

Embodied emissions of buildings

Reporting and target setting in the
Carbon Neutral Government
Programme



Carbon Neutral
Government Programme



Te Kāwanatanga o Aotearoa
New Zealand Government

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1. Background

1.1. Purpose of this guidance

Carbon Neutral Government Programme (CNGP) organisations are involved in the construction of a wide range of buildings, including houses, offices, schools, and defence and emergency management facilities. This can be an infrequent activity such as constructing a new office building, or form part of an ongoing portfolio of work. Embodied emissions (emissions associated with a material or end product) resulting from construction activities will usually be a scope 3 (other material) emission source for CNGP organisations as they include purchased goods (construction materials) and physical works undertaken by third-party contractors.

This guidance covers embodied emissions associated with buildings. The broad principles and approach described can also be applied to other types of infrastructure projects undertaken by CNGP organisations.

Use this guidance if your organisation is constructing a new building, or refurbishing or fitting out an existing building for its complete or partial use. The guidance will help you set targets for and report on embodied emissions associated with buildings. It does not include detailed recommendations for measuring or reducing these embodied emissions. Documents that provide this guidance are listed under [Standards and guidance documents](#).

1.2. Embodied emissions

Emissions throughout the lifecycle of a building can be divided into operational and embodied emissions. There are different definitions of embodied emissions. For the purposes of the CNGP, we have adopted the definition used by the [Building for Climate Change](#) programme run by the Ministry of Business, Innovation and Employment (MBIE).

This definition states that:

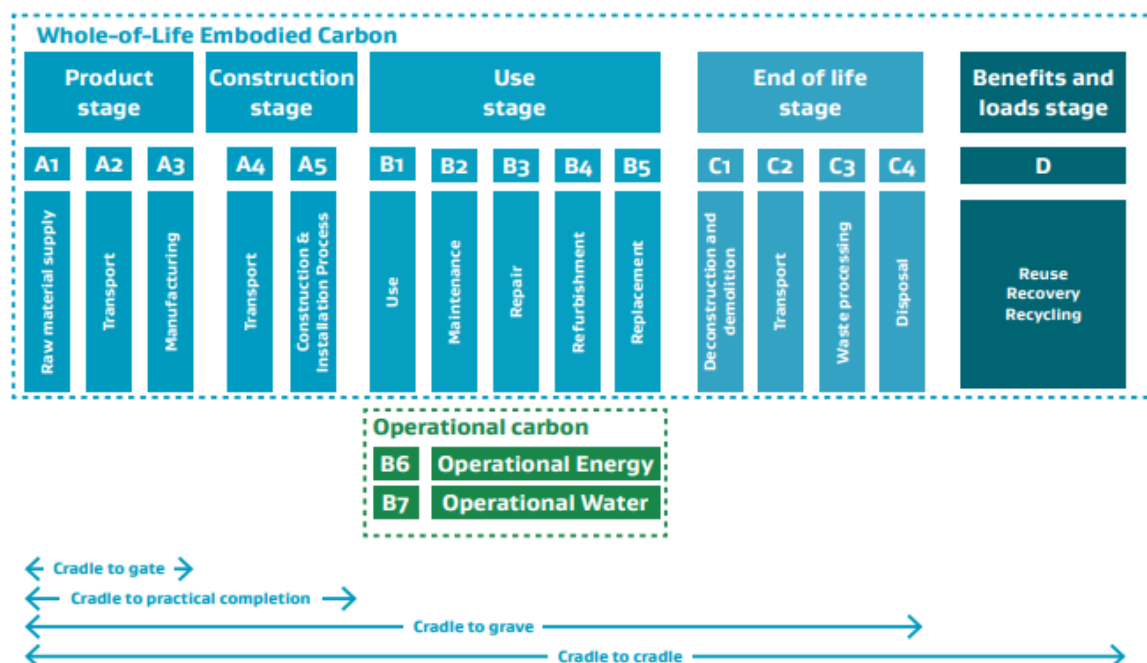
“A building’s whole-of-life embodied carbon:

