

# Green Impact Report

## Hornamossen Wind Farm



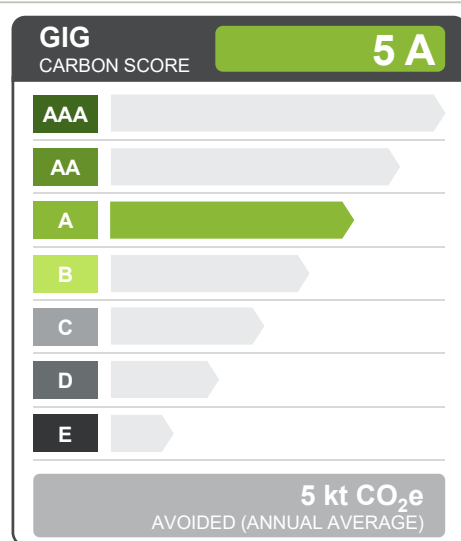
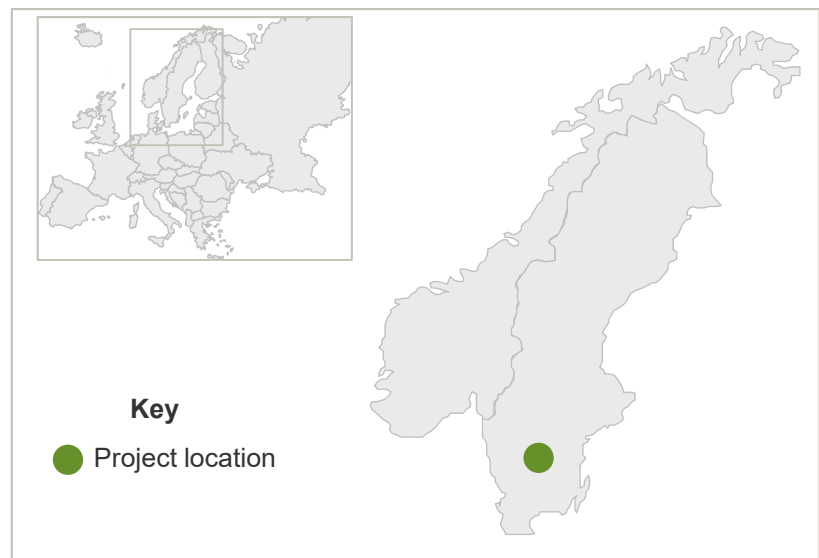
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### Introduction

The Green Investment Ratings ('GIR') team of Green Investment Group Limited ('GIG') has prepared this report (the 'Report') in connection with the Hornamossen Wind Farm (the 'Project'). The GIR team has forecast the Project's avoided: greenhouse gas ('GHG') emissions; emissions to air; and fossil fuels consumption (together, the 'Green Impact') of the Project, as summarised below. This Report also considers the Project's alignment with the United Nations Sustainable Development Goals.

The Project's GIG Carbon Score is 5 A. Refer to page 2 and the methodology in Appendix 1 for further information on how this is calculated.

Project Information	
Technology	Onshore Wind
Country	Sweden
Capacity (MW)	43
Stage	Pre-construction
Anticipated commencement of operations	2020



### Green Impact: Forecast & Performance

GHG emissions avoided (carbon dioxide equivalent)	
Remaining lifetime	121 kt CO <sub>2</sub> e
Average annual	5 kt CO <sub>2</sub> e / yr
Other emissions to air avoided (oxides of nitrogen)	
Remaining lifetime	360 t NO <sub>x</sub>
Average annual	15 t NO <sub>x</sub> / yr
Fossil fuels consumption avoided (oil equivalent)	
Remaining lifetime	43 kt oe
Average annual	2 kt oe

**Important note:** This Report has been prepared by GIG on the basis of, and should be read in conjunction with, the methodology v1.1, assumptions, limitations and other terms set out in Appendices 1, 2 and the Important Notice and Disclaimer, Appendix 3. This is not a due diligence report and should not be relied upon as such. If appropriate, recipients and users of this Report should conduct their own separate environmental, social and governance enquiries and assessments. This Report is provided for information purposes only and does not constitute and shall not be deemed to be in any way an offer or invitation or solicitation of any offer or invitation to sell or purchase shares or invest in any Project. This Report has not been filed, lodged, registered or approved in any jurisdiction and recipients of this document should keep themselves informed of and comply with and observe all applicable legal and regulatory requirements.

