greenhouse gases. For an offset to be of sound quality it should meet the following four requirements.

**Additionality** – The proposed project reduces GHG emissions that wouldn't be reduced through other initiatives.

**Leakage prevention** – A reduction of GHG emissions through one project might simply shift, or leak, to another location or activity.

**Permanence** – GHG prevented from entering the atmosphere should be stopped permanently. Again, there is a concern where GHG are being stored for a period (e.g. within forests) there is the chance of a release of stored carbon through a fire.

**Verifiability** – The need to seek third party verification that emissions reductions have occurred.

### Offsetting standards

Many offsetting projects are accredited by one of various certification schemes available, such as VCS or gold standard, which put in place a range of procedural requirements geared towards increasing the likelihood that the scheme actually reduces (or absorbs) global carbon emissions whilst minimising the risk of adverse consequences (such as damage to ecosystems).

The verified carbon standard (VCS) is one of the leading standards for voluntary carbon offsetting. It provides a credible but simple set of criteria that will provide integrity to the voluntary carbon market.

Gold standard VER (verified emission reduction) projects provide additional social and community benefits in addition to high quality carbon offsetting.



## Climate change risk reporting

Cundall can provide support for climate change risk reporting at corporate and portfolio level for the following global schemes:

 **Global real estate sustainability benchmark (GRESB)**  
GRESB is an ESG benchmark tool for defining sustainability performance in real estate assets. More than 80 institutional investors, collectively representing over US\$ 18 trillion in institutional capital, use GRESB data and analytical tools. In 2018, a record 903 property companies and funds participated in the GRESB real estate assessment; the infrastructure assessment covered 75 funds and 280 assets, and 25 portfolios completed the Debt Assessment.

 **Carbon risk real estate monitor (CRREM)**  
CRREM aims to allow investors and property owners to assess the exposure of their assets to stranding risks based on energy and emission data and the analysis of regulatory requirements. By setting science-based carbon reduction pathways, CRREM assesses the risk and uncertainty associated with commercial real estate de-carbonization, building a methodological body and empirically quantifying the different scenarios and their impact on investor portfolios. It aims at supporting the industry to tackle these risks and foster investments in energy efficiency as many assets will become 'stranded' properties that will not meet future energy efficiency standards and whose energy upgrade will not be financially viable.

 **Task force on climate-related financial disclosures (TCFD)**  
TCFD was formed by the Financial Stability Board (FSB) Chairman and Bank of England Governor Mark Carney. It aims to help companies identify and disclose the potential financial impacts of climate-related risks and opportunities on their businesses, which in turn will help lenders, insurers and investors better assess and price those risks and opportunities. It has developed recommendations on disclosing climate-related risks that centre around four elements:

- Governance
- Strategy
- Risk management
- Metrics and targets

 **Carbon disclosure project (CDP)**  
CDP supports companies and cities in disclosing environmental impact. It aims to make environmental reporting and risk management a business norm, and to drive disclosure, insight and action towards a sustainable economy. Since 2002, over 8,400 companies have publicly disclosed environmental information, and the CDP's annual A-list names the world's most pioneering companies in environmental performance.





PORTFOLIO STRATEGIES AND ROADMAPS

## NZC portfolio strategies and roadmaps

Cundall is helping global investors and developers produce net zero carbon pathways and roadmaps to meet their corporate ESG reporting requirements, Green Building Council net zero carbon buildings and Better Building Partnership climate change commitments.

We provide an in-depth review of our client's current position including the competitor landscape and use emissions targets to provide a comprehensive reduction strategy. We will then make green energy and offset recommendations and advise on the creation of a transparent and accessible reporting mechanism that aligns with internal targets.

Approach:

1. Legislative, competitor and consumer landscape reviews and mapping
2. Carbon footprint and target setting for agreed emission scopes
3. Reduction strategies and action plans, to cover:
  - Operational energy and carbon
  - Embodied and whole life carbon
  - On-site energy generation
  - Green energy and power procurement agreements
  - Carbon offsetting strategies
  - Certification and industry standards
  - Setting internal carbon costs and budgets including procurement carbon costs
4. Reporting and disclosure strategies in line with wider business strategies

We are already working with a number of large portfolio asset owners to produce net zero carbon roadmaps for their portfolios and individual pathways for their existing assets, if desired we can bring this experience to your portfolio.



PORTFOLIO STRATEGIES AND ROADMAPS

## NZC roadmaps for decarbonising existing assets

Considering that over 75% of the existing building stock will still be in use in 2050, the importance of deep retrofit cannot be underestimated if we are to achieve our net zero carbon (NZC) targets.

To achieve this every aspect of energy and resource consumption must be considered and minimised. The best course of action is to look at all energy flows in a building, identify how they can be minimised without interrupting business continuity and generate as much renewable energy on site, thereby creating a zero carbon enabled building. The point at which the building reaches zero carbon in operation will therefore be dependent on the rate of increase in the renewable energy content of the grid.

Net zero will be achieved when the emissions from operational energy is zero and the embodied energy of the construction, use, refurbishment, fit-out and demolition is compensated for either onsite or offsite. Any offsite compensation should be considered a last resort as many offsetting schemes have failed to deliver the full environmental benefits.

For existing buildings, we propose a phased approach to developing net zero carbon road maps in order to save cost and focus resources on quick wins and high impact areas:

1. The first phase will be a high-level review of the building to understand the systems and to benchmarking current asset performance. This will identify any fundamental issues that would attract cost, impact on the feasibility of achieving net zero carbon and determine which areas should be prioritised.
2. The second phase will be commissioning investigations to understand the building performance and opportunities for improvement, depending on the findings of the initial high-level review. This would assess the benefit of system/fabric changes and their resulting impacts on energy consumption.
3. The final phase will be the detailed design of the building systems that require enhancements, including detailed simulations to optimise plant selection and control strategies. This will require, as accurate as possible, a comprehensive understanding of how the building will be occupied and the behaviour of the occupants.

While achieving net zero in existing buildings is a much bigger challenge. Cundall's seven steps to net zero carbon buildings equally apply. The difference being when and how they applied, especially where buildings have sitting tenants, MEP and cladding replacement programmes. Therefore, for existing buildings, we propose a phased approach, setting pathways for when they do these works with a final end date as to when it becomes net zero.



# Net zero carbon buildings strategies

Utilising our steps to net zero carbon we can provide design advice and guidance for new and existing buildings. Setting individual pathways to net zero carbon appropriate to each building and their constraints.



1

### Passive design optimisation

Façade design is key. Utilise the useful daylight index to ensure the best possible daylight for occupants, whilst limiting artificial lighting use, reducing glazing areas, glare, heat loss, cooling loads and improving views and occupancy comfort. This enables full or partial natural ventilation for a proportion of the year, supplemented by mechanical systems to provide heat recovery in winter and cooling in summer where required.



2

### Reduce operational energy demand and consumption

Prioritise fabric measures to drive down heating, cooling and lighting demand. Widen temperature set bands and allow occupants to adapt and control their own comfort by adjusting clothing, using fans and natural air flow. Review drivers of energy consumption to determine suitable alternate approaches that can be taken. Challenge conventional design practices and standards, recognising that the same solutions will result in the same energy intensive buildings and looking for alternative solutions. Utilise industry standards approaches like NABERS, Passivhaus and Design for Performance to embed energy savings at every stage and meet best practice energy intensity targets.



3

### Eliminate fossil fuels

Prioritise fifth-generation heat networks and electric heat pump technologies over fossil fuel technologies to supply affordable low carbon energy. When considered in conjunction with zero emission vehicles, this will significantly improve local air quality.



4

### Provide onsite renewable energy and storage where possible

Supply all remaining energy from on-site technologies or off-site renewable certified energy sources.