- *is the sum of the embodied carbon of the constituent materials and products in the building, to the extent that it includes those elements that make the most significant contribution to the total embodied carbon of the building*
- *includes all the emissions associated with these materials and products that occur right across their lifecycle, namely production and manufacture, transportation and construction processes, maintenance activities, and what happens when the building is no longer used (end-of-life)*
- *excludes emissions associated with the operation of the building, typically from energy used for heating, cooling, lighting, and water consumption.”*

(MBIE, 2022, p 5)

This definition includes all lifecycle modules specified within European Standard EN15804, except operational energy use (module B6) and operational water use (module B7), within the whole-of-life embodied emissions of a building (figure 1).

Figure 1: Operational and whole-of-life embodied carbon lifecycle stages



Source: MBIE, 2022, p 6.

Emissions associated with buildings occur at different stages of the lifecycle. A large proportion of these emissions are ‘locked in’ or determined by design-phase decisions such as building orientation and form, materials used, insulation levels, and the type of services installed. These early decisions can influence both the embodied emissions associated with materials and construction and the ongoing operational emissions (eg, the type or extent of heating and cooling required).

Achieving the lowest greenhouse gas (GHG) emissions over the lifetime of a building or asset can sometimes involve a trade-off between embodied and operational emissions. For example, additional insulation, triple glazing, and solar panels can all reduce operational heating demand but will add embodied emissions associated with the manufacture of the additional materials.

The CNGP programme aims to reduce GHG emissions in the public sector, and to lead by example. CNGP organisations are encouraged to adopt a ‘whole-of-life’ approach when considering the emissions associated with buildings over which they have influence. This means minimising the combined operational and embodied emissions over a building’s full lifecycle. However, a whole-of-life approach does not fit easily with annual emissions reporting and reductions based on point-in-time targets which are features of the CNGP programme. This guidance describes how to include embodied emissions sources in your annual CNGP reporting and target setting.

Embodied emissions reporting in the CNGP focuses on the product and construction stage. We encourage you to report embodied emissions associated with other lifecycle stages where relevant

and material to the organisation. Developing the capability to report embodied emissions across the full lifecycle of a building will take time, and you should prioritise your efforts to the areas of greatest emissions or potential reductions in the short term.

The definition of embodied emissions excludes operational emissions associated with building use. These are covered under the CNGP mandatory emission sources such as fuel use, refrigerant use, purchased electricity, water supply, wastewater services and waste to landfill. Guidance on how to measure and set targets over these sources is covered in:

- [Carbon Neutral Government Programme: A guide to managing your greenhouse gas emissions](#) (Ministry for the Environment, 2023a)
- [Measuring emissions: A guide for organisations: 2023 detailed guide](#) (Ministry for the Environment, 2023b).

1.3. Standards and guidance documents

Consistent with other GHG emissions, prepare your embodied GHG emissions inventory using international standards:

- [ISO 14064-1:2018](#)
- [Greenhouse Gas Protocol](#).

The [Corporate Value Chain \(Scope 3\) Accounting and Reporting Standard](#) (World Resources Institute and World Business Council for Sustainable Development, 2011) is a supplementary standard to the Greenhouse Gas Protocol. It is relevant as most embodied emissions will be value-chain emissions.

The following additional standards and guidance documents are specifically concerned with measuring and reporting GHG emissions associated with the built environment.

- [Sector Supplement for Measuring and Accounting for Embodied Emissions in the Built Environment: A Guide for measuring and reporting embodied emissions using the Greenhouse Gas Protocol](#) (Brightworks Sustainability & WAP Sustainability, 2021).
- [Construction CO₂e Measurement Protocol: A Guide to reporting against the Green House Gas Protocol for construction companies](#). (ENCORD, 2012). This guidance document is less directly relevant for most CNGP organisations but provides useful information on what constitutes best practice for construction companies.
- [PAS 2080](#) provides a specification for whole-of-life carbon management when delivering projects and programmes in the built environment including buildings and infrastructure.
- [EN 15804:2012+A2:2019](#) covers the sustainability of construction works, environmental product declarations, and core rules for the product category of construction products.
- [EN 15978:2011](#) covers sustainability of construction works, assessing the environmental performance of buildings and calculation methods.
- [ISO 21930](#) covers sustainability in buildings and civil engineering works and core rules for environmental product declarations of construction products and services.

