Fossil Fuel Free Construction Site

Leadership

Points: 3 points

Developed in partnership with Lendlease

Outcome

The project minimises the use of fossil fuels for powering construction machinery, equipment and site offices during on-site construction activities.

Rating tool applicability

- Green Star Buildings v1.1
- Green Star Communities v2

Criteria

Credit Achievement	**1 point**	• **Prerequisite**: The project has achieved specific credits within the relevant rating tool. • **Fossil Fuel Free Equipment Energy:** 20% of energy from all high emitting construction activities are fossil fuel free • **Renewable Site Energy:** All electricity used on the site and all non-electricity energy provided for the site offices are powered by 100% renewables.
Exceptional Performance	**Up to 2 points**	In conjunction with *Credit Achievement:* • **Fossil Fuel Free Equipment Energy:** Up to 100% of the energy from all high emitting construction activities are fossil fuel free.

Additional information

Scope of credit

Construction activities that would contribute to the project's on-site scope 1 and scope 2 emissions boundaries under the National Greenhouse Emissions Reporting (NGER) Scheme. This includes fuel use and electricity use from non-transport plant and equipment used for construction activities that are operated and refuelled on site. Equipment used for transporting materials to and from site are excluded.

Scope of Electricity

The scope of electricity includes all electricity under the operational control of the Head Contractor used in the construction including all commissioning activities up to the point of handing over control of the construction site at Practical Completion.

Stage Implementation

Strategy | Brief | Concept | Design | **Tender** | **Construction** | Handover

Synergies with other credits

- Responsible Construction
- Responsible Procurement
- Upfront Carbon Reduction
- Life Cycle Impacts

Sustainable Development Goals

- Goal 11 (Sustainable Cities and Communities)

Relevant reporting initiatives

- ASRS

Why is this Leadership Challenge important?

Construction is a key industrial sector, and the global construction industry produces 23% of the world's total carbon emissions. Roughly 5.5% of these emissions are related directly to activities on the construction sites, mainly through the combustion of fossil fuels to power machinery and equipment[1]. It is these emissions from fossil fuels used in construction activities and site accommodation (when powered by generators) that form the focus of this Leadership Challenge[2]. Construction equipment manufacturers are now investing in innovative zero-emission non-road mobile machinery powered by batteries, fuel cells or direct electrification.

The use of these emerging technologies where they are available combined with the replacement of liquid fossil fuel with biofuels, such as renewable diesel (from biogenic feedstock) and biodiesel, leads to the decarbonisation of construction activities. Transitioning to fossil fuel free construction is important not only for achieving environmental targets, but in the process can also deliver a range of co-benefits including reduced local air and noise pollution, lower operating and maintenance costs, increased energy efficiency, reduced reliance on foreign fuel, and utilisation of locally produced renewable energy.

Emissions from construction equipment constitute a relatively small proportion of existing credits like the *Upfront Carbon Reduction* credit which does not provide strong driver to use of fossil fuel free construction equipment. The long timelines and large investment for industry to switch to fossil fuel free construction equipment require a strong demand signal to support this transition that requires additional support beyond the *Upfront Carbon Reduction* credit.

This Leadership Challenge aims to incentivise fossil fuel free construction activities and the manufacturers of major construction equipment to provide fossil fuel free construction equipment.

The Leadership Challenge has been updated to recognise biodiesel blended with mineral diesel as an interim step towards a fossil fuel free construction site. The scope for high emitting construction activities is also now consistent across all performance levels to reflect advancements in the construction industry.

---

[1] L. Huang, G. Krigsvoll, . F. Johansen, Y. Liu and X. Zhang, "Carbon emission of global construction sector," *Renewable and Sustainable Energy Reviews,* pp. 1906-1916, 2018.

[2] Emissions from construction sites also include transport of construction machinery and materials, transport of construction workers, energy use at the construction site, internal transport, storage, temporary works, transport of waste, and waste treatment and disposal. These emissions are not considered in this Leadership Challenge.

Requirements

Credit Achievement

The project must comply with **all** the following criteria:

- Prerequisites
- Fossil Fuel Free Equipment Energy
- Renewable Site Energy

Prerequisites

The project achieves *Minimum Expectation* in the *Upfront Carbon Reduction* credit without the inclusion of fossil fuel free energy from construction activities.

Fossil Fuel Free Equipment Energy

20% of energy from all *high emitting construction activities* (refer *Definitions*) is *fossil fuel free* (refer *Definitions*).

Calculating energy from high emitting construction activities

The amount of energy from high emitting construction activities that is fossil fuel free is calculated by completing the *Fossil Fuel Free Construction Site calculator*.

Renewable Site Energy

Site Electricity

All electricity used on site is sourced from 100% renewables. This includes where electricity is used for all site offices (regardless of their location), any construction equipment, site services (e.g. lighting) and any electricity consumption in the building's construction or commissioning prior to handover.

Both on-site, or off-site renewables or a combination of both are used. For off-site renewables, this may be done via a renewable electricity contract or power-purchasing agreement.