5

### Limit upfront embodied carbon

Consider all upfront carbon associated with the initial build and restrict carbon intensity to a maximum of 500kgCO<sub>2</sub>/m<sup>2</sup>. This applies to all construction materials from extraction to installation, including the emissions associated with the construction works themselves. Use modular construction approaches, design for deconstruction using circular economy principles, and limit waste generated during construction.



6

### Consider whole life carbon in conjunction with whole life costing

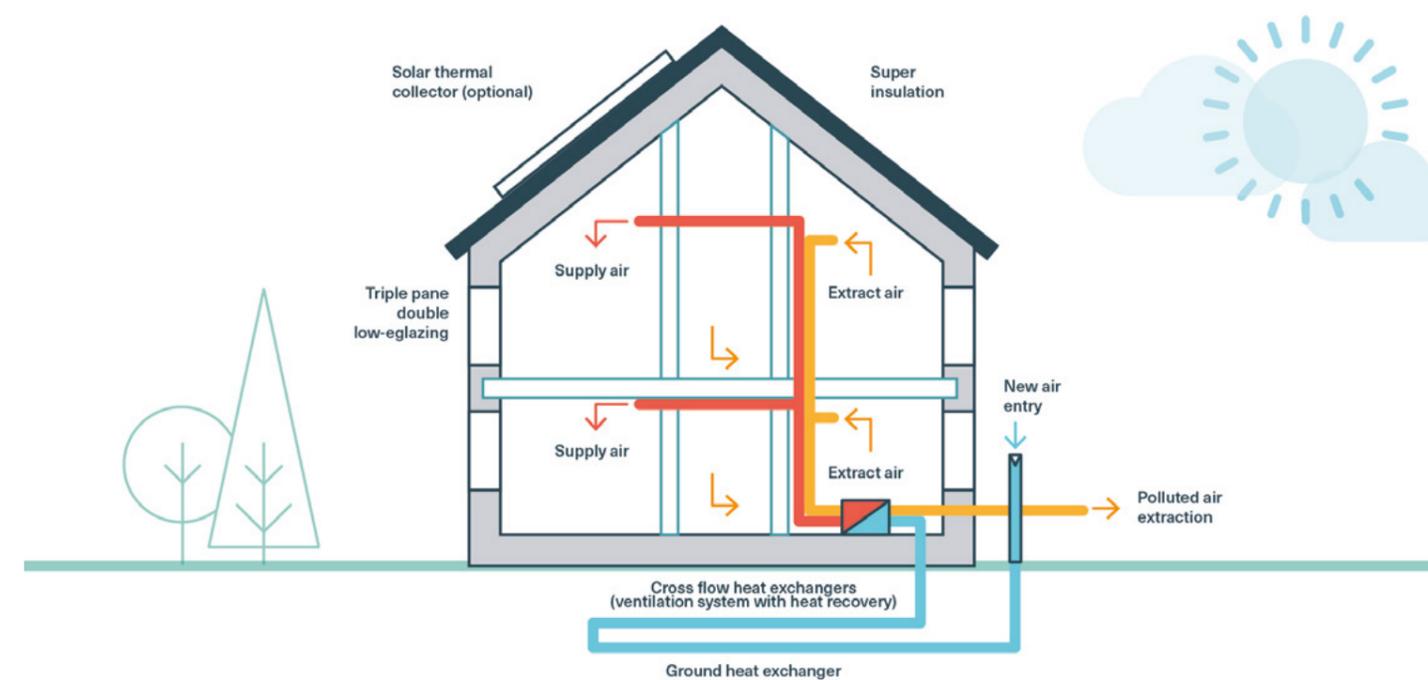
Measure all upfront and operational carbon emissions, including maintenance, fitouts, minor and major refurbishments, deconstruction and the reuse of building materials. All this must be considered over an extended design life allowing for durability and robustness.



7

### Publicly disclose performance annually using an embodied carbon database

Use Gold Standard carbon offset schemes or equivalent to offset any residual emissions with the aim of reducing offsets over time through further onsite reductions. Publicly disclose all operational, embodied and whole-life carbon on an annual basis using an embodied carbon database like RICS Whole Life Building Carbon Database in the UK.



## Passivhaus accreditation and certification

With the current drive for fabric first and net zero energy, the international Passivhaus standard is a valuable tool for the design and build of high-performance buildings of any typology.

The Passivhaus standard is a world-leading high-performance building design and construction methodology. By focusing on the quality of the building envelope, ventilation systems and utilisation of the natural environment, it enables warm and dry indoor environments naturally, with minimal reliance on mechanical and electrical systems. Beyond its best practice building fabric standards, the reason Passivhaus buildings performance far exceeds conventional buildings is the close inspection during construction. Vigilant quality assurance and commissioning of the installation process ensures the design materialises correctly and the building can perform as intended. As a result of the close attention to energy efficiency and high level of confidence in the product, there is a strong database of empirical evidence demonstrating the exceptional performance of Passivhaus buildings.

There are multiple levels of achievement under Passivhaus. Passivhaus Premium represents the highest level under the standard with is comparable to net zero energy building (NZEB) standards.

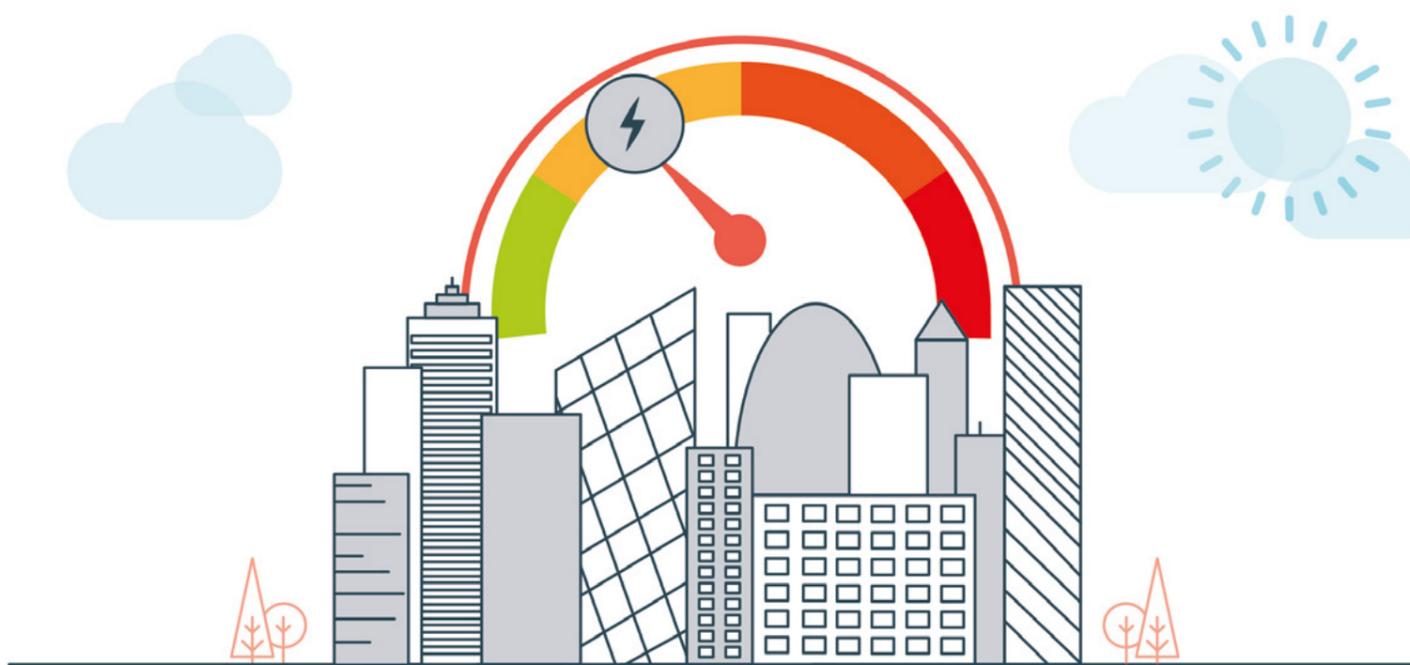
### Cundall expertise and services:

Cundall's expertise in building physics and sustainable design are at one with the Passivhaus principles. Our certified Passivhaus designers are using these principles to help clients realise their highest quality building aspirations. Through the following services:

- Early stage passive design advice and optimisation
- Certified Passivhaus and EnerPHit Designers

The first step to reaching net zero energy buildings (NZEB) is minimising energy consumption through a fabric first approach; Passivhaus is the most effective standard and tool for doing this.





