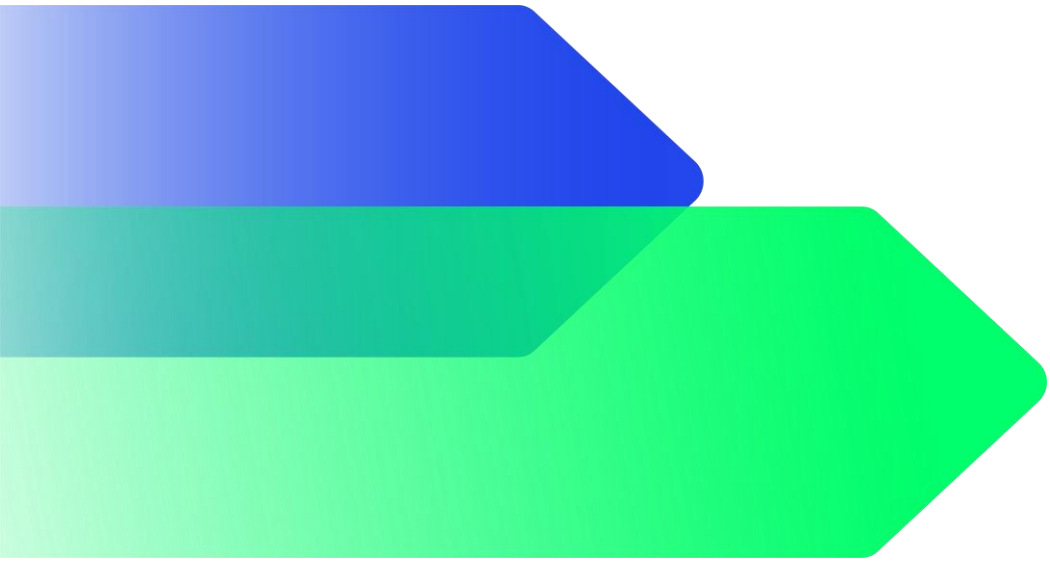
CARBON TRUST

REPORT

AIB Energy Transmission Infrastructure Impact Assessment

For eligible Energy Transmission Infrastructure projects

December 2022



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Abbreviations

HVDC: High Voltage Direct Current

GHG: Greenhouse gases

SF_6: Sulfur Hexaflouride – a commonly used insulation gas that is a powerful GHG

GWP: Greenhouse warming potential

1. Introduction

Aligned with its sustainability strategy, Allied Irish Banks ("**AIB**") is intending to issue green bonds to finance and / or refinance loans that meet the requirements as described in the AIB Green Bond Framework ("**Framework**")[1]. The objective of the Framework, and subsequent green bonds issued from it, is to fund projects or assets that mitigate climate change by reducing emissions, protect ecosystems, or otherwise have a positive environmental impact. The Framework has been aligned to the ICMA Green Bond Principles and has received a Second Party Opinion from Sustainalytics.

The ICMA Green Bond Principles are a set of voluntary guidelines that recommend transparency and disclosure and promote integrity in the development of the green bond market by clarifying the approach for issuing a green bond. The Framework therefore has four key components:

1. Use of Proceeds
2. Process for Project Evaluation and Selection
3. Management of Proceeds
4. Reporting

For each green bond issued, AIB asserts that it will adopt (1) Use of Proceeds, (2) Process for Project Evaluation and Selection, (3) Management of Proceeds, (4) Reporting, as set out in the Framework.

AIB, at its discretion but in accordance with the Green Bond Principles, will allocate the net proceeds of the Green Bonds to an eligible loan portfolio of new and existing green loans ("Eligible Green Project Portfolio"). The Eligible Green Project Portfolio is to be financed and/or refinanced in whole or in part by an allocation of the bond proceeds.