Aotearoa New Zealand-specific guidance relating to measuring and minimising the embodied emissions in building and construction includes:

- [Whole-of-life Embodied Carbon Assessment: Technical Methodology](#) (MBIE, 2022)
- [Procurement guide to reducing carbon emissions in building and construction: A practical guide](#) (New Zealand Government, 2022) and the supporting [Carbon brief template](#).

1.4. Relationship to other building requirements

The CNGP is one of several initiatives that aim to reduce emissions associated with buildings and construction within government and the wider economy. [Figure 2](#) provides a summary of these initiatives and how the different programmes and requirements interact. The CNGP complements and supports these other requirements and programmes.

This document is aligned with guidance applicable to all buildings in Aotearoa developed as part of MBIE's Building for Climate Change programme. However, there are differences between MBIE's programme and the CNGP, particularly in terms of the timeframes for reporting and assessment.

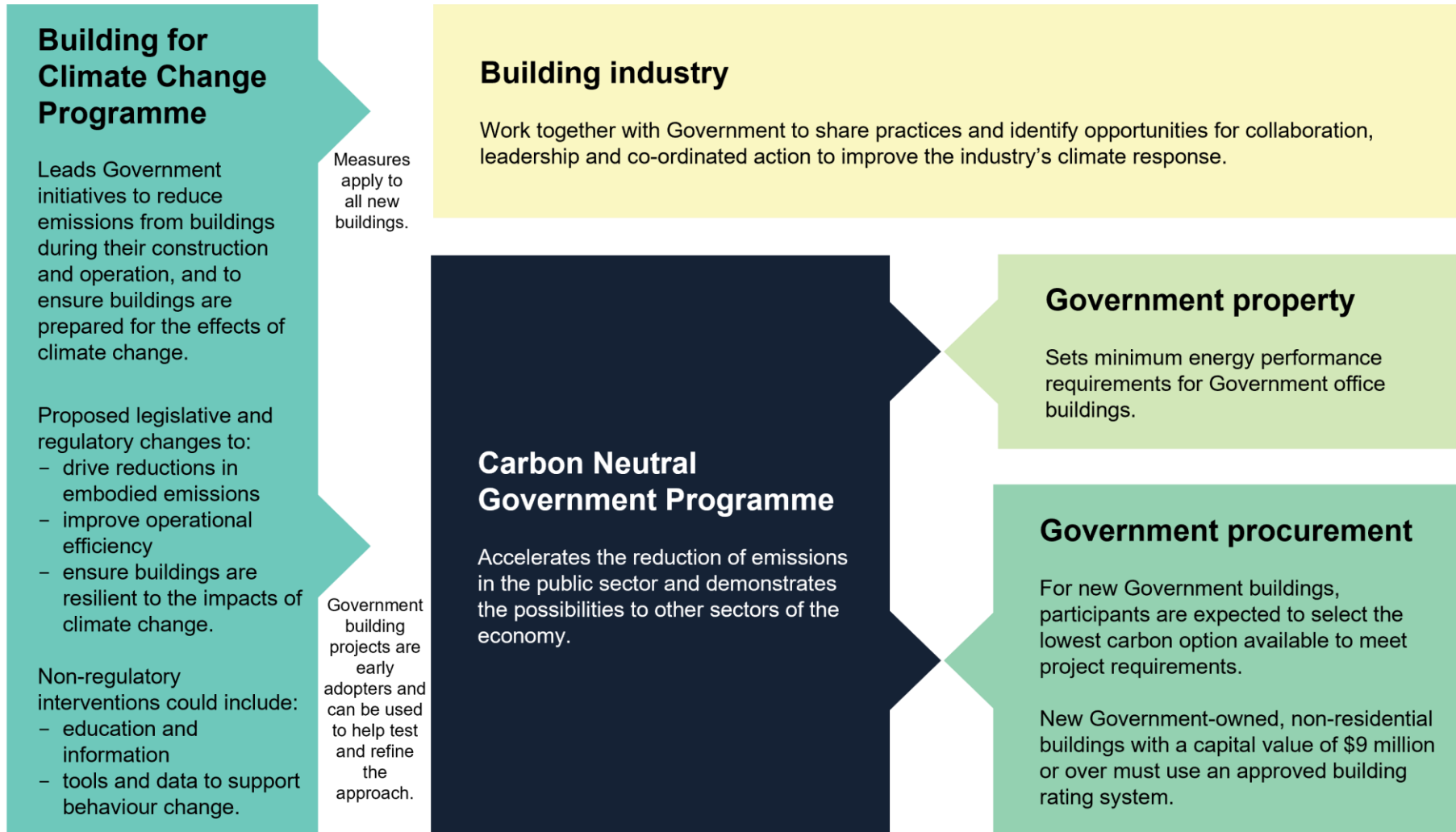
We encourage you to undertake a whole-of-life assessment and seek to reduce emissions over the lifetime of a building consistent with Building for Climate Change proposals. However, CNGP emissions reporting is undertaken annually and embodied emissions should be reported at the time they occur as far as practicable (see [section 2 Reporting](#)).

