

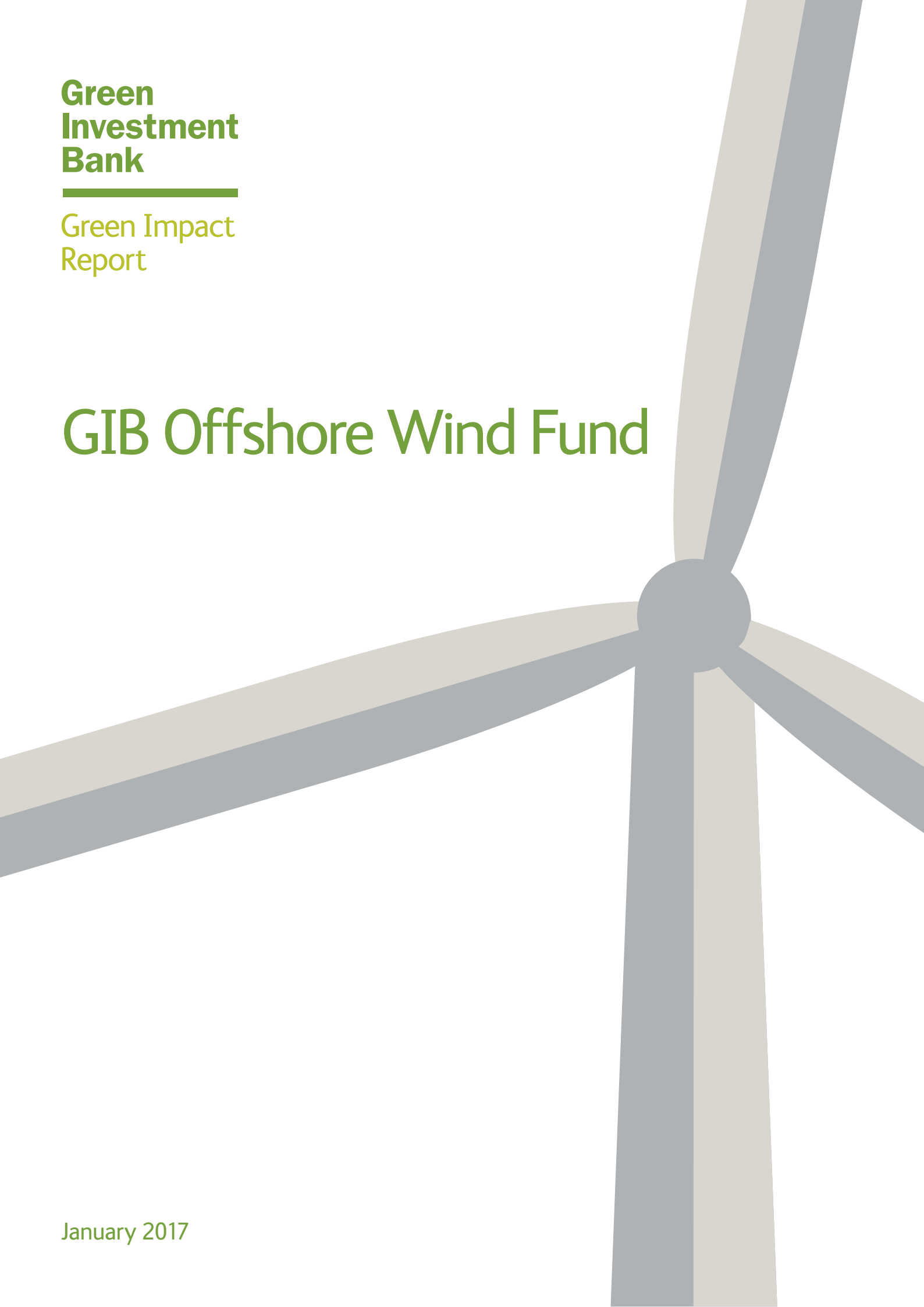
**Green  
Investment  
Bank**

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Green Impact  
Report

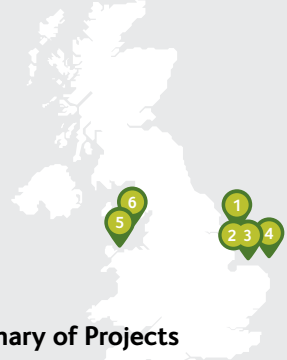
# GIB Offshore Wind Fund

January 2017



## Executive summary

The Sustainable Finance Team of the UK Green Investment Bank plc ('GIB'), acting on behalf of GIB Financial Services (GIB FS), has assessed the Green Impact of the Projects which make up the GIB Offshore Wind Fund portfolio (the 'Projects') and is pleased to set out its assessment in this Report.



**Summary of Projects**

Name:	1. Lincs 2. & 3. Lynn and Inner Dowsing 4. Sheringham Shoal 5. Rhyl Flats 6. Gwynt y Môr
Technology:	Offshore Wind
Location:	UK
Commercial operations date:	2009-2015
Design life:	20-25 years
Number of turbines:	402
Generation capacity:	1,447 MW
Remaining lifetime generation:	81,279 GWh
Forecast average annual generation:	4,513 GWh

### Green Investment classification

- Each of the Projects is forecast to achieve positive Green Impact, based on GIB's Green Impact assessment criteria
- An investment in the GIB Offshore Wind Fund may accordingly be classified as a Green Investment.

### Green Impact forecasts

**GIB's Green Impact forecasts for the Projects taken together, are in summary:**

- A total of 39,810 kt CO<sub>2</sub>e of greenhouse gas emissions avoided over the Projects' remaining lifetimes
  - Equating to average annual greenhouse gas emissions avoided of 1,955 kt CO<sub>2</sub>e