NET ZERO CARBON BUILDINGS

## Design for performance

The 'performance gap' between design energy consumption and actual operational energy use in UK buildings has been widely publicised.

Design for performance (DfP) is based on Australia's NABERS, a tried and tested approach to design, simulation, handover and operation of buildings. NABERS has delivered a 75% reduction in landlord operational energy use.

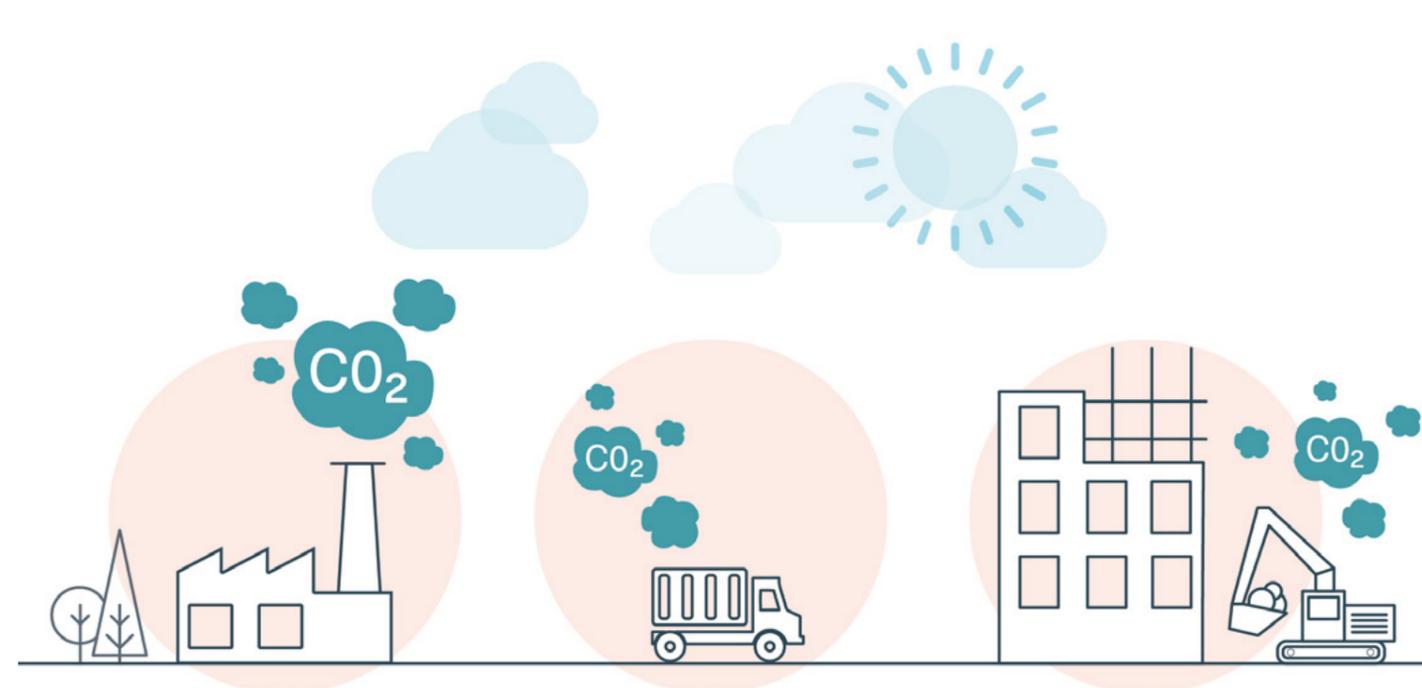
An accurate building energy model is generated at early design stage and an operational energy performance target set. In the first year this energy model is used to check that the meters are correctly collecting data, that the controls are set up correctly and the systems are performing as designed. The energy performance in use is then assessed on a system by system basis, identifying any short comings through design or operation.

Ongoing monitoring against this performance in-use target ensures that opportunities to reduce energy consumption are embedded in the operation of the building.

Cundall are pioneer delivery partners for DfP. Drawing on the experience of our Australian offices, we are currently delivering a number of the UK DfP pilot projects.

One of the strengths of DfP is the requirement for independent design reviews. Off the back of our work carrying out these reviews and training in Australia for DfP parent scheme NABERS, we are currently the only UK consultancy providing these reviews.

1. **Target setting**  
Create a model to identify the performance potential of design options and set an energy target for the building
2. **Detailed design and procurement**  
Refine the model to incorporate final product selections and controls strategies and identify energy targets for each end use, as well as identifying key design and operational risks
3. **Handover**  
Monitor consumption of the building against the simulated targets and identify areas for improvement
4. **Operation**  
Review the actual energy data and interrogate building management systems to identify cost effective energy improvement options in operation



NET ZERO CARBON BUILDINGS

## Upfront embodied carbon assessments

The World Green Building Council (WGBC) reports that buildings are responsible for 39% of global energy related carbon emissions of which 11% are from the upfront use of materials and construction. This upfront embodied carbon is defined as the carbon footprint of construction materials from its extraction, through manufacture, to installation, and the emissions associated with the construction works.

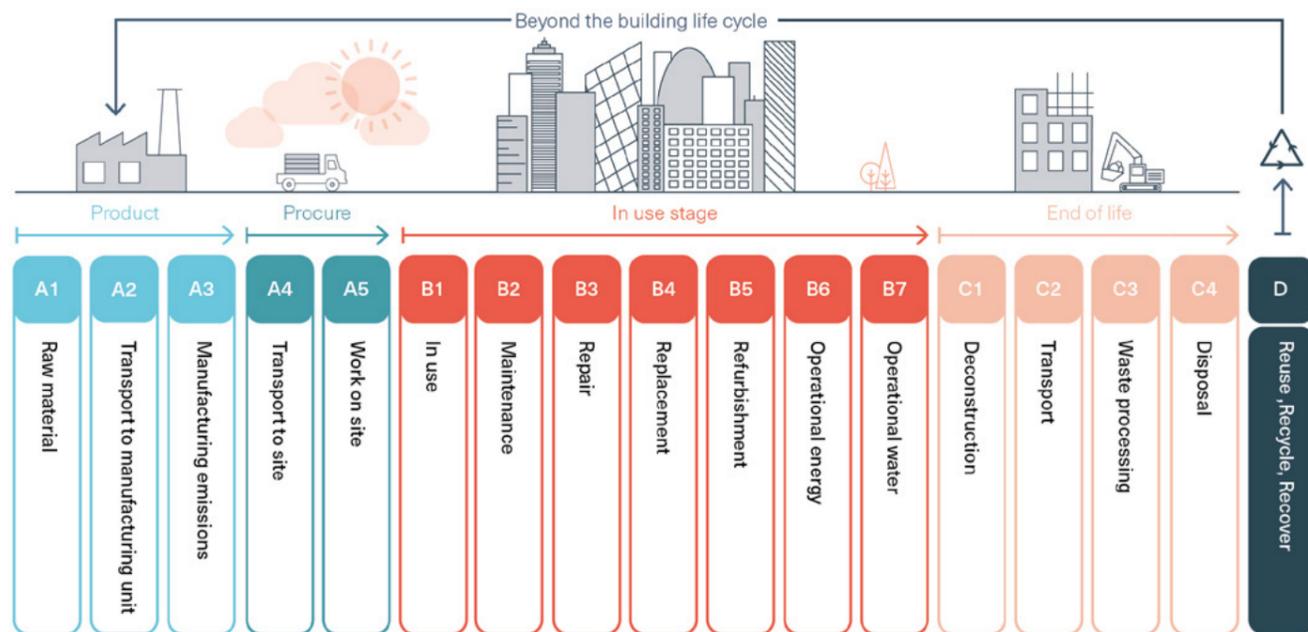
The construction industry is therefore a major contributor globally in terms of the carbon footprint it creates. It is estimated that globally 230 billion square meters of new construction and major renovations will be carried out by 2060; the equivalent of a brand-new New York City being built every month for the next 40 years. It is vital that we start to address this often-overlooked impact.