The Eligible Green Project Portfolio for "Energy Transmission Infrastructure" includes loans to finance or refinance equipment, development, manufacturing, construction, operation, distribution and maintenance of energy transmission; the specific technology types for energy transmission facilities are set out below, as per AIB's Green Bond Framework[1]:

- Interconnectors between transmissions systems, provided that the systems meet one of the following criteria:
    - The system is the interconnected European system, i.e., the interconnected control areas of Member States, Norway, Switzerland and the United Kingdom, and its subordinated systems
    - More than 67% of newly enabled generation capacity in the system is below the generation threshold value of 100gCO_2e/kWh measured on a life cycle basis in accordance with electricity generation criteria, over a rolling five-year period
    - The average system grid emission factor, calculated as the total annual emissions from power generation connected to the system, divided by the total annual net electricity production in that system, is below the threshold value of 100gCO_2e/kWh measured on a life cycle basis in accordance with electricity generation criteria, over a rolling five-year period

[1] AIB Green Bond Framework (2022)

1.1. Who We Are

The Carbon Trust are a trusted, expert guide to Net Zero, bringing purpose led, vital expertise from the climate change frontline. We have been pioneering decarbonisation for more than 20 years for businesses, governments and organisations around the world.

We draw on the experience of over 400 experts internationally, accelerating progress and providing solutions to this existential crisis. We have supported over 3,000 organisations in 70 countries with their climate action planning, collaborating with 200+ partners in setting science-based targets, and supporting cities across 5 continents on the journey to Net Zero.

The Carbon Trust's Green Finance team helps financial institutions navigate the risks and opportunities of climate change and the transition to a low carbon economy. We are independent experts who understand the environmental impacts, technologies and global markets that underpin green asset classes. We leverage this bottom-up understanding to create bespoke solutions and help financial institutions deliver genuinely green outcomes. We offer a comprehensive advisory and assurance service for green bonds and loans. We provide feasibility assessments, help identify eligible assets (Green Tagging), and build Green Bond and Loan Frameworks. For assuring green bonds and loans, we provide Second Party Opinions and certifications to recognised standards. We are approved verifiers to the Climate Bonds Initiative Standard and we are members of the ICMA Green Bond Principles, contributing in both cases as technical advisors. As impartial experts, we advise on methodologies and reporting on the environmental impacts of the use of proceeds, giving investors clarity and reassurance on the impact of their investment.

2. Methodology

2.1. Reporting Principles

Reporting of the environmental impacts of green bonds is evolving and is a relatively new concept. However, AIB is committed to reporting on the method used to calculate the avoided GHG emissions for its Green Bond Framework based on:

- PCAF's *The Global GHG Accounting and Reporting Standard for the Financial Industry*[2], chapter 5.3 Project Finance;
- Green Bond Principles, *Voluntary Process Guidelines for Issuing Green Bonds (June 2022)*[3]*; and,*
- ICMA Harmonised Framework for Impact Reporting (2022)[4].

AIB follows the key recommendations outlined in the Green Bond Principles, with external reviewers present across their reporting process. In addition, AIB is committed to reporting greenhouse gas emissions in accordance with the five principles contained within the Greenhouse Gas Protocol, namely: relevance; completeness; consistency; transparency; and, accuracy. In accordance with the principles of

[2] PCAF (2020), The Global GHG Accounting and Reporting Standard for the Financial Industry. First edition.

[3] ICMA (2022), Green Bond Principles, Voluntary Process Guidelines for Issuing Green Bonds

[4] ICMA (2022), Harmonised Framework for Impact Reporting

reporting described above, AIB commits to transparent disclosure of any assumptions and estimations used in the calculation of its reporting framework.