- More details are in the table below and on pages 3 and 4.

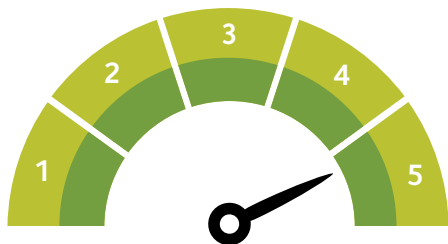
### Green Impact Forecast Accuracy:

- GIB has assessed at Level 5 (Very High) its level of confidence in the accuracy of these Green Impact forecasts.
- More details of this assessment are on page 4.

### Green Impact performance

All of the Projects are currently operational. The quantified Green Impact performance of the Projects to date, since they were acquired by the GIB Offshore Wind Fund, is provided on page 5. The actual Green Impact performance achieved by the Projects to date is 0.7% above the Green Impact forecasts.

### Green Impact Forecast Accuracy: Level 5 (Very High)



### Green Impact forecast metrics

Greenhouse gas emissions avoided (carbon dioxide equivalent)	
Remaining lifetime	35,210 kt CO <sub>2</sub> e
Average annual	1,955 kt CO <sub>2</sub> e / yr
Fossil fuel consumption avoided (oil equivalent)	
Remaining lifetime	15,350 ktoe
Average annual	852.4 ktoe / yr
Other emissions to air avoided (oxides of nitrogen)	
Remaining lifetime	35,260 t NO <sub>x</sub>
Average annual	1,958 t NO <sub>x</sub> / yr

Full details of the Projects' Green Impact forecasts and our opinion on the Green Impact Forecast Accuracy can be found on subsequent pages of this Report.

**Important note:** This Report has been prepared by GIB on the basis of, and should be read in conjunction with, the methodology, assumptions, limitations and other terms set out in Appendices 2 and 3.

