Enablement of avoided greenhouse gas emissions

OX2's approach to estimating project's contribution towards climate change mitigation

Content

Coverpage: Hornamossen wind farm, Sweden.

Introduction

Increased access to renewable energy means that fossil energy can be avoided to a larger extent, whereby greenhouse gas emissions stemming from combustion of fossil energy can be avoided.

Enablement of avoided greenhouse gas emissions is a measure reflecting the extent of which projects can enable greenhouse gas emissions to be avoided. These emissions are sometimes referred to as climate handprint or scope 4 emissions.

The enablement of avoided greenhouse gas emissions is estimated for energy solutions that generate renewable electricity such as solar and wind power. Ancillary (supporting) services play an important role in enabling the avoidance of greenhouse gas emissions, although this is not estimated.

OX2's methodology adheres to:

- The Greenhouse Gas Protocol for Project Accounting, 2005
- World Business Council on Sustainable Development's Guidance on Avoided Emissions, 2023
- EQT's Avoided Emissions Framework, 2024 [internal]

OX2 seeks to follow the latest standards and adhere to best practice. Therefore, updates may occur. See revision log for former updates.

Rutki solar farm, Poland.

Project/intervention method

OX2's approach to calculating enablement of avoided greenhouse gas emissions follows the project/intervention method, as defined by the Greenhouse Gas Protocol.

The methodology applied to estimating enablement of avoided greenhouse gas emissions is referred to as the project or intervention method. It estimates the difference between a baseline scenario and a project/intervention scenario.

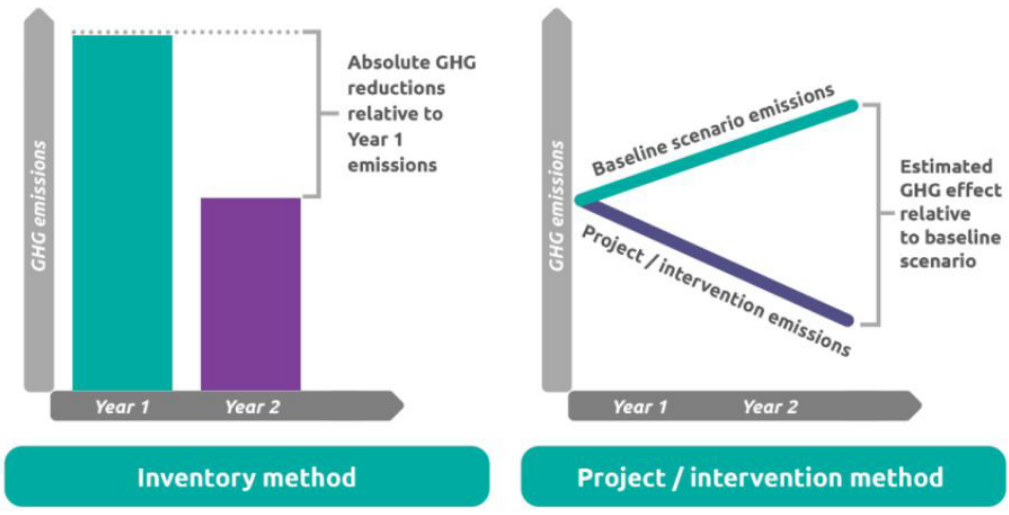
The value for enablement of avoided greenhouse gas emissions is the difference between the baseline scenario (without project) and the project/intervention scenario (project realized). Enablement of avoided greenhouse gas emission can be calculated as an intensity figure, per generated electricity (gCO_2e/kWh), or total amount (tCO_2e) for the exected lifetime and productivity of that project.

Project/intervention scenario

The greenhouse gas intensity from electricity generated in projects are estimated based on value chain activities; material extraction and processing, manufacturing, transport and logistics, construction activities, repair and maintenance activites, and land use change.

Baseline scenario

The greenhouse gas intensity of the electricity grid in the country where the project is located is obtained from external sources. It will vary over time in line with the kinds of electricity production facilities operating within that market and their productivity.



Source: The Greenhouse Gas Protocol

When commissioned, Juniewicze wind farm enabled 650 gCO_2e to be avoided for every kWh