The importance of this will increase over time as the emissions from operational energy reduce through energy efficiency and the decarbonisation of the grid as more renewable energy generation comes online.

Limiting embodied carbon cannot be an afterthought, it needs to be integrated early into the design. Cundall's specialist team has contributed to the creation of the leading global whole life and embodied carbon methodologies, including for the Royal Institution of Chartered Surveyors, the World Green Building Council, the Greater London Authority and the Hong Kong Construction Industry Council. We can help by:

1. Reviewing the impact and feasibility of reusing existing building elements
2. Specifying lower carbon materials
3. Choosing lower carbon alternatives or sequestering materials such as timber
4. Reusing materials from other projects rather than virgin materials
5. Calculating and reducing embodied and whole life carbon
6. Designing to enable Modular Integrated Construction and for deconstruction using the principles of circular economy
7. Optimising design to reduce the material input and avoid over-designing





NET ZERO CARBON BUILDINGS

## Whole life embodied carbon assessments

Over the past year we have seen a global tide of momentum with governments and local authorities declaring climate emergencies and setting net zero carbon targets. Achieving these targets means not just considering upfront or operational energy emission but whole life carbon.

Whole life-cycle carbon emissions are the total greenhouse gas emissions arising from a development over its lifetime. This includes the emissions associated with the raw materials, the manufacture and transport of building materials, installation / construction, operation, maintenance, fit-outs, minor and major refurbishments and eventual material disposal.

Cundall has a specialist team who contributed to the creation of UK's first nationally recognised assessment methodology: RICS guidance document 'Whole life carbon assessment for the built environment'.

We developed the whole life carbon planning methodologies for both the Greater London Authority and the Construction Industry Council Hong Kong.

Using our practical experience in life cycle assessment, we can guide clients and design teams on the actions necessary to reduce a project's life cycle impact offering the following LCA services:

### Full project involvement:

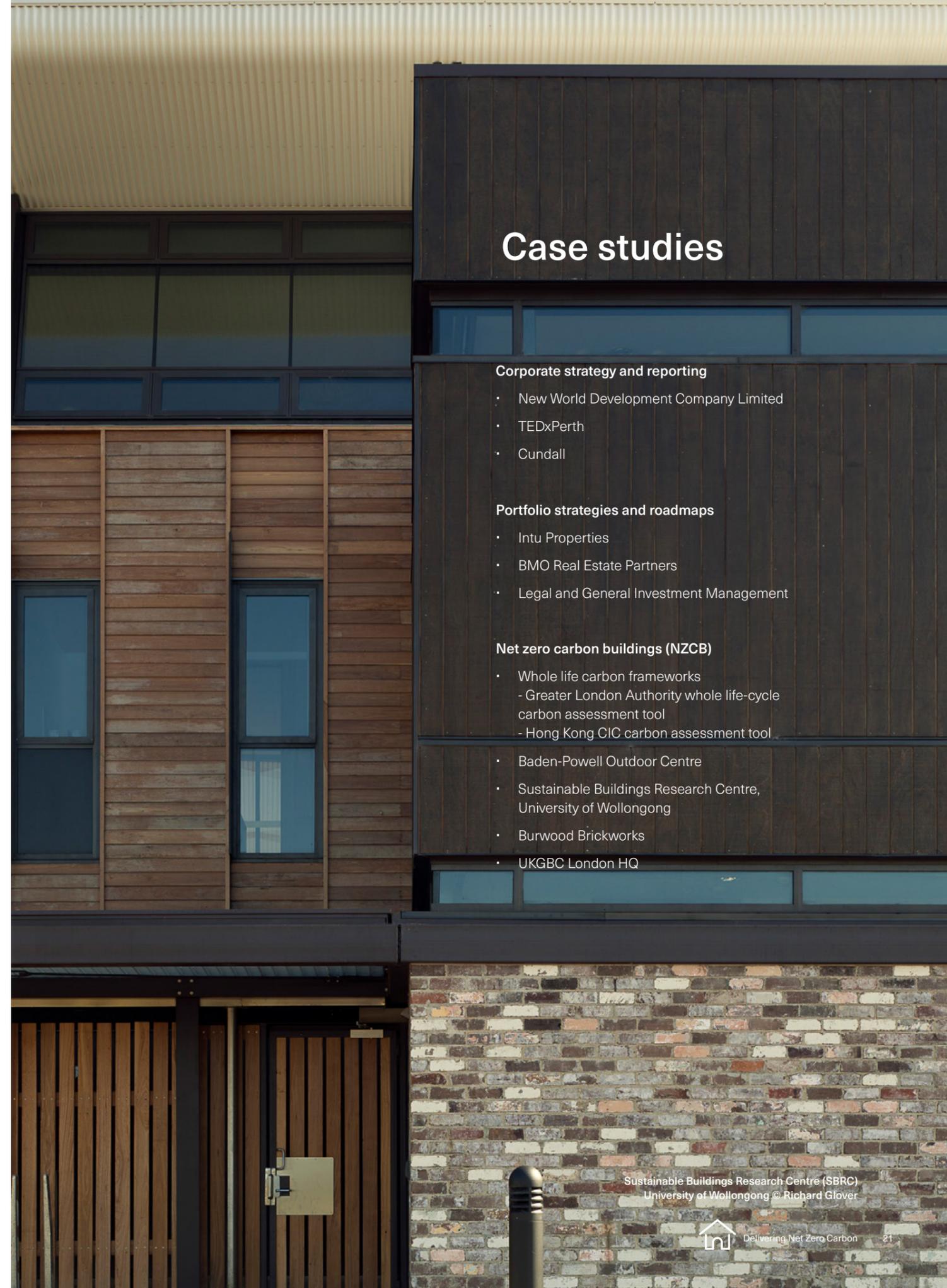
- Whole life-cycle carbon assessment throughout RIBA stages covering design and construction process
- Carbon reduction options appraisal during the design stage and setting reduction targets
- Monitoring and tracking embodied carbon 'expenditure' during construction
- Post completion review and verification

### Planning application:

- Whole life-cycle carbon assessment reports and reduction options to demonstrate compliance with local planning policy, including the London Plan and Greater Manchester spatial framework

### BREEAM credits:

- Whole life-cycle assessment report and option appraisals for BREEAM Mat01 credits
- LCA and life cycle costing alignment
- Third party verification of LCA assessment



## Case studies

### Corporate strategy and reporting

- New World Development Company Limited
- TEDxPerth
- Cundall

### Portfolio strategies and roadmaps

- Intu Properties
- BMO Real Estate Partners
- Legal and General Investment Management

### Net zero carbon buildings (NZCB)

- Whole life carbon frameworks
  - Greater London Authority whole life-cycle carbon assessment tool
  - Hong Kong CIC carbon assessment tool
- Baden-Powell Outdoor Centre
- Sustainable Buildings Research Centre, University of Wollongong
- Burwood Brickworks
- UKGBC London HQ

Sustainable Buildings Research Centre (SBRC)  
University of Wollongong © Richard Glover