Engage with your designers and suppliers early in the scoping and design phases of a building project. This will ensure that sufficient time, expertise and resources are factored into the project objectives, timeline and supplier contracts. It will also help you to source the necessary information, undertake GHG assessments, and refine your design based on the findings.

Procurement-mandated organisations are required to obtain a rating using an approved sustainable building rating system when building a new government-owned, non-residential building with an estimated capital value of over \$9 million. Approved sustainable building rating systems have specified standards and minimum requirements, such as focusing on reducing embodied and operational carbon emissions. A list of approved sustainable building rating systems and minimum requirements is available on the [New Zealand Government procurement website](#).

Figure 2: Emissions reduction initiatives within the government sector and wider economy

Driving emissions reduction for buildings and construction



2. Reporting

2.1. Principles

Use the following principles when reporting embodied emissions associated with buildings and construction.

- Prioritise your efforts towards the largest emission sources or those areas with the greatest potential for emission savings.
- Align your CNGP reporting to your project timing, but report embodied emissions as close to the year they occur as practical.
- Identify and report the emissions associated with construction projects separately to other scope 3 emissions sources.
- The assessment methodology used should align with the Building for Climate Change Programme's *Whole-of-Life Embodied Carbon Assessment: Technical Methodology* (MBIE, 2022) as far as practical (see section 2.3 [Assessment methodology](#)).

2.2. Including embodied emissions in your inventory

Embodied emissions from building construction are a scope 3 (other material) emission source for most CNGP organisations. Use the significance criteria in table 7 of *the Carbon Neutral Government Programme: A guide to managing your greenhouse gas emissions* (Ministry for the Environment, 2023a) to determine whether to include embodied emissions associated with a specific building in your GHG inventory.

Embodied emissions do not need to be reported for existing buildings but should be considered if a new building or other asset is constructed, or an existing building is refurbished or fitted out, for the full or partial use of your organisation (either as owner or lessee).

Consider the expected embodied emissions of a project in relation to your organisation's total emissions when deciding whether they should be included in your inventory. Any emissions source across any scope can be excluded if it is less than 1 per cent of your organisation's total inventory. The total of all sources excluded should be no higher than 5 per cent of the total inventory.

2.3. Assessment methodology

Measure embodied emissions in accordance with MBIE's 2022 technical methodology *Whole-of-life Embodied Carbon Assessment: Technical Methodology* as far as practicable. In general, this will mean adopting the methodology outlined in the section 4 of that document. Note that the reporting requirements for CNGP are different.