2.2. Scope of Calculations and Reporting

2.2.1. General scope of green bond impact assessment

The EU has set an interconnection target of at least 15% by 2030, to encourage EU countries to interconnect their installed electricity capacity. AIB intends to report the expected or actual quantitative environmental impact of the energy transmission infrastructure it finances or co-finances through its green bond issuance. The reporting includes the estimated reduction or avoidance in greenhouse gases ("GHGs") estimated to have occurred from its energy transmission infrastructure loans, both directly measured and, if the assets provide electricity grid stabilisation services, the estimated avoided emissions from these services relative to a fossil fuelled counterfactual (normally natural gas fuelled power, though will depend on what the energy mix of the connected countries is). AIB also evaluates other indicators that are appropriate to report for environmental impact and performance, such as to approximately what degree the construction of the assets enable deployment of additional low carbon energy generation assets. At this stage, social and other economic indicators are not within the scope of the green bonds in question. Governance indicators are also not in scope.

AIB undertakes to report the environmental impact of projects it finances or co-finances through its green bonds based, where possible, on the actual environmental performance of the asset. Where this is not possible, expected performance is used. The reporting includes both green indicators and resulting emissions reductions or avoidance, both of which require assumptions and calculations. The reporting is based on the net-benefit resulting from the asset in a given period of operation, rather than the gross emissions change before or after the life of the asset or project.

Calculations include project-by-project impacts, as well as aggregated results across the portfolio of assets financed or co-financed with the proceeds of AIB's green bonds. Environmental indicators are attributed to AIB on a project-by-project basis, based on the current percentage share financed (where applicable) and disbursed by the bank. The reporting is undertaken on an annual basis, covering the previous 12-month period and considers any dynamic changes in the assets financed or co-financed that occur from one reporting period to another.

In accordance with the principles of reporting described above, AIB continues to commit to transparent disclosure of any assumptions and estimations used in the calculation of its reporting framework.

2.2.2. Scope of Energy Transmission Infrastructure impact assessment

The emissions impact of energy transmission infrastructure is assessed by calculating net avoided emissions arising from the operation of electricity interconnectors between two countries. It is important to note that electricity is expected to travel both ways along the interconnector, motivated by price. While there is a general correlation between amount of variable low carbon electricity generation (wind and solar) supply and electricity price, such that when it is windy and/or sunny, the price tends to be low, there is a risk that this correlation does not hold all the time. In this case, electricity with a high carbon intensity might be transported across the transmission infrastructure to the lower carbon jurisdiction which would, under the current methodology, result in positive carbon emissions net. An example is that France has very low average carbon intensity due to a large volume of nuclear

generation in the mix, but when demand exceeds the available low carbon generation in France, this leads to higher prices which drive imports from higher average emission countries. Nevertheless, in line with EU targets, a climate neutral Europe, running firmly on intermittent renewable power sources, will require more interconnected energy systems.

Net avoided emissions refer to the incremental difference in emissions calculated as the:

- **Scope 1: Direct emissions**
  - Possible fugitive GHG emissions from high voltage switchgear (sulphur hexafluoride, SF_6).

- **Scope 2 (Indirect Emissions from the generation of energy):**
  - Emissions from energy losses incurred from transmitting electricity between countries, calculated on the average of the carbon intensities of the two countries at the time of transport (ideally half hourly granularity).
  - Net emissions changes due to the transmission of electricity between countries. This is counted as the transported volumes times the difference in carbon intensity between the two countries at time of transport (ideally half hourly granularity).
  - Emissions avoided by the electricity transmission asset providing grid stabilisation / ancillary services relative to the fossil fuelled counterfactual (normally natural gas fuelled power, though will depend on which the energy mix of the connected countries).

In other words, the assessment quantifies the estimated change in annual GHG emissions due to the operation of a funded electricity transmission asset.

Both Direct and Indirect emissions originate from the use phase of the asset and do not currently include upstream (embedded construction emissions) or downstream (e.g., end of life treatment) emissions (Scope 3). Details around the calculations and justifications for all emission scopes are explained below.

2.3. Environmental impact methodology

2.3.1. Scope 1: Direct emissions from electricity transmission between countries

The Direct emissions are the GHG emissions from operation of electricity transmission assets.