# New World Development Company Limited (NWD)

Hong Kong, China

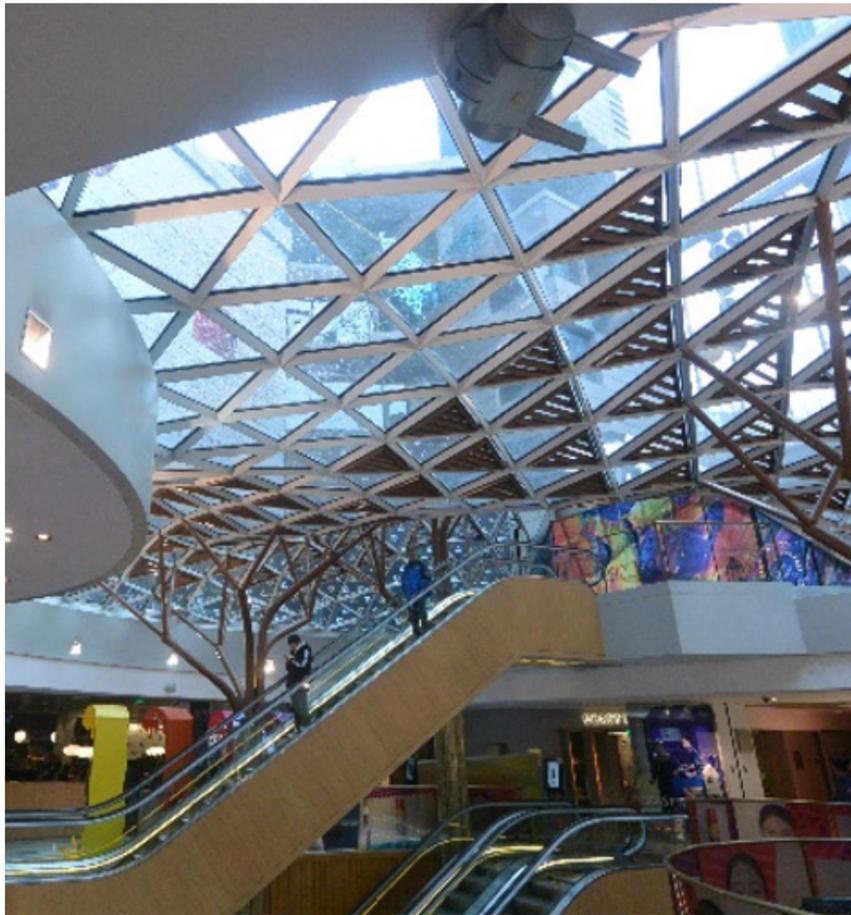
Cundall was appointed by New World Development (NWD) to assist in developing robust long-term targets as part of their sustainability strategy – Sustainability Vision 2030 (SV2030). The SV2030 covers three overarching areas; Green, Wellness, and Caring.

The aim of the project was to support NWD and its five major Business Units (BUs) – NWD, K11, New World China (NWC), New World Department Stores (NWDS), and New World Services (NWS). NWD's business portfolio in this project covered real estate (current and future portfolio), construction, and transportation companies across Hong Kong and China.

The project included desktop reviews to evaluate the selected BUs' current sustainability performance, site audits on the BU's portfolios, and extensive engagements with sites representatives and senior management.

Working with the BUs, Cundall developed a list of realistic measures to be implemented which all work towards the overarching targets.

A bottom-up model was developed to include energy, water, and greenhouse gas (GHG) reductions. A business-as-usual and a 2030 target scenario were developed to visualise the benefits of carbon reduction, and to forecast their future performance. This approach enabled Cundall to estimate a year-on-year



consumption of each asset, for both existing and future buildings. The impact of each reduction initiative was estimated, and initiatives were applied to the appropriate assets in order to understand the total expected savings. This enables NWD to set interim targets and track performance on a yearly basis.

On top of the technical implementation plan, Cundall also provided a series of strategic support recommendations to NWD. These recommendations covered data quality, data transparency, the enhancement of in-house capability, and financial tools to assist BUs to tackle the barriers identified through the site audits and engagement sessions.

Cundall successfully provided a holistic approach to create aspirational yet achievable sustainability targets for NWD and its BUs through our knowledge and expertise from both the sustainability and engineering teams.

**Client** New World Developments  
**Value** Confidential  
**Services** Science-based targets setting and roadmap



# TEDxPerth

Perth, Australia

Cundall has partnered with TEDxPerth to help them achieve Climate Active Carbon Neutral certification for all of their events, and their flagship TEDxYouth@Perth event aims to be the first TEDx event ever to seek certification under this initiative.

The TEDxPerth events in 2020 are expected to attract over 2,500 attendees, and to certify each, TEDxPerth will consider emissions resulting from travel of attendees and speakers, venue energy usage, water consumed, and the food served. They will then look at how to mitigate and reduce this impact with any remaining emissions eliminated through offsets. Only then can the

event be certified Carbon Neutral by Climate Active, which confirms that a carbon neutral claim is based on best practice, international standards and represents genuine emissions reduction. This partnership pioneers and sets the bar for other event organisers around the globe to do the same.

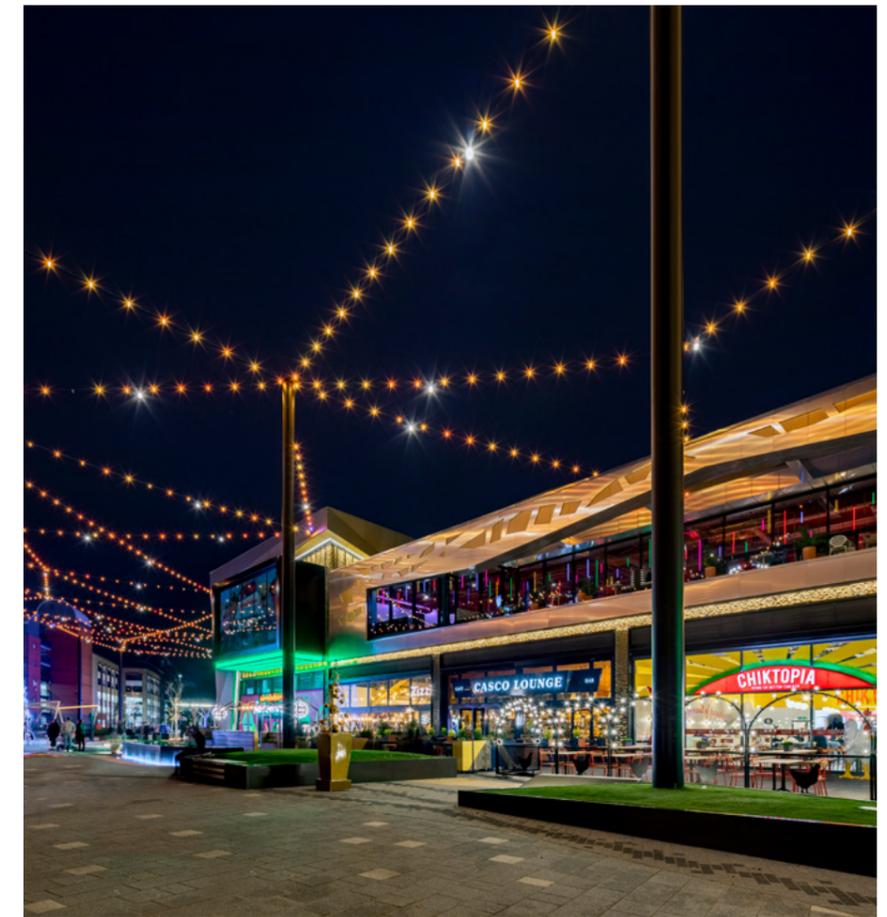
**Client** TEDxPerth  
**Sector** Workplace  
**Value** Confidential  
**Services** Carbon neutral strategy and certification



PORTFOLIO STRATEGIES  
AND ROADMAPS

# Intu Properties Plc

Global



CORPORATE STRATEGY AND REPORTING

# Cundall

Global

In 2012, Cundall became the world's first consultancy to be formally endorsed as a One Planet Company and we set out our sustainability roadmap for the business. The roadmap focused on what we do as an organisation, but we wanted to go further. As a consultancy, we understand that our biggest impact is on our projects, so in 2017 we undertook a detailed materiality review to understand our impacts and areas of influence.