Renewable electricity can be claimed using the market-based method. See *Guidance* for more information.

See *Guidance* for information on making renewable claims.

Site Office Energy

All non-electricity energy use for site offices, regardless of their location, is from 100% *fossil fuel free* energy sources.

Exceptional Performance

The project must comply with the following criterion:

- Fossil Fuel Free Equipment Energy

Fossil Fuel Free Equipment Energy

Up to 100% of energy from all *high emitting construction activities* (refer *Definitions)* is *fossil fuel free* (refer *Definitions*).

Stepped points are available for fossil fuel free proportions between 20% to 100% as below.

Available points	Percentage requirements
1 point	At least 50% of energy from all *high emitting construction activities* is *fossil fuel free*.
1 additional point	100% of energy from all *high emitting construction activities* is *fossil fuel free*.

Calculating energy from high emitting construction activities

Refer to *Credit Achievement.*

Definitions

Definitions provided here must be applied to *Requirements* unless agreed with GBCA via a Technical Question.

Biodiesel

A sustainable liquid fuel derived from vegetable oils or animal fats. It has physical properties similar to petroleum diesel, but it is a cleaner-burning renewable alternative. It can be used in many concentrations, from B5, (95% petroleum diesel & 5% biodiesel), all the way up to B100, which is pure biodiesel.

This differs from renewable diesel. Refer to definition for *Renewable diesel* below.

Battery energy storage systems

Battery energy storage systems (BESS) can be used on site to provide additional power to site where the grid connection is insufficient to power. Where these systems are used instead of a diesel generator, the electricity delivered to the BESS should be entered into the calculator in the 'Generator' category.

Fossil fuel free

Fossil fuel free energy includes electricity sourced from renewables, renewable hydrogen, renewable diesel and biodiesel.

Avoided emissions (i.e., not having a specific high emitting construction activity occurring on-site) is excluded from this definition. The intent of the Leadership Challenge is to incentivise construction activities that produce a high amount of emissions to be fossil fuel free.

High emitting construction activity

A construction activity that typically emits a high amount of greenhouse gas emissions. The following activities are considered to be a high emitting construction activity:

- Demolition
- Earthworks
- Concrete pumping
- Piling and drilling
- Generators powering construction activities or site sheds
- Cranes

Original Equipment Manufacturers

An Original Equipment Manufacturer is the company that produces the parts that may be used by another manufacturer. In the context of construction, the company that manufactures the construction machinery and equipment may be the same e.g. a Volvo excavator contains a Volvo engine, or may differ from the company that makes the engine e.g. a Putzmeister diesel concrete pump may contain a Caterpillar engine. The OEM refers to the company that makes the engine and is what is considered in the context for fossil fuel free construction and energy sources (biofuels, electricity, hydrogen used by the engine).

Renewable diesel

An advanced biofuel made from renewable resources such as animal fats, vegetable oils and greases. It is chemically identical to conventional diesel which allows the fuel to be integrated into existing engine infrastructure without any modification.

It can be used in many concentrations, such as RD5, (95% petroleum diesel & 5% renewable diesel), all the way up to RD100, which is pure renewable diesel.

Renewable diesel can be made from a wide range of feedstock. Only renewable diesel manufactured from biogenic feedstocks can be claimed as 'fossil fuel free'. Where waste tires or plastic are used to manufacture 'renewable diesel', it cannot be claimed as fossil fuel free for this credit.

Renewable hydrogen

Renewable hydrogen is made from renewable energy and is used to fuel hydrogen and hydrogen fuel cell construction machinery.

Zero-emission

A zero-emission construction site requires all processes on the construction site to use zero emission technologies, such as battery or direct electrification or hydrogen. These technologies do not produce any carbon dioxide and they also reduce noise pollution. To maximise the reduction of lifecycle greenhouse gas emissions, zero emission machinery should be powered using renewable energy, which can include renewable electricity or renewable hydrogen.

Guidance

Guidance is supporting information for the credit requirements and is not mandatory to apply.

Purpose of the prerequisite in *Credit Achievement*

As Leadership Challenges aim to recognise actions that drive market transformation, implementing best practices in upfront carbon or on-site construction is expected. To support this, relevant prerequisites from the core rating tool have been prescribed.

Market-based method and the renewable power percentage (RPP)

Projects can claim the renewable power percentage (RPP) as published by the Clean Energy Regulator each year as off-site renewable energy supply. For further information, refer http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/the-renewable-power-percentage

Offsets and Renewable Electricity

Renewable electricity and offsets for on-site fossil fuels must comply with Appendix A, B, and C of the guide *'Climate Positive Buildings and our Net Zero Ambitions'* published by GBCA. For purposes of this requirement for this leadership challenge, Option 'I' can be used to make claims.

Fossil fuel free construction site

It is defined as a construction site that does not use any fossil fuels in any of its on-site construction activities. Liquid fossil fuels in construction equipment and machinery can be replaced with biofuels and/or alternative renewable energy resources such as electricity or hydrogen.