Conservative approach

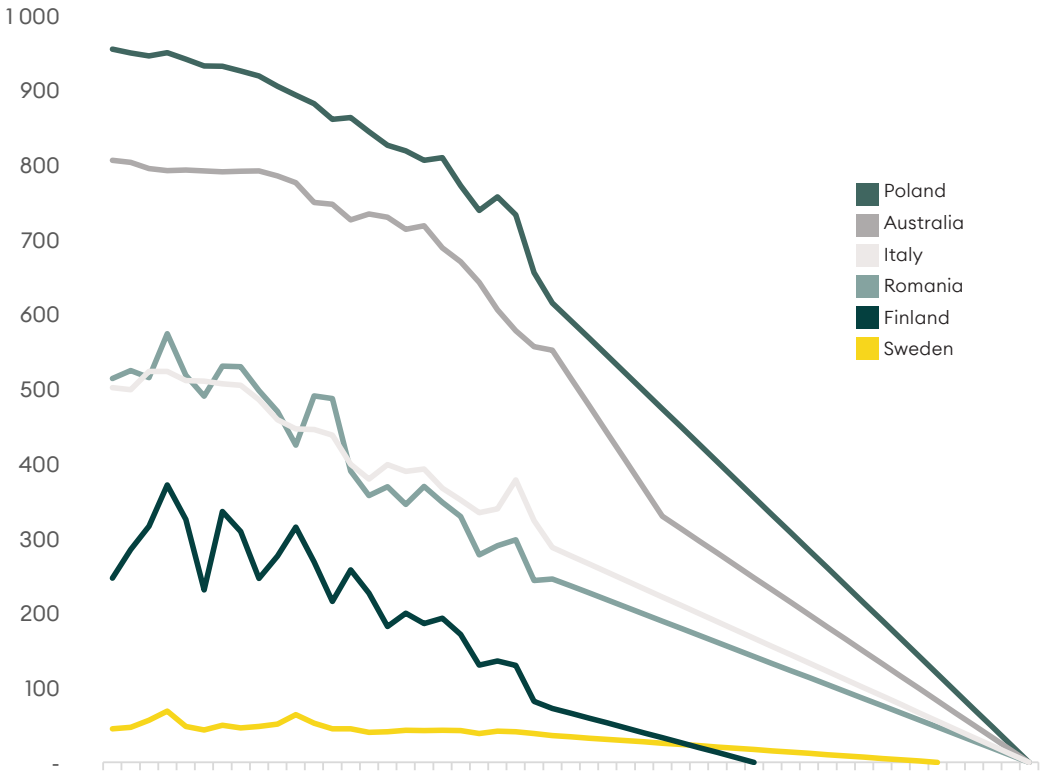
A conservative approach implies that the methodology is more likely to underestimate than overestimate the potentially avoided greenhouse gas emissions.

There are multiple cases for under- and overestimating the enablement of avoided greenhouse gas emissions. For example, the effects of electrification, whereby renewable electricity replaces fossil fuels, are not accounted for. These uncertainties are managed conservatively, managin the risk of overstating the projects impact

A conservative approach is applied by considering targets in the baseline scenario. This means that a project's ability to enable avoided greenhouse gas emissions decreases over time, as countries approach their targets.

The graph visualizes the actual (2000-2024) and anticipated (2025-2050) greenhouse gas emission intensity values for the electricity grids in different countries. The projections follow a linear reduction towards target year for net zero, where it is assumed that the electricity grids reach 0 gCO_2e/kWh.

Note that a conservative approach may be applied in other ways for different contexts. For example, a solar panel manufacturer may estimate potentially avoided greenhouse gas emissions by using the global average as the baseline, which is suitable since the location of the cells are unknown.



Source: Our World in Data (actuals) and International Energy Agency (projections), retrieved June 2025. The EU target is applied if a country does not have a national target.

Australia aims to reduce 43% of greenhouse gas emissions between 2022 and 2030 and achieve net zero by 2050

Example: Project A in Finland

This example aims to demonstrate how the project/intervention method is applied in practice. Project A is fictional but inspired by real projects.

Project A is an onshore wind power project located in Finland commissioned 2004. The life expectancy is 30 years and the estimated annual energy production is 135 GWh. The greenhouse gas emissions arising from project A is 10 gCO_2e/kWh.

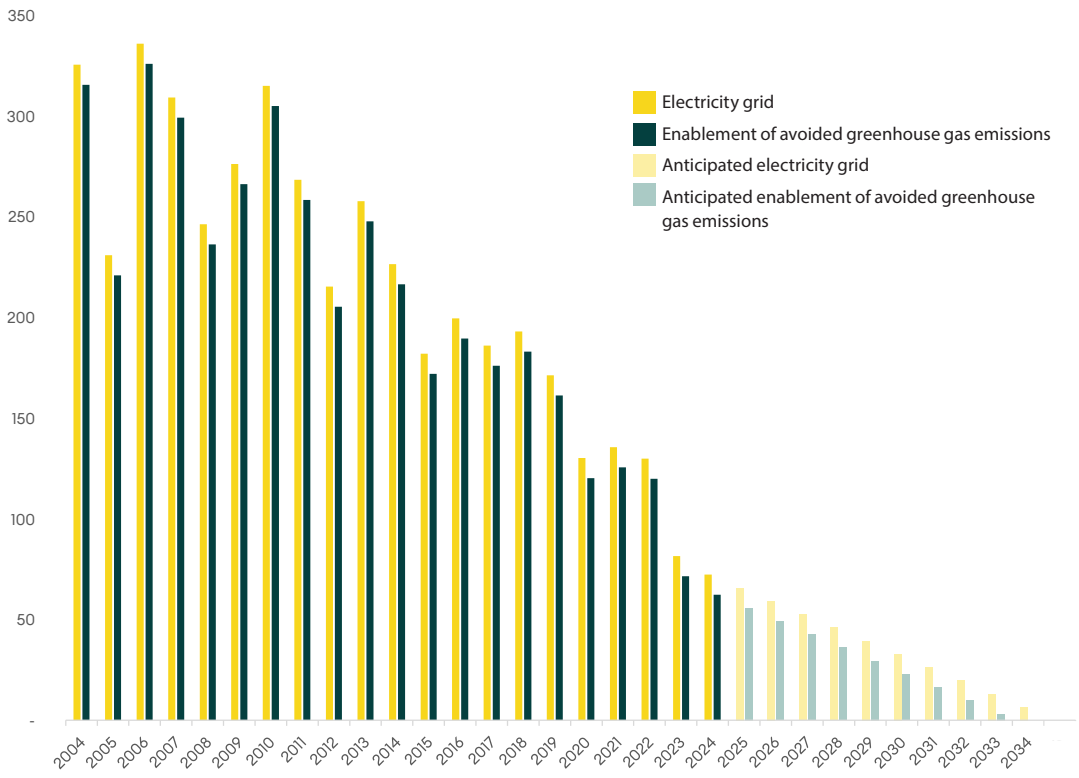
The electricity grid in Finland has decreased over the years, from 325 gCO_2e/kWh in 2004 to 72 gCO_2e/kWh in 2024 (source: Our World In Data). Finland aims to reach net zero by 2035 (source: International Energy Agency). Therefore, an annual reduction of 7 gCO_2e/kWh is assumed, reaching 0 gCO_2e/kWh by 2035.