Some electricity transmission assets use sulphur hexafluoride (SF_6), (a very powerful GHG with a Greenhouse Warming Potential (GWP) 22,800 times that of CO_2) as a high efficiency, non-toxic, non-flammable insulator in high voltage switchgear. The EU is looking to phase out the use of SF_6 in favour of alternatives[5,6].

If funded, electricity transmission assets use SF_6, in their high voltage switchgear, and if the asset operator provides reporting on annual fugitive emissions, these will be included in the quantification of emissions.

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[5] c_2020_6635_en.pdf (europa.eu)

[6] Fluorinated greenhouse gases – review of EU rules (2015-20)

If SF_6 is not used and/or the reporting is not available, this will be noted in the reporting methodology.

$$\boldsymbol{Direct\ (Scope\ 1)\ emissions\ in\ tCO2e} = kgSF6\ emitted\ per\ year\ * 22{,}800^{7}$$

Description	Unit	Input	Source(s)
Emissions of SF_6	Kg/year	Depends on design, maintenance approach / cycles	Provided by operators of electricity transmission assets
Direct (Scope 1) emissions	**kg CO_2**		

2.3.2. Scope 2: Indirect emissions from operations of electricity transmission assets

Indirect emissions from electricity transmission assets are the net CO_2 emissions from generating electricity in the sending country less the emissions avoided in the receiving country. These are split into three types:

1) Indirect emissions from electricity losses
2) Net indirect emissions from operation of the electricity transmission asset
3) Avoided emissions from the electricity transmission asset providing grid stabilisation services in either the exporting or importing country relative to a fossil fuel counterfactual.

1) Emissions from Electricity Losses

When transmitting electricity from one country to another, some of the electricity is lost due to resistance in wires and transformers.

The magnitude of interconnector losses depends on several factors, including distance, operating voltage and converter station design choices. Current UK interconnectors losses range from 2.34% – 3.40% while the two current Irish interconnectors range from 2.36% (Moyle, 63.5km long) to 4.68% (East-West Interconnector, 262km)[8].

The allocation of these losses is typically done on a “mid-point” basis, i.e., half of the losses are assumed incurred by the sending country/entity and half by the receiving country/entity.

This means that for assessment purposes losses can be calculated as the average of the carbon intensities of the two countries electricity grid at the time of transmission multiplied by the volumes of electricity transmitted.

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[7] Pollutant information - NAEI, UK (beis.gov.uk)

[8] Carbon Trust Desktop research

$$\sum_{i=1} \frac{(Emission\ Intensity\ Export\ Country_i + Emission\ Intensity\ Import\ Country_i)}{2} \times MWh_i \times ElectricityLossFactor$$

1) Net emissions from electricity transmission asset operation

With losses separated out above, the emissions from interconnector operations are simplified into the difference in emissions intensities of the connected countries' grids at the point of transmission.

$$\sum_{i=1} (Emission\ Intensity\ Export\ Country_i - Emission\ Intensity\ Import\ Country_i) \times Transmission\ Volume\ MWh_i$$

2) Avoided emissions from grid services

Depending on data availability, the avoided emissions from provision of grid stabilisation services, if present, are assessed relative to a fossil fuelled counterfactual (normally natural gas fuelled, though will depend on which the energy mix of the connected countries).

$$\sum Ancillary\ Services\ Provision_i \times (Country\ Emissions\ Intensity_i - Counterfactual\ Carbon\ Intensity)$$

Table 1 Summary of inputs to calculate Scope 2 emissions

Description	Unit	Input	Source(s)
Electricity Loss Factor	%	Varies by electricity transmission asset	Provided by operators of electricity transmission assets on their respective websites.
Transmission volumes flow through the electricity transmission asset	MWh	Varies by half hour	Provided by operator via AIB or Carbon Trust collects this data from public sources if available.
Carbon intensity of exporting and importing countries	$kgCO_2/kWh$	Differs by half-hour	ENTSO-E platform has data for most large assets in most EU countries (including Ireland and Germany)[9]. National Grid in the UK provides half-hourly data on generation and emissions[10].

