Fossil Fuel Free Construction Site

Leadership

Points: 3 points

Developed in partnership with Lendlease

Outcome

The project minimises the use of fossil fuels, such as diesel, petrol or LPG, for powering construction machinery, equipment and site offices during on-site construction activities.

Rating tool applicability

- Green Star Buildings
- Green Star – Design & As Built (all versions)
- Green Star – Communities

Criteria

Credit Achievement	**1 point**	• The project has achieved specific credits within the relevant rating tool • **20% of high emitting** construction equipment on high emitting construction activities is fossil fuel free • The site offices are powered by **100% renewable energy** • All **electricity** used by the construction site is **100% renewable**.
High Performance	**1 point**	In addition to the *Credit Achievement*: • **50% of high emitting** construction equipment on high emitting construction activities is fossil fuel free
Exceptional Performance	**1 point**	In addition to the *High Performance*: • **100% of all** construction equipment is fossil fuel free

Additional information

Stage Implementation

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

Synergies with other credits

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

Sustainable Development Goals

- Goal 11 (Sustainable Cities and Communities) Relevant reporting initiatives

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 Innovation 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, i.e. renewable diesel, also known as hydrotreated vegetable oils (HVO), 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.

This Leadership Challenge aims to incentivise fossil fuel free construction activities.

[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 Innovation Challenge

Requirements

Credit Achievement

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

- Prerequisites
- High emitting construction equipment and activities – good practice
- Site office energy
- Construction site electricity

Prerequisites

For Green Star Buildings, the project must achieve the *Responsible Construction* Credit Achievement in Green Star Buildings.

For Green Star – Design & As Built, the project must achieve all points in the *Responsible Construction Practices* (v1.3, v1.2) or *Construction Environmental Management* (v1.1)

For Green Star – Communities (Pilot, v1, v1.1) must achieve all points in *Environmental Management*.

High emitting construction equipment and activities – good practice

20% of high emitting construction equipment on high emitting construction activities is fossil fuel free.

Fossil fuel free energy can include electricity (sourced from renewables), ‘renewable hydrogen, renewable diesel including hydrotreated vegetable oils (HVO), and biodiesel not blended with mineral diesel.

This leadership challenge does not include equipment used for transporting materials to and from site.

Calculating compliance

High carbon emitting construction activities are defined as the following:

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

To calculate the amount of high emitting construction equipment that is compliant for an activity, the head contractor must create a register of all construction equipment used on site and identify those that are fossil fuel free. The register should also specify the fuel source used for each equipment. The head contractor can then total the number of individual equipment items used, the number of individual fossil fuel free equipment, and calculate the percentage that is compliant.

The boundary of the construction activities for this Leadership Challenge aligns fuel use (scope 1) and electricity use (Scope 2) with the National Greenhouse Emissions Reporting boundaries of operational control for construction activities including non-transport plant and equipment that is used or operates on a project and that is refuelled on site.

Site office energy

The site offices for the project, regardless of their location, must be fully powered by renewable energy. This may be done via a power-purchasing agreement for electricity (where there are no other sources) or via fossil fuel free energy sources used on site.

See *Guidance* for information on making renewable claims.

Construction site electricity

All electricity used on site must be 100% renewable. This is the case regardless of whether it is electricity used for the site offices, any construction equipment, site services (e.g. lighting) and any electricity consumption in the building's construction or commissioning prior to handover.

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

High Performance

The project must comply with the following criteria:

- High emitting construction equipment and activities – best practice

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This leadership challenge does not include equipment used for transporting materials to and from site.

Calculating compliance

Refer to *Credit Achievement.*

Exceptional Performance

The project must comply with the following criterion:

- Fossil fuel free construction activities

Fossil fuel free construction activities

100% of high emitting construction equipment on high emitting construction activities is fossil fuel free.

Fossil fuel free energy can include electricity (sourced from renewables), 'renewable hydrogen, renewable diesel including hydrotreated vegetable oils (HVO), and biodiesel not blended with mineral diesel.

This leadership challenge does not include equipment used for transporting materials to and from site.

Calculating compliance

Refer *Credit Achievement.*

Guidance

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 are often replaced with biofuels (i.e. renewable diesel RD100 / HVO) 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; 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/HVO 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 within the scoping of the Fossil Fuel Free Construction Leadership Challenge, 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 hydrotreated vegetable oils (HVO), a type of 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

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

Submission content

Submission for this credit must contain:

- **Submission form** through Green Star Online
- **Evidence** to support claims made in the submission

Recommended evidence:

As per Leadership Challenge. The key requirement is that evidence is provided to support each claim made within the Submission form.

Definitions

Biodiesel

A sustainable liquid fuel derived from vegetable oils or animal fats. 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

Construction Plant and Equipment

The construction plant and equipment used in Construction Activities includes equipment from the following Equipment Classifications: Earth Moving, Access, Materials Handling, Compaction, Concrete and Masonry, Lift, Shift and Propping, Trucks, Vehicles, & Trailers, Generators and Energy Storage Systems (for construction). Refer below Supporting Guidance for specific equipment.

HVO

Hydrotreated vegetable oils (HVO) are a type of renewable diesel made of 100% renewable raw materials that are oil or fats based including used cooking oil, vegetable oils such as canola, and animal fats including tallow.

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 manufacturers 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

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.

Supporting information

The following resources support this credit

- *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 2002. (https://doi.org/10.48610/6973e0a)