The CNGP does not require the use of a particular tool or dataset for reporting embodied emissions. For all building materials, use the highest quality data that is available at that point in the design or construction process.

Emissions reported to the CNGP should be net of removals (ie, excluding biogenic carbon sequestration and concrete carbonisation).

[Examples of embodied carbon assessments](#) for building projects have been published on the Building for Climate Change website, to illustrate what they can look like for those who are not familiar with the process.

2.4. Reporting embodied emissions from the product and construction stage (modules A1–A5)

Include emissions from the product and construction stage (modules A1–A5) of a new building project in your GHG inventory and report them to the CNGP if they are a material emissions source¹ for your organisation. Consider including emissions associated with horizontal infrastructure, building services, and building fit-out, in addition to the base building.

Emissions from modules A1–A5 (product and construction stages) will generally be a scope 3 (other material) emission source under the CNGP if a third-party construction company is used to source, transport and install the construction materials. If some of these activities (eg, transport) are undertaken directly by your organisation, consult the guidance in section 11 of the [Sector Supplement for Measuring and Accounting for Embodied Emissions in the Built Environment – A Guide for measuring and reporting embodied emissions using the Greenhouse Gas Protocol](#) (Brightworks Sustainability & WAP Sustainability, 2021) to determine the appropriate categorisation of construction emissions in terms of GHG Protocol scopes.²

Report the embodied emissions associated with construction projects separately from other scope 3 emissions. The CNGP reporting template has a space for this purpose (see appendix).

Undertaking a carbon assessment at an early design and concept stage is likely to identify the most significant areas for reducing both embodied and operational carbon emissions. As a minimum, you should measure embodied emissions at the detailed design stage. Best practice would be to update these emissions based on actual materials used at the as-built stage. Report the most accurate emissions data available to the CNGP.

You have two options for reporting your building construction emissions to the CNGP. Report emissions based on:

¹ Those indirect GHG emissions sources that an organisation identifies through its chosen approach to consolidation and determines should be included in its GHG emissions inventory by assessing them against significance criteria (see table 7 in [Carbon Neutral Government Programme: A guide to managing your greenhouse gas emissions](#) (Ministry for the Environment, 2023a)).

² See [Appendix 2](#) of the [Carbon Neutral Government Programme: A guide to managing your greenhouse gas emissions](#) (MfE, 2023a) for the relevant ISO classification for different emissions sources.

- **actual or as-built data at the completion of the project or on an annual basis for multi-year projects.** This is the preferred approach, if the data is available. If you choose to report emissions for a multi-year project over multiple years, take care not to report individual emissions more than once
- **estimated quantities at the detailed design stage.** In this case, the reporting year should align to the year that construction commences, and all emissions associated with a project should be reported in a single year.

Anticipated emissions do not need to be reported for a project that is planned but for which construction has not yet started.

2.5. Reporting emissions from the embodied use stage (modules B1–B5) and end-of-life stage (modules C1–C4 and D)

Embodied emissions associated with the use stage (modules B1–B5) and end-of-life stage (modules C1–C4) of a building should be reported in the year in which they occur as far as practical if they are material to your organisation. Use the criteria in Table 7 of the [Carbon Neutral Government Programme – A guide to managing your greenhouse gas emissions](#) (Ministry for the Environment, 2023a) to determine whether to include embodied emissions associated with a particular activity or project.

This may include one-off projects such as a major refurbishment of a building or part of a building, or ongoing activities such as the regular replacement of office furniture and equipment. Obtaining good-quality information to enable reporting use-stage embodied emissions may be challenging and this area of reporting may take some time to incorporate. You should prioritise your efforts to measure the most significant of these emissions sources or where there is the greatest potential to make reductions.