## Green Impact forecasts

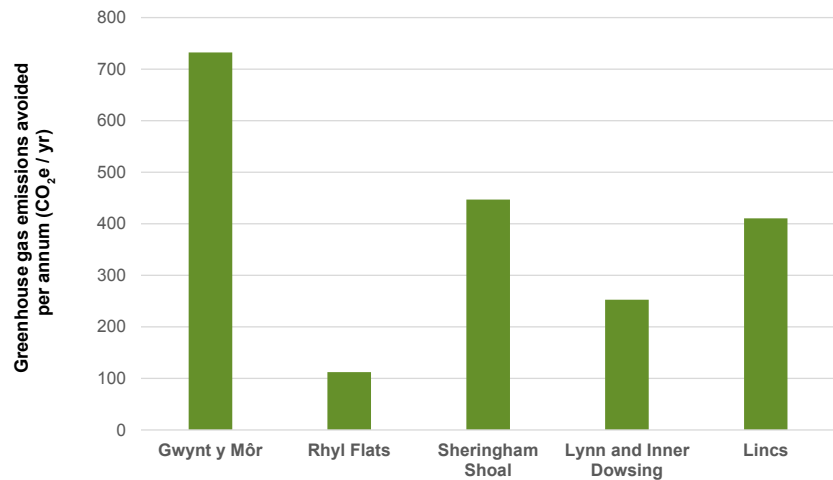
In this Report, we use the term “Green Impact” to refer to the environmental benefits of any given Project. The Green Impact forecasts in this section are those benefits estimated to be achievable by the Projects, and this includes estimated avoided greenhouse gas emissions, other emissions to air and resource use (fossil fuel equivalent). Where applicable, energy generation forecasts may be based on actual performance achieved by a Project to date. The actual performance of the Projects against the generation forecast will be monitored for the lifetime of the investment; performance to date is set out on page 5. Each of the Green Impact forecasts set out below is based on data derived from the Projects and is subject to GIB’s assessment of Green Impact Forecast Accuracy (as set out on page 4). The Green Impact forecasts and Green Impact Forecast Accuracy are subject to the methodology, assumptions, limitations and other terms set out in Appendices 2 and 3.

### Green Impact forecast: Greenhouse gas emissions avoided

Projects are forecast to avoid emissions of 1,955 kt CO<sub>2</sub>e each year

Avoidance of greenhouse gas (GHG) emissions (measured in carbon dioxide equivalent – CO<sub>2</sub>e), both actual and forecast, is derived by comparing the emissions associated with the Projects to a counterfactual (alternative) method of energy generation, e.g. UK marginal grid electricity generation.

**GIB has assessed the Projects, taken together, as having the potential to avoid emissions amounting in aggregate to over 35 million tonnes CO<sub>2</sub>e over their remaining lifetimes, resulting in an average annual avoidance of 1,955 thousand tonnes CO<sub>2</sub>e for each year of operation.**



#### GHG emissions avoided

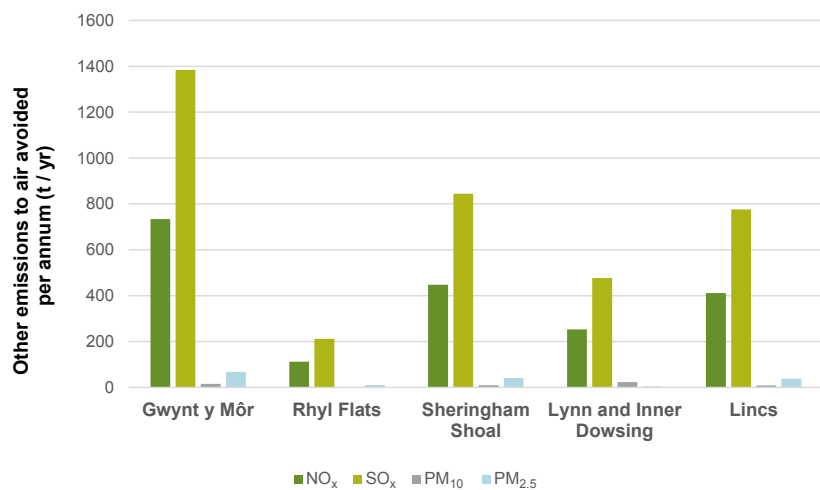
Remaining lifetime	35,210 kt CO <sub>2</sub> e
Average annual	1,955 kt CO <sub>2</sub> e / yr

### Green Impact forecast: Other emissions to air avoided

Projects are forecast to avoid emissions of NO<sub>x</sub>, SO<sub>x</sub> and particulates each year

Other emissions to air avoided is a measure of net air pollutant emissions compared to the counterfactual method of energy generation. Quantified air pollutant emissions include oxides of nitrogen (NO<sub>x</sub>), oxides of sulphur (SO<sub>x</sub>), particulates 10 micrometres in diameter (PM<sub>10</sub>) and particulates 2.5 micrometres in diameter (PM<sub>2.5</sub>).