We used Bioregional's One Planet Living Principles and the UN Sustainable Development Goals as a guide. This informed our new sustainability roadmap, which was

published in November 2018 and sets targets across our projects, our offices, our homes and communities, and through industry leadership.

We strengthened this in 2018 by becoming the only UK consultant to have a Science Based Target (SBT), formally endorsed by the Science Based Target Organisation across all 3 scopes of our emissions.

Cundall is also set to be endorsed by the Carbon Trust as carbon neutral across all scopes this year, after a successful trial last year where our Australian offices become carbon neutral using the Australian Government's National Carbon Offset Standard (NCOS).

**Client** Cundall  
**Value** Confidential  
**Services** Sustainability and low carbon consultancy

### Cundall's science based targets

Reduce scope 1 and 2 emissions by 63% per FTE employee by 2025 (from a 2015 baseline).

Reduce scope 3 emissions by 57% per FTE employee for purchased goods and services, and business travel by 2025 (from a 2016 baseline).

Intu is currently in the process of updating their Corporate Social Responsibility (CSR) strategy with updated goals for 2030 which will look to ingrain the United Nations Sustainable Development Goals (SDGs) into all of Intu's operations. Given that real estate makes up a significant proportion of Intu's global impacts, Cundall has been appointed to work the new 2030 CSR strategy into a Sustainable development brief (SDB) for all development works, including minor and major schemes.

Cundall has translated Intu's nine relevant materiality items into four headline sustainable development aims to be addressed on all development projects. These four aims are as follows:

1. Achieving net zero carbon by 2030 – addressing the carbon emissions of developments
2. Embed climate resilience – addressing the ability of the developments to adapt to climate change
3. Eliminate waste – reduce consumption and eliminate waste to landfill
4. Developing resilient communities – contribute to improving the communities where new developments are built

**Client** Intu Properties Plc  
**Value** Confidential  
**Services** Sustainability strategy and development brief  
**Images** © Intu and Daniel Shearing

As part of each of these targets we have developed specific measurable indicators that will define the success of each of the four headline aims for projects. We have proposed a list of future steps that we believe could contribute to Intu's CSR and sustainability strategy going forwards.



PORTFOLIO STRATEGIES  
AND ROADMAPS

# BMO Real Estate Partners

UK



Cundall is currently working with BMO's Real Estate Partners to develop a bespoke sustainable development framework for the residential portfolio.

At the same time we are reviewing the current performance of their commercial portfolio to understand their carbon footprint and set a net zero carbon roadmap to meet their 2030 targets.

This includes collating data from all assets on their scope 1 and 2 emissions and highlighting gaps in data. Putting in place plans for improving their data collection processes.

The end result will be to produce a net zero carbon pathway to meet their Better Building Partnership net zero carbon commitment agreements.

**Client** BMO Real Estate Partners  
**Value** Confidential  
**Services** Sustainability strategy and net zero carbon strategy and roadmap  
**Images** © Paul Zanree



PORTFOLIO STRATEGIES AND ROADMAPS

# Legal & General Investment Management

UK

Cundall has been appointed by Legal & General Investment Management (LGIM) to develop a net zero carbon strategy for their UK portfolio.

LGIM are in the process of finalising their business-wide science based targets. Part of the works is translating their targets and roadmap into their Real Estate net zero carbon strategy and aligning it with the UKGBC's 'Net zero carbon buildings: A framework definition', and the BBP's 'Climate change commitment.'

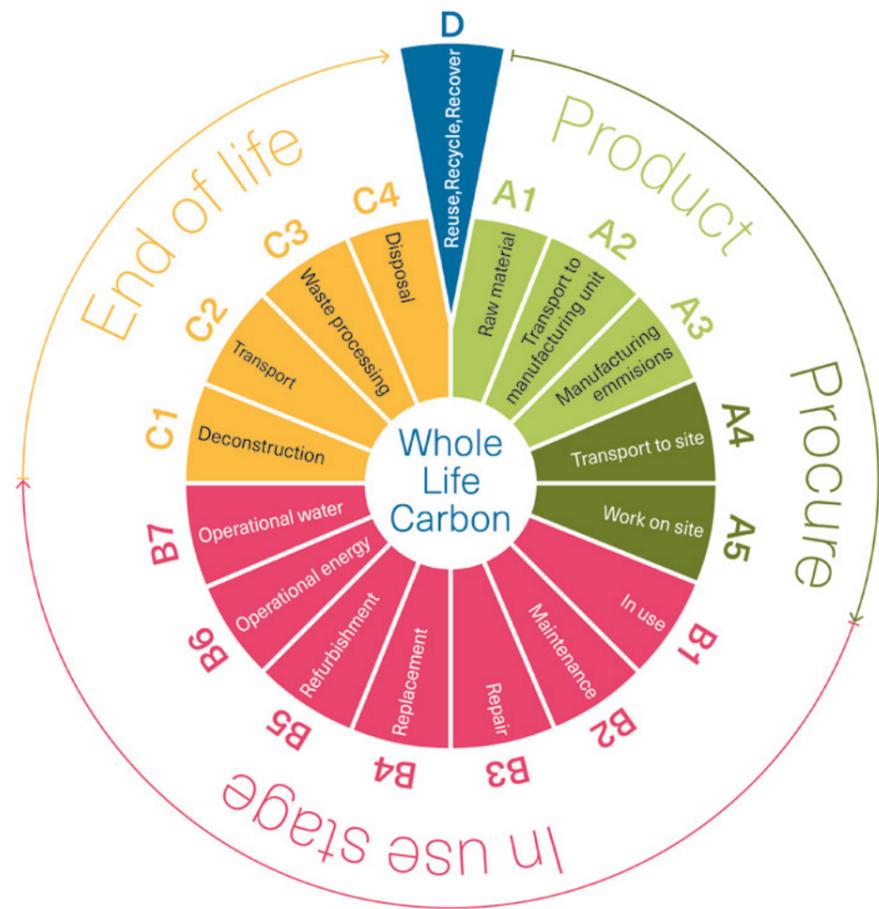
For their existing assets we have been developing individual bespoke net zero carbon pathways, considering sitting tenants; existing maintenance and plant replacement

strategies. For each asset a detailed programme of works was developed to enable it to achieve the net zero targets.

For new developments we set individual bespoke whole life strategies, including using the BBP's 'Design for performance' standard for the operational energy and the RICS' 'Whole life carbon assessment for the built environment' for the embodied carbon.

**Client** Legal & General Investment Management  
**Sector** Workplace  
**Value** Confidential  
**Services** Net zero carbon strategy and roadmap





NET ZERO CARBON BUILDINGS

## Whole life carbon frameworks: GLA whole life-cycle carbon assessment

London, UK

Cundall has been appointed by Great London Authority (GLA) to write the whole life-cycle carbon (WLC) assessment guidance for the New London Plan. All planning applications referred to the Mayor must include a WLC assessment prepared in accordance with this guidance document.

The aim is to inform the implementation of the new WLC policy and determine exactly what information planning applicants will need to provide and how the GLA will review and assess this aspect of the policy.