Where such activities are considered part of business as usual, include these emissions sources in your organisation’s normal emissions inventory. Significant one-off projects during the lifecycle of a building or asset (such as a major refurbishment or demolition) can be treated in the same way as product and construction stage emissions and reported separately from your main annual emissions inventory. Make a value judgement to determine which type of reporting is appropriate for a particular activity. Document your decisions on where embodied emission sources are reported, including the criteria used, and aim to be consistent from year to year.

Reporting emissions associated with module D (benefits and loads beyond the system boundary) may optionally be included in CNGP reporting and would normally be reported alongside end-of-building-life emissions (modules C1–C4).

2.6. CNGP mandatory operational emissions (modules B6 and B7)

Operational energy use (module B6) and operational water use (module B7) are not embodied emission sources and are out of scope of this guidance. Report them as CNGP mandatory emissions sources (see Ministry for the Environment, 2023a).

2.7. Verifying embodied emissions

Obtain third-party verification of reported embodied emissions in the same way and according to the same standards as your other CNGP emissions. The relevant standards are the:

- [ISAE \(NZ\) 3410](#) – Assurance Engagements on Greenhouse Gas Statements standard (XRB External Reporting Board, 2012)
- [ISO 14064-3:2019](#) standard (International Organization for Standardization, 2019). A minimum of limited assurance is required.

3. Target setting

Due to the infrequent or variable nature of construction activities for most CNGP organisations, it is generally not appropriate to set gross emissions reduction targets for embodied emissions based on a ‘point year’ approach. If you identify embodied construction emissions as a material emissions source, you should develop targets appropriate to your situation and/or project that will encourage real reductions in emissions.

Where appropriate, targets should take a whole-of-life approach that considers reducing both embodied and operational emissions over the lifetime of the asset. Given that operational emissions will generally be included within your core CNGP targets covering mandatory emission sources, it may be more meaningful to develop separate targets specifically addressing embodied emissions.

As a minimum, if you are undertaking a new-build project that represents a material emissions source for your organisation, you should undertake an embodied emissions assessment for the product and construction stages (A1–A5) to inform decisions throughout the design and construction.

The best approach will depend on the nature of your organisation and its ongoing operational control over the asset. For example, Kainga Ora commissions the building of residential property but does not have operational control or the ability to record or report data on the operational emissions associated with those properties. In this case, a whole-of-life emissions target based on modelling the full lifecycle of a house is appropriate. In comparison, a CNGP organisation that contracts the building of a new office building for its own use would incorporate the building’s use-stage targets into its existing core CNGP targets and consider separate embodied emission targets specifically relating to the product and construction stages (A1–A5) of the new build.

The most appropriate form of embodied emissions targets will depend on your organisation’s circumstances but may include measurement and reporting targets, intensity-based targets (eg, per occupant or per square metre), targets based on a reference building, targets based on an external standard, or scenario modelling. If your project is required to adopt an approved building-rating system, you may wish to align your CNGP targets with the requirements of that system.

Due to the wide range of building activities undertaken by CNGP organisations it is not appropriate to set embodied emission targets that you should achieve for each type of asset. However, the general approach to target setting within the CNGP is that targets should be ambitious and aimed at real reductions in emissions.

If your organisation is planning a significant building project, we encourage you to obtain advice from specialists in embodied carbon measurement and reduction if you do not have this expertise internally.

Appendix

Figure A1: Extract from CNGP annual reporting template for embodied construction emissions

Enter any construction emissions on this page.						Please provide the following information where available/relevant to the project type you've listed			
Please enter each project type and lifecycle stage on a separate line. Do not include any building-related emissions already reported in other reporting categories (eg, building operational energy use).									
GHG scope <i>(select from drop-down)</i>	CNGP activity group <i>(select from drop-down)</i>	Project category <i>(select from drop-down)</i>	Lifecycle stage <i>(select from drop-down)</i>	Project type (eg, two-lane road, three-storey house, etc) <i>(free text)</i>	Total year emissions <i>(tCO₂e)</i>	Total number of buildings in project	Total gross floor area (m ²)	Expected number of occupants per building	Km of horizontal infrastructure

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