**GIB has assessed the Projects, taken together, as having the potential to avoid emissions amounting in aggregate to the equivalent of: 1,958 tonnes NO<sub>x</sub>, 3,693 tonnes SO<sub>x</sub>, 41 tonnes PM<sub>10</sub> and 181 tonnes PM<sub>2.5</sub> annually.**



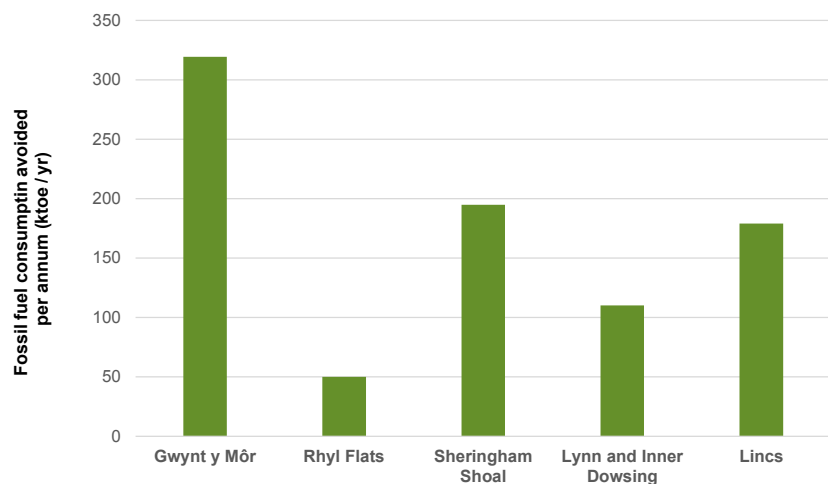
#### Emissions to air avoided

Average annual nitrogen oxides	1,958 t NO <sub>x</sub> / yr
Average annual sulphur oxides	3,693 t SO <sub>x</sub> / yr
Average annual particulate matter 10µm	41 t PM <sub>10</sub> / yr
Average annual particulate matter 2.5µm	181 t PM <sub>2.5</sub> / yr

**Green Impact forecast: Fossil fuel consumption avoided** Projects are forecast to avoid the consumption of 852 kt oil equivalent each year

Fossil fuel consumption avoided is a measure of the net consumption of natural resources compared to the counterfactual method of energy generation, and is normalised to tonnes of oil equivalent (toe) as a proxy measure.

**GIB has assessed the Projects, taken together, as having the potential to avoid the consumption of over 15 million tonnes of oil equivalent over their remaining lifetimes, resulting in an average annual avoidance of 852 thousand tonnes of oil equivalent for each year of operation.**