High carbon emitting construction activities generally use large diesel machinery and equipment and can include civil activities such as demolition and earthworks using large excavators, graders and rollers; static concrete pumping for multistorey buildings that use concrete trailer pumps; large scale piling and drilling activities; generators used to power construction activities or site accommodation; or diesel crane usage.

Major construction Original Equipment Manufacturers (OEMs) are starting to electrify a diverse range of construction equipment, including smaller excavators, loaders, lifts, mobile cranes, and telehandlers. However, for a significant number of construction equipment types within typical trades, such as civil, demolition and piling, there are limited or no battery-electric or hydrogen models currently available. Biofuels, particularly renewable diesel, provide a cost-effective solution to decarbonising construction activities, enabling ongoing use of diesel using engines until zero emission technologies are readily available that cover the broad spectrum of machinery and equipment used by the industry.

Transitioning towards fossil fuel free construction requires maximising the use of electric construction machinery and equipment in construction activities. To maximise the utilisation of electric machinery and equipment, energy storage and generation options such

as large battery systems may need to be utilised where grid constraints exist for projects. Where electric equipment and machinery options are not available, renewable diesel can directly substitute fossil diesel use.

The European construction industry has adopted a stepwise approach towards the ambition of a zero-emission construction site[3]. The Leadership Challenge adopts a boundary for including all low-emission and zero-emission classes, excluding EN15978 - A4 for Transportation emissions.

The transition to clean construction: Fossil fuel free or zero emission?

A fossil fuel free construction site uses no fossil fuel powered construction machinery or internal transport. This can be achieved by using 100% electric or hydrogen fuel cell machinery or 100% sustainable biofuels like renewable diesel or a combination of both. Sustainable biofuels, like renewable diesel, are made of 100% renewable raw materials which do not release any new carbon emissions into the atmosphere. Biofuels release small amounts of tailpipe carbon emissions, although these are substantially less than mineral diesel. As biofuels are used in diesel engines, they still contribute to noise pollution on construction sites.

A zero-emission construction site, on the other hand, requires all processes on the construction site to use zero emission technologies, such as battery or direct electrification or hydrogen. These technologies do not produce any carbon dioxide and they also reduce noise pollution. To maximise the reduction of lifecycle greenhouse gas emissions, zero emission machinery should be powered using renewable energy, which can include renewable electricity or renewable hydrogen

Delivered energy

Delivered energy is defined as the energy used to perform useful work on site. This is important to take into consideration when comparing equipment that burns fossil fuels on site with equipment that uses electricity to perform the same task. Equipment that burns fuels in an internal combustion engine is only able to convert around 30% of the fuel energy into useful delivered energy. However, electric machinery is able to convert around 90% of the electrical energy into delivered energy. To enable a fair comparison of equipment options, it is important to take this efficiency difference into consideration to avoid bias towards inefficient fuel-based systems. The calculator supplied with this Leadership Challenge takes primary energy measured on site (e.g. litres of diesel or kWh of electricity) and converts these to delivered energy by applying a conversion factor.

Default efficiency values are included in the calculator. Where a value differs from the default, project teams may submit a Technical Question with evidence to use a different value.

Using the Fossil Fuel Free Construction Site calculator

The *Fossil Fuel Free Construction Site calculator* is available on the Green Star resources portal. The calculator enables projects to determine the proportion of delivered energy that is fossil fuel free. Projects are to indicate which high emitting construction activities are being undertaken on site, identify the energy sources used in that activity and the proportion of that energy that is fossil fuel free. A register of construction equipment is also to be included to provide a record of the equipment and energy source used.

Submission content

Submission for this credit must contain:

- **Submission form** through Green Star Online
- **Fossil Fuel Free Construction Site calculator v1.1**
- **Evidence** to support claims made in the submission

Recommended evidence

Prerequisite

- Extracts from relevant prerequisite credit submission

[3] URL: https://espace.library.uq.edu.au/view/UQ:93110de

Fossil Fuel Free Equipment Energy and **Renewable Site Energy**

- Evidence of energy consumption (e.g. bills, metered data, invoices)
- Evidence to validate fossil fuel free proportion (e.g. ISCC certification or similar)
- Signed energy contract or PPA or evidence of on-site generation

Supporting information

The following resources support this credit:

- *Fossil Fuel Free Construction*, Australian Constructors Association 2025 (https://www.constructors.com.au/wp-content/uploads/2026/02/7122_ACA_Fossil-Fuel-Report_2025_Single-Page_Digital_FA.pdf)
- *Stepping up the Pace: Fossil Fuel Free Construction*, Lendlease 2022 (https://www.lendlease.com/better-places/stepping-up-the-pace-fossil-fuel-free-construction/)
- *Planning a Transition to Low and Zero Emission Construction Machinery*, University Queensland 2022 (https://doi.org/10.14264/93110de)
- *Low and Zero Emission Construction Machinery and Equipment Database*, University Queensland 2022 (https://doi.org/10.48610/6973e0a)
- NGER: Supplementary Guideline Operational Control