Intensity

The graph below demonstrates how electricity generated in Project A enables avoidance of greenhouse gas emissions over time. The higher the greenhouse gas intensity of the grid, the more greenhouse gases can be avoided as a result of this project. Data between 2025-2035 are predicted values, and therefore presented in a muted colour.

Accumulation

The graph to the right demonstrates the accumulation of enablement of greenhouse gas emissions over the lifetime of a project.



The greenhouse gas emission intensity of the electricity grid in Finland and the enablement of avoided greenhouse gas emissions throughout the lifetime of project A.

It is estimated that Project A enables the avoidance of 613 thousand tCO_2e over its life-time.

2004 2034

Limitations and uncertainties

When interpreting or applying the estimated enablement of avoided greenhouse gas emissions, consider the following limitations and uncertainties.

Forward-looking statements

The project/intervention method builds upon scenarios, indicating that the future can turn out differently. Enablement of avoided greenhouse gas emissions is based on several assumptions about the future, such as:

- number of years that the project is operational,
- the amount of electricity generated from the project,
- the amount of greenhouse gas emissions arising from the operation of the renewable energy project, and
- the decarbonization of electricity grids.

Dependency on external data

The greenhouse gas intensity of electricity is obtained from external sources. The baseline scenario is therefore dependent on the granular and frequency of available data. For example:

- Sweden is divided into four zones; SE1, SE2, SE3 and SE4. The greenhouse gas intensity varies between these regions but many available datasets use the national average.
- The greenhouse gas emission intensity varies over time depending on many factors including electricity demand and weather.

Revision

The methodology is reviewed regularly based on new guidance, standards, stakeholder expectations, and the emergence of common practice.

Version		Updated
V.0	See Annual and Sustainability Report 2023 pages 77-78, 81	2023
V.1	See Annual and Sustainability Report 2024 pages 67	2024
V.2	Updated methodology where the reference scenario follows the stated policies for respective market.	2025-07-07

Glossary

Accumulation
An amount of something that has been collected (Cambridge Dictionary).

Carbon dioxide equivalent*
The universal unit of measurement to indicate the global warming potential (GWP) of each greenhouse gas, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate releasing (or avoiding releasing) different greenhouse gases on a common basis.

Climate change
A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (Framework Convention on Climate Change).

Climate change mitigation*
The process of reducing GHG emissions and holding the increase in the global average temperature to 1,5 °C above pre-industrial levels, in line with the Paris Agreement.

Fossil fuel*
Non-renewable carbon-based energy sources such as solid fuels, natural gas and oil.

Global Warming Potential (GWP)*
A factor describing the radiative forcing impact (degree of harm to the atmosphere) of one unit of a given GHG relative to one unit of CO_2.

Greenhouse gases*
The gases listed in Part 2 of Annex V of Regulation (EU) 2018/1999 of the European Parliament and of the Council. These include Carbon dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Sulphur hexafluoride (SF_6), Nitrogen trifluoride (NF_3), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs).

Renewable energy*
Energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas.

Electricity units

Electric power is often measured in Watts (W). Electric energy is measures in Watt-hours (Wh) as it is generated over time (h).

1 kWh = 1 kW in one hour
1 MWh = 1 000 kW in one hour
1 GWh = 1 000 000 kW in one hour

Other units for energy such as Joule can be converted to kWh.

Measuring greenhouse gas emissions

All greenhouse gas emissions are measured using carbon dioxide equivalents (CO_2e). This unit uses the heating effect of a carbon dioxide molecule as a reference. These values can change over time. These values below are obtained from Intergovernmental Panel on Climate Change's 6th Assessment Report through the Greenhouse Gas Protocol:

1 CO_2 = 1 CO_2e
1 CH_4 = 30 CO_2e
1 SF_6 = 24 300 CO_2e

*Defined by Corporate Sustainability Reporting Directive (CSRD)

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