**Fossil fuel consumption avoided**

Remaining lifetime	15,350 ktoe
Average annual	852.4 ktoe / yr

**Green Impact Forecast Accuracy**

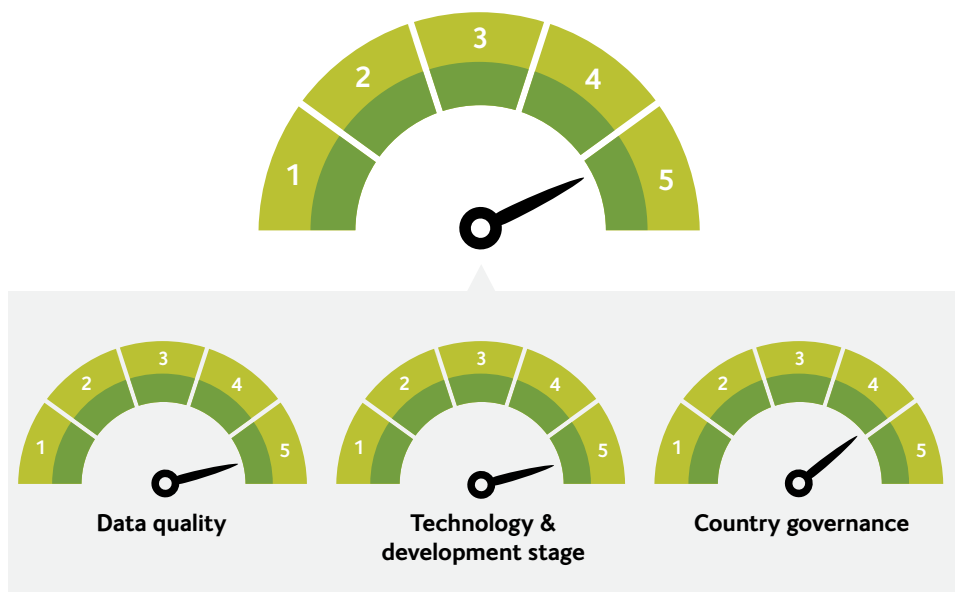
Green Impact Forecast Accuracy is GIB's assessment of the level of confidence that can reasonably be placed on the accuracy of any quantified Green Impact forecast. It is based on information derived from the Projects and on the methodology referred to in Appendix 2.

GIB assesses Green Impact Forecast Accuracy at levels ranging from Level 1 (Low) to Level 5 (Very High), which represent the combined and weighted average of a series of factors as presented on the right.

**GIB has assessed the Green Impact Forecast Accuracy for the Projects at Level 5 (Very High). This is based on the fact that all of the Projects have been operational for at least a full year, and have demonstrated operational performance in line with forecasts.**

Further information on the Projects' actual performance is provided in the next section.

**Green Impact Forecast Accuracy: Level 5 (Very High)**



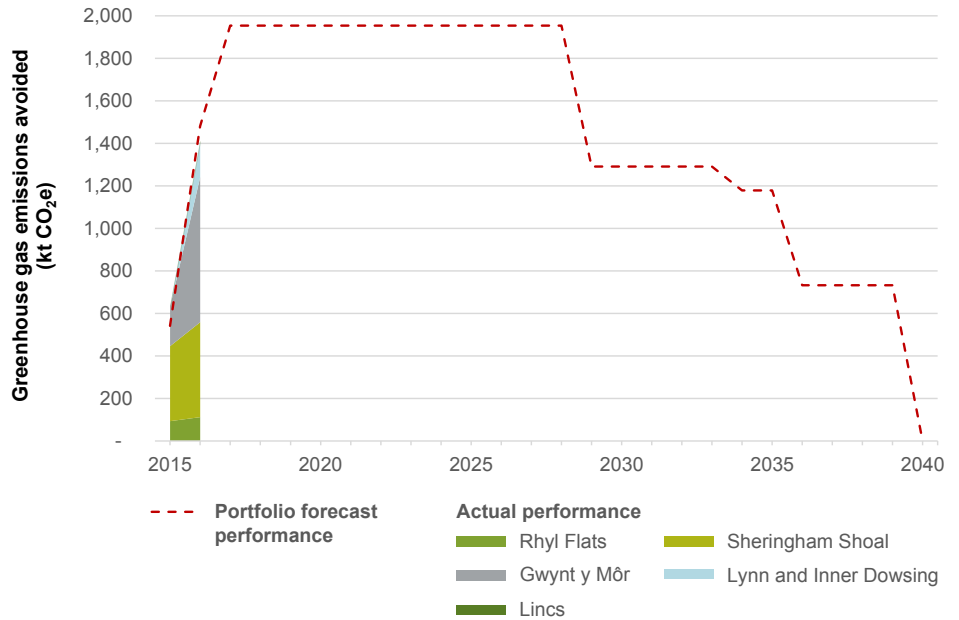
## Green Impact performance

**Green Impact performance:** Greenhouse gas emissions avoided, other emissions to air avoided, fossil fuel consumption avoided

As stated above, actual performance of each of the Projects is measured against its forecast and reported annually. Performance of the Projects which make up the GIB Offshore Wind Fund portfolio against the Green Impact Forecast is shown in the chart and table to the right.