[9] Entsoe Transparency Platform, Actual Generation per Generation Unit

[10] National Grid ESO Data Portal: Historic Generation Mix & Carbon Intensity

Provision of grid/ancillary services	Units vary depending on service,	Varies by each half-hour	Data on ancillary services provision to be provided by operator via AIB.
Carbon intensity of a counterfactual grid/ancillary service – Normally a gas fired power station but can vary depending on electricity mix of different countries.	$kgCO_2/kWh$	Depends on counterfactual – a range of $0.4kgCO_2/kWh$ (efficient CCGT) to a ~$1.0kgCO_2/kWh$ for a brown coal plant.	For simplicity, the operating margin will be used as the counterfactual ancillary services carbon intensity[11].
Direct (Scope 1) emissions	**kg CO_2**		

Note: only includes the inputs not already outlined in Table 1

2.3.3. Scope 3: Upstream and Downstream emissions

General approach

PCAF[12] recommends that if Scope 3 emissions were to be reported, they should only be accounted as a lump sum in the initial financing year.

Scope 3 emissions are not currently included in this assessment but, depending on data availability, the inclusion of Scope 3 emissions may be revisited in future impact reports.

2.3.4. Annual avoided emissions

The Scope 1 (fugitive SF_6 emissions) and Scope 2 (net operational impact on emissions) are calculated by adding all of these together, as per the below formula:

$$\boldsymbol{Annual\ net\ emissions} =$$

1) $Direct\ (Scope\ 1)\ emissions\ in\ tCO2(e) = kgSF6\ emitted\ per\ year * 22{,}800$[13]

+

[11] For the UK, the impact on a counterfactual CCGT was calculated. The minimum carbon intensity was approximately equal to the operating margin in the UK, leading to the operating margin (being more widely available and used, to be used). For Germany, if the same approach was taken using a coal plant counterfactual, the carbon intensity would be greater than the Germany operating margin. This is due to the marginal generation in Germany being a mix of gas and coal. Without further information on the German ancillary services market and any inherent bias towards one or the other of the two fossil generation technologies typically at operating margin, the standard annual operating margin is used as the counterfactual for ancillary services in Germany, consistent with the approach applied to the UK.

[12] PCAF (2020), The Global GHG Accounting and Reporting Standard for the Financial Industry. First edition.

[13] Pollutant information - NAEI, UK (beis.gov.uk)

2) $\sum_{i=1} \frac{(Emission\ Intensity\ Export\ Country(i) + Emission\ Intensity\ Import\ Country(i))}{2} \times MWh\ (i) \times Electricity\ Loss\ Factor$

+

3) $\sum_{i=1} (Emission\ Intensity\ Export\ Country(i) - Emission\ Intensity\ Import\ Country(i)) \times Transmission\ Volume\ MWh\ (i)$

+

4) $\sum Ancillary\ Services\ Provision(i) \times (Country\ Emissions\ Intensity\ (i) - Counter\ factual\ Carbon\ Intensity)$

Annual avoided emissions 2022	**kg CO_2**

2.3.5. Attributed impact to AIB

In some cases, AIB does not finance the entire project. As a result, the avoided emissions are adjusted by the share of financing attributable to AIB. This share is calculated by taking the amount outstanding on the deal and dividing by the project value:

$$\boldsymbol{Attribution\ Factor} = \frac{Amount\ of\ AIB\ Financing\ Outstanding\ (mEUR)}{Total\ Project\ Value\ (mEUR)}$$

Table 2 Summary of inputs to calculate attribution factor

Description	Unit	Input	Source(s)
Outstanding loan per project	€	Differs by project	Provided by AIB
Total cost of project	€	Differs by project	Provided by AIB
AIB annual attributed avoided emissions	**kg CO_2**		

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