Cundall provided options and analysis of suitable existing

methodologies and tools, including their relevance and appropriateness for London, key information that should be provided and how the GLA should assess these assessments. This will facilitate a smooth roll-out of the policy by providing clear guidance to developers in how to comply with the policy and establishing a clear process for GLA officers and boroughs. The final framework will be based on the Royal Institution of Chartered Surveyors' (RICS) "Whole life carbon assessment for the built environment",

Cundall have also prepared a series of WLC benchmarks have been developed which applicants are

encouraged to use and which the GLA will refer to in its review of WLC assessments. An 'aspirational' set of WLC benchmarks have also been devised which applicants who are already well versed in WLC assessment are encouraged to use. Both sets of benchmarks are included in the policy.

The policy also links to the energy assessment for the development and the circular economy statement which will be submitted as part of the planning applications. All three documents should be aligned with appropriate cross-referencing.

NET ZERO CARBON BUILDINGS

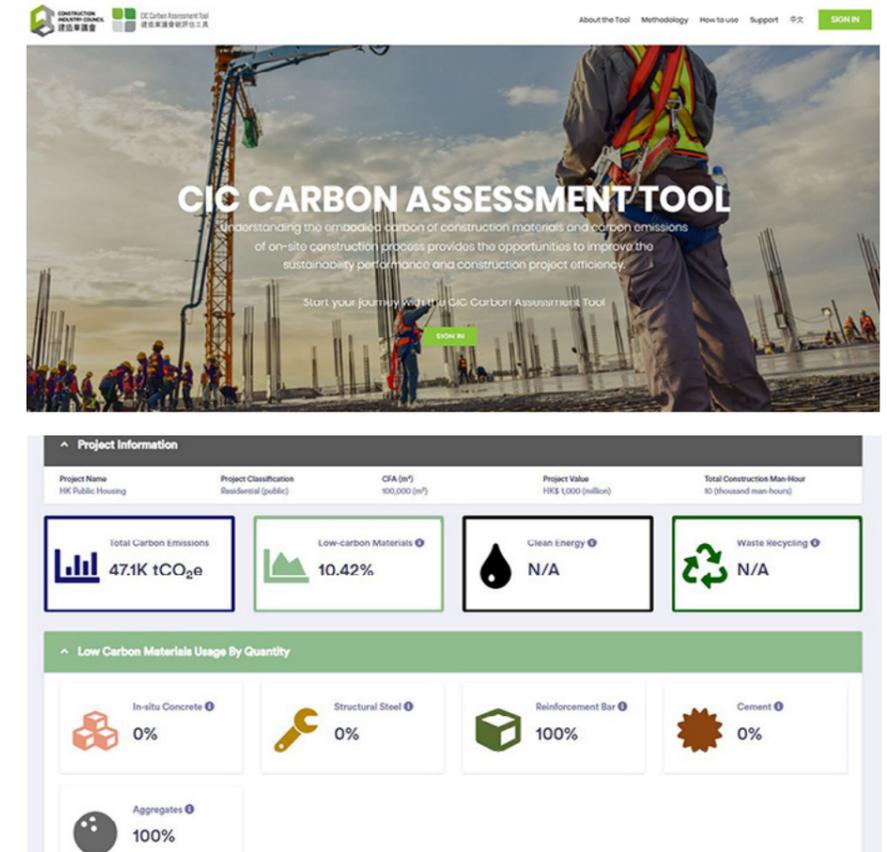
## Whole life carbon frameworks: CIC carbon assessment tool

Hong Kong, China

Cundall was engaged by the Hong Kong Construction Industry Council (CIC) to develop the carbon assessment tool (CAT) as part of their wider sustainability strategy. This online tool is publicly available and designed to be used across the industry, from public owners, developers and designers, to contractors and suppliers. The CAT encourages carbon reduction through low carbon design and construction.

The CAT will collect data from projects, ultimately enabling carbon benchmarks for multiple typologies, e.g. commercial, residential, tunnel, highway, etc. Users will then be able to compare their performance against the benchmark. The data will also assist CIC with their annual reporting for the industry against the Hong Kong carbon reduction targets.

Two key focuses for CIC in the development of the CAT are the usability of the CAT and the suitability of the carbon emission factors for Hong Kong. It is therefore important to engage with the end-



users throughout the development to ensure their feedback. Suggestions from users were considered in order to get their buy-in for using the CAT. Cundall hosted numerous stakeholder engagement workshops with public owners, private developers, contractors, and material suppliers throughout the development process.

In order to measure the carbon footprints of these materials, the team at Cundall used Hong Kong trade statistics and worked closely with materials suppliers to understand the materials' source locations and developed the database to reflect this. Representative data sources were collected to develop a database reflecting the material type, recycled content, manufacturing process and source location of these materials.

Generic numbers were also included for each material type in case users do not know the source location or specification of the materials used.

It is anticipated the integration of the CAT into BEAM Plus (Hong

**Client** The Construction Industry Council, Hong Kong  
**Client type** Local Government  
**Value** Confidential  
**Completion date** September 2019  
**Project duration** 1 year  
**Services** Whole life carbon advise  
**Involved stakeholders type** Contractor, academic and suppliers

Kong Green building certification system) will drive industry buy-in as the scheme is widely used on building projects in Hong Kong. The CAT users can generate automated reports through this platform to aid other sustainability reporting, such as ESG reporting and carbon audits.



NET ZERO CARBON BUILDINGS

# Baden-Powell Outdoor Centre

Dorset, UK



The Baden-Powell Outdoor Centre is located on a site of special scientific interest (SSSI) on Brownsea Island in Poole Harbour, Dorset. The island is particularly important to the history of the scouting movement as it is where Robert Baden-Powell set-up his first scout camp. The centre, which was opened in time to host the 100-year anniversary of the scouting movement, consists of four timber-framed buildings including a heritage centre with a learning room and shop and a toilet and shower block. The heritage centre is open to all Brownsea Island visitors and there is accommodation for staff and volunteers as well as storage space for camping equipment. The aim was to provide a highly sustainable scheme utilising the development ideal of 'leaving the land as found'. It was also important for the centre to act as an education resource, demonstrating sustainable energy technologies to visiting scouts and guides. With all this in mind, Cundall's sustainability team developed a sustainable servicing strategy, and careful use of passive design elements were

considered initially, such as using as much natural light and ventilation as possible to achieve substantial reductions in energy whilst providing a comfortable environment for the occupants. After maximising the contribution of the passive elements, the aim was to further reduce the energy consumption by selecting efficient mechanical and electrical systems with efficient controls to manage the energy used during operation. Low and zero carbon technologies were then used for on-site energy generation. The development's heating and hot water (including all the camping showers) is supplied by a biomass boiler, fed with wood waste gathered from the island. All electricity used on-site is supplied by a 1.5kW horizontal axis wind turbine. The excess electricity generated is stored in a battery bank which is used during periods when there is little or no wind. In addition to energy saving technologies, low water use appliances such as waterless urinals, were installed to reduce overall water consumption. The buildings themselves were designed to use sustainable

**Client** National Trust, Brownsea Island Scouts and guides management Committee  
**Value** £535,000  
**Completion date** 2007  
**Architect** Wilkinson King  
**Images** © Paul Tyagi  
  
**Awards** RIBA Awards (2008), Wessex, Winner

materials and touch very lightly on the ground - an idea inspired by the tents used in the original encampment. Building timbers came from a sustainable source and the floor finishes are timber and rubber. The outdoor centre is built on helical steel foundation piles, which can be unscrewed from the ground without damaging the landscape at the end of the building's natural life. This means that the site can also be easily returned to its original condition when the buildings reach the end of their useful lives.

NET ZERO CARBON BUILDINGS

# Sustainable Buildings Research Centre

University of Wollongong, Australia

The University of Wollongong's Sustainable Buildings Research Centre (SBRC) is designed to be a living laboratory. The centre will test a range of existing sustainable building technologies, whilst researching and developing new products in conjunction with industry partners.