Green Impact performance is measured from the point at which the GIB Offshore Wind Fund acquired a stake in each Project.

**To date, the cumulative Green Impact of the Projects is 0.7% above the Green Impact forecasts\*.**



### Green Impact performance to date

GHG emissions avoided	2,038	kt CO <sub>2</sub> e
Nitrogen oxides emissions avoided	2,041	t NO <sub>x</sub>
Sulphur oxides emissions avoided	3,850	t SO <sub>x</sub>
Particulate matter 10µm emissions avoided	43	t PM <sub>10</sub>
Particulate matter 2.5µm emission avoided	189	t PM <sub>2.5</sub>
Fossil fuel consumption avoided	889	ktoe

\* December 2016 performance is provisional at the time of writing.

## Appendix 1

### User input: Project data

Project Information*	Rhyl Flats
Technology	Offshore Wind
Country	UK
Capacity	90 MWe
Number of turbines	25
Stage	Operational
Year Project commenced operations	2009
Year Project acquired by GIB Offshore Wind Fund	2015
Percentage ownership of Project by GIB Offshore Wind Fund	24.95%

Project Information*	Sheringham Shoal
Technology	Offshore Wind
Country	UK
Capacity	316.8 MWe
Number of turbines	88
Stage	Operational
Year Project commenced operations	2012
Year Project acquired by GIB Offshore Wind Fund	2015
Percentage ownership of Project by GIB Offshore Wind Fund	20%

Project Information*	Gwynt y Môr
Technology	Offshore Wind
Country	UK
Capacity	576 MWe
Number of turbines	160
Stage	Operational
Year Project commenced operations	2015
Year Project acquired by GIB Offshore Wind Fund	2015
Percentage ownership of Project by GIB Offshore Wind Fund	10%

Project Information*	Lynn and Inner Dowsing
Technology	Offshore Wind
Country	UK
Capacity	194.4 MWe
Number of turbines	54
Stage	Operational
Year Project commenced operations	2009
Year Project acquired by GIB Offshore Wind Fund	2016
Percentage ownership of Project by GIB Offshore Wind Fund	61%

Project Information*	Lincs
Technology	Offshore Wind
Country	UK
Capacity	270 MWe
Number of turbines	75
Stage	Operational
Year Project commenced operations	2013
Year Project acquired by GIB Offshore Wind Fund	2017
Percentage ownership of Project by GIB Offshore Wind Fund	44%

\* Source: Technical Adviser's reports and data provided by UK Green Investment Bank Financial Services Ltd

## Appendix 2

### Terminology and Methodology

#### Terminology

##### Green Investment

“Green Investment” means an investment into a project on which GIB has made an assessment that it will, or is reasonably likely to, deliver Green Impact.

##### Green Impact

“Green Impact” is a collective term referring to the environmental benefits which have been calculated in accordance with GIB’s methodology to be, or to be reasonably likely to be, delivered by the project which is the subject of this Report. Green Impact includes estimated avoided greenhouse gas emissions, NO<sub>x</sub>, SO<sub>x</sub>, particulate matter and fossil fuel use. Green Impact is calculated and reported as defined metrics, which include tonnes carbon dioxide equivalent (t CO<sub>2</sub>e), tonnes oil equivalent (toe), and tonnes (t) of other air pollutant emissions.

##### Green Impact Forecast Accuracy

“Green Impact Forecast Accuracy” is an expression of the level of confidence that, in the opinion of GIB, can reasonably be placed on the accuracy of any quantified Green Impact forecast. This assessment of forecast accuracy is described in levels as follows: Level 1 (Low), Level 2 (Moderate), Level 3 (Good), Level 4 (High), and Level 5 (Very High).

#### Methodology

The Green Impact and Green Impact Forecast Accuracy assessments presented in this Report are based on GIB’s approach to assessing Green Impact using the methodologies set out within its proprietary green investment principles, policies and the associated processes of the Green Investment Handbook<sup>1</sup>. The Green Impact assessment has applied proprietary modelling techniques and comparative data developed and owned by GIB, or by third party owners and made available under licence to GIB.

##### Green Impact calculation

GIB’s initial calculation of the Green Impact of each project is produced by comparing relevant information and data derived from that project against relevant counterfactual (or baseline) data for the assumed environmental impacts that would occur if the project did not take place, based on GIB’s proprietary reference sources or provided to GIB by relevant third parties or obtained from publicly available sources. The resultant estimated Green Impact is then subject to further qualitative evaluation before production of GIB’s formal Green Impact Report.

For grid-connected projects that generate electricity, the counterfactual is assumed to be marginal electricity generated from the national grid in that country, which includes resources consumed to supply grid electricity. GIB’s methodology calculates the net Green Impact of the project by comparing its likely emissions to those of a marginal grid electricity mix, using the methodology set out in the *International Financial Institutions (IFI) approach to GHG accounting for renewable energy projects*<sup>2</sup> and the *IFI approach to GHG accounting for energy efficiency projects*<sup>3</sup>.

The counterfactual of marginal grid electricity does not include the total quantifiable lifecycle environmental burdens (e.g. resources consumed during construction, or indirect emissions during operations such as those from associated transport vehicles) associated with energy generation. Therefore, to produce a valid comparison, the calculation of Green Impact for the project(s) assessed in this Report is based solely on the operational phase of the relevant project(s), and does not include a full lifecycle assessment of the project(s) unless specifically stated otherwise. This approach is aligned with the Greenhouse Gas Project Protocol<sup>4</sup>.

GIB’s methodology calculates likely Green Impact on an annual and lifetime basis.

The Green Impact reported is 100% of the Green Impact of the project(s). There is no proportionate allocation of Green Impact to any particular project investment or to particular investors, all of whom may report the same Green Impact from the underlying project(s).

##### Green Impact Forecast Accuracy

Green Impact Forecast Accuracy is determined from a number of project parameters that include the project technology, stage of project development, and country in which the project is located, together with GIB’s opinion of the input data quality. These parameters have been assigned values that represent the degree to which they affect the accuracy of the forecast Green Impact, and are used to produce Forecast Accuracy scores for three elements: Data quality, Technology & development stage, and Country governance<sup>5</sup>. The Forecast Accuracy scores for the three elements are weighted according to GIB’s in-house experience of the sensitivity of each element and combined to derive an overall level of Green Impact Forecast Accuracy.

1 [www.greeninvestmentbank.com/green-impact](http://www.greeninvestmentbank.com/green-impact)

2 <http://documents.worldbank.org/curated/en/2015/12/25514886/ifi-approach-ghg-accounting-renewable-energy-projects>

3 <http://documents.worldbank.org/curated/en/2015/12/25514884/ifi-approach-ghg-accounting-energy-efficiency-projects>

4 [www.ghgprotocol.org/standards/project-protocol](http://www.ghgprotocol.org/standards/project-protocol)

5 Country governance scores are determined from datasets of indicators from the World Bank, Transparency International, and United Nations University Institute for Environment and Human Security.

## Appendix 3

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GIB calculates Green Impact using reference data obtained from, among others, by the Ecoinvent life cycle inventory datasets for the calculation of environmental impacts. Green Impact is also calculated based on data supplied by the International Energy Agency (IEA), specifically from the 2015 editions of the World Energy Statistics and Balances dataset and the CO<sub>2</sub> Emissions from Fuel Combustion dataset.

Any limitations and caveats that are applicable to the Ecoinvent and IEA datasets, as published on their websites, are also applicable to the results presented in this Report.

GIB's method is designed to work with a limited number of key inputs and to create results for over 200 different countries and makes some simplifying assumptions in order to achieve this degree of flexibility.

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