As well as targeting a 6 Star Green Star Design rating, the Sustainable Buildings Research Centre is the first Australian building to be certified by the Living Building Challenge, the world's most advanced measures of sustainability in the built environment. It produces all its own power on-site from renewable sources, is water neutral, uses local

resources and eliminates the 14 most common toxic chemicals found in buildings (known as the Red List).

The project comprises a 900 metre square testing facility along with a two-storey office and training wing for researchers, industry collaborators and administrative staff. The testing facility is fully naturally ventilated. It is primarily constructed from re-used bricks that have been locally sourced and heavily insulated to achieve thermal comfort.

The operational energy will be generated using a range of photovoltaic technologies, geothermal and wind energy to achieve zero net energy in operation.

**Client** University of Wollongong  
**Sector** Education  
**Value** AU\$26 million  
**Completion date** 2013  
**Architect** Cox Richardson  
**Services** Sustainable design

All construction and operational embodied energy will be offset onsite using the excess electricity generated by the centre extensive solar array will less than 10 years.

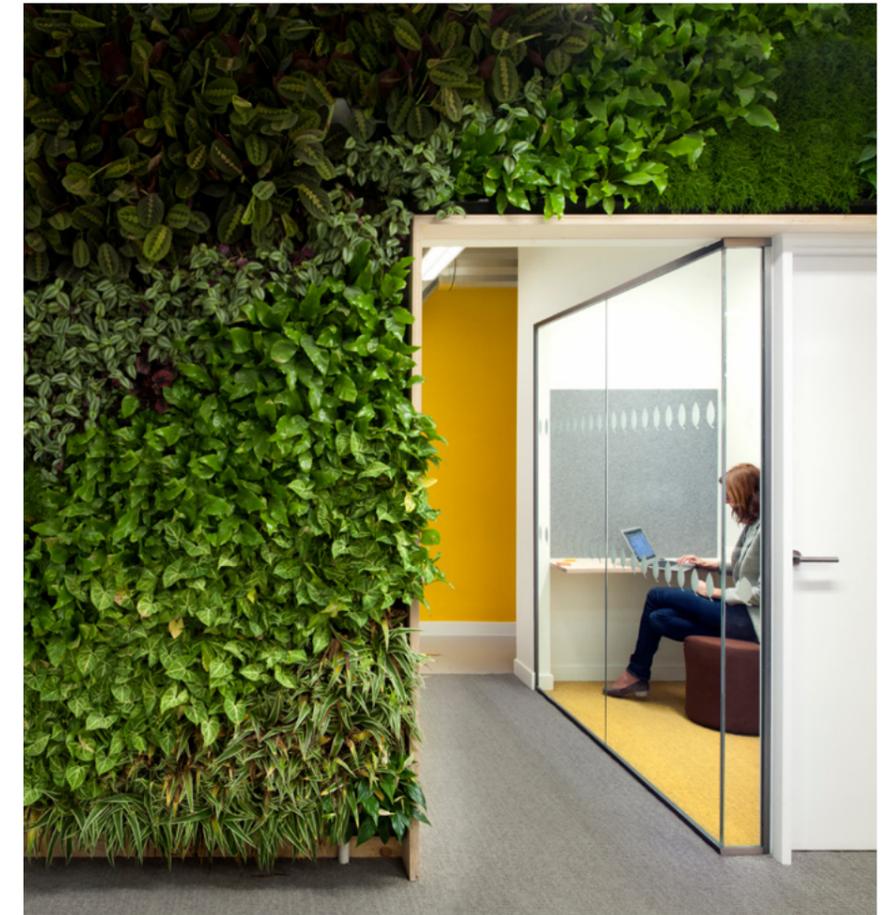




NET ZERO CARBON BUILDINGS

# UK GBC London Headquarters

London, UK



NET ZERO CARBON BUILDINGS

# Burwood Brickworks

Melbourne, Australia

**Client** Frasers Property  
**Value** \$115m  
**Architect** NH Architects  
**Images** © Studio Magnified

Billed as the most sustainable shopping centre in the world, Burwood Brickworks is one of Frasers Property's most bold projects to date. This community-scale development located 15km east of Melbourne's central building district in the City of Whitehorse, will feature an exciting new shopping centre, park land and civic plaza. The retail centre will include a large proportion of food and beverage outlets, plus destination and experienced-based retail.

The \$115m mall will house a commercially operated urban farm on its roof, recycle rain and waste water and create enough power through solar panels to be net

energy positive.

The project achieved a 6 Star Green Star Design Review rating and is on track to achieve both its As-Built rating and Living Building Challenge (LBC) certification, making it the first net zero carbon and energy positive retail development in Australia.

The prefabricated mall will include the use of sustainably sourced laminated timber and recycled bricks along with 3,900 square metres of billabong plantings and 2,000 square metres of vines while up to 99% of construction waste will be repurposed rather than become landfill.

Cundall has been providing ESD consulting services for the development, which has included initial guidance on achieving a LBC certification and has also acted as the Green Star Accredited Professional (GSAP) for its 6-Star Design Review rating achievement.

Cundall was delighted to be selected by the UK Green Building Council (UKGBC) to be a part of the design team, chosen from their member organisations, to design their new office. As appropriate to an organisation that aims to lead the industry in all things sustainable, they wanted their office to be an exemplar for sustainable fit out. It was therefore important to them to have Cundall involved.

UKGBC's mission is to radically improve the health and wellbeing of their working environment in a highly sustainability manner. The organisation refurbished its headquarters with the aim of challenging industry thinking as to what is achievable in a small-scale fit-out.

Cundall joined architectural practice Barr Gazetas, working closely with the client and leaseholder, The Building Centre, on refurbishing the office space. We drew on our experience of WELL and other sustainability rating tools to create a bespoke sustainability framework to

respond their own demanding brief.

The brief aimed to balance the health, wellbeing and productivity of the 25 regular office users with outstanding resource efficiency within a restrained budget. Cundall provided advice on sustainability, health and wellbeing, and building services engineering for the office fit-out. Where possible, we reused and enhanced the existing systems, conserving the embodied energy,

Targets:

- Achieved the lowest measured fit-out carbon footprint in UK
- 98% of original fixtures and finishes reused and repurposed, each with an 'end of life' plan
- 99.4% of construction waste diverted from landfill
- A responsible sourcing plan was developed for all new materials, which took an integrated view of the environmental impact including carbon profiling
- Air quality maximised in line with the relevant WELL Standard

**Client** UK Green Building Council  
**Sector** Workplace  
**Value** Confidential  
**Completion date** 2016  
**Architect** Barr Gazetas  
**Services** Building services engineering, sustainable design and health and wellbeing  
**Images** © Philip Vile

requirements, including the minimisation of VOCs

- Reducing energy used per employee for lighting and small power by 40% by 2020 compared to a 2013 baseline, and the overall performance (including HVAC) should equal or better best practice benchmarks





If achieving net zero carbon is of interest to you on a project or to your organisation, please let us know. We would be more than happy to have an introductory chat.

We believe that together we can create a positive change in our world.

## Contact us

### UK

**Simon Wyatt**

T +44 20 7438 1600

s.wyatt@cundall.com

### Ireland

**Alan Fogarty**

T +44 20 7438 1600

a.fogarty@cundall.com

### Spain

**Jose Castilla**

T +34 913 600 284

j.castilla@cundall.com

### Poland

**Wojtek Stec**

T +48 79 0510 717

w.stec@cundall.com

### MENA

**Mario Saab**

+971 4323 2629

m.saab@cundall.com

### China and Hong Kong

**Jonathan Yau**

T +852 5806 1500

j.yau@cundall.com

### Singapore

**Marcus Eckersley**

T +65 6911 2602

m.eckersley@cundall.com

### Australia

**David Clark**

T +612 8424 7003

d.clark@cundall.com

This statement has been developed in consideration of the United Nations Sustainable Development Goals (UN SDGs).



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