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### Green Impact Forecast

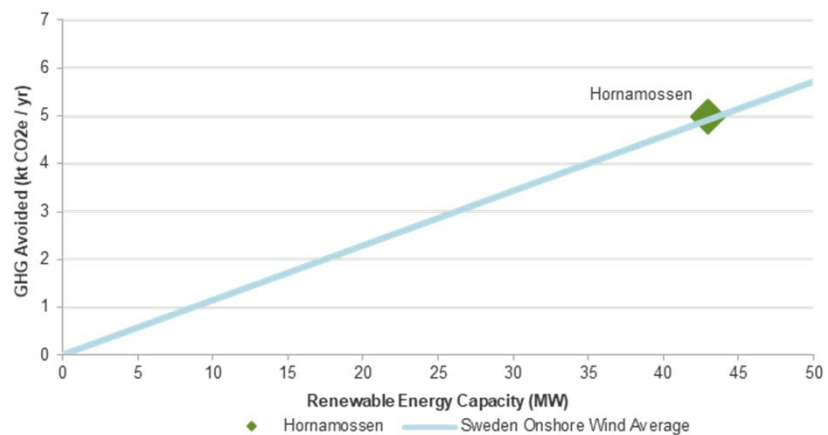
In this Report we use the term ‘Green Impact’ to refer to the GHG, emissions to air and fossil fuels consumption avoided by the Project, as defined in Appendix 1. Forecasts are based on data provided to the GIR team and are subject to our assessment of Green Impact Forecast Accuracy (as set out on page 3). The forecasts and Green Impact Forecast Accuracy are subject to the methodology, assumptions, limitations and methods set out in Appendices 1 & 2.

### Greenhouse gas emissions avoided

The Project is forecast to avoid emissions of 5 kt CO<sub>2</sub>e / yr

Avoidance of 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 Project to a counterfactual (alternative method of energy generation). In this case the counterfactual is marginal grid emissions.

The Project is forecast to avoid an average of 5 kilotonnes of CO<sub>2</sub>e / yr over its remaining lifetime.



#### Greenhouse gas emissions avoided (carbon dioxide equivalent)

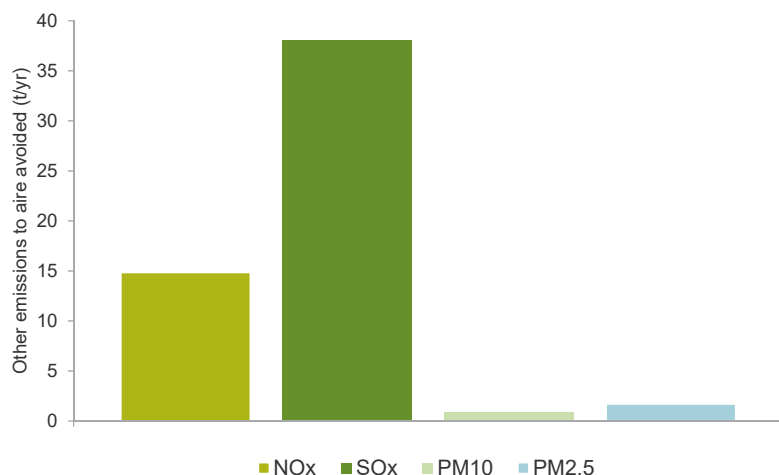
Remaining lifetime	121 kt CO <sub>2</sub> e
Average annual	5 kt CO <sub>2</sub> e / yr

### Other emissions to air avoided

The Project is forecast to avoid emissions of 15 t NO<sub>x</sub> / yr

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 up to 10 micrometres (µm) in diameter (PM<sub>10</sub>) and particulates up to 2.5 µm in diameter (PM<sub>2.5</sub>).

The Project is forecast to result in the avoidance of 15 tonnes NO<sub>x</sub>, 38 tonnes SO<sub>x</sub> and 3 tonnes of particulate matter per year.



#### Emissions to air avoided

Average annual nitrogen oxides	15 t NO <sub>x</sub> / yr
Average annual sulphur oxides	38 t SO <sub>x</sub> / yr
Average annual 10µm particulate matter	1 t PM <sub>10</sub> / yr
Average annual 2.5µm particulate matter	2 t PM <sub>2.5</sub> / yr

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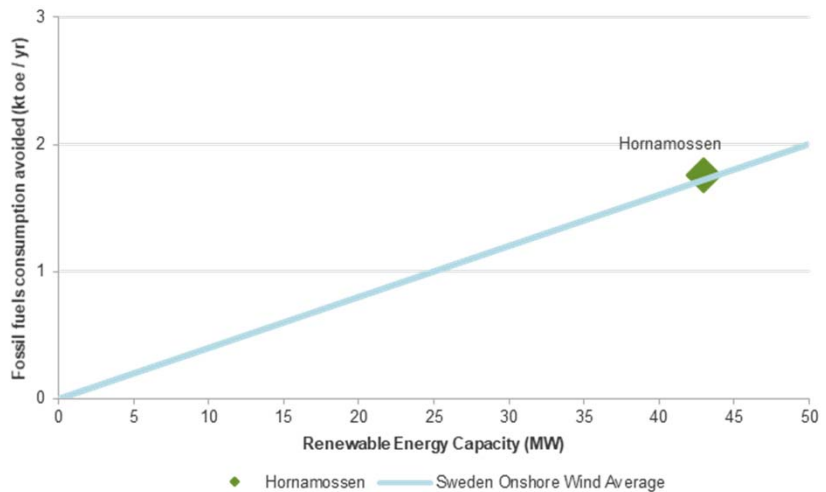
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### Fossil fuels consumption avoided

Fossil fuels consumption avoided is a measure of the net consumption of coal, oil and gas compared to the counterfactual method of grid-based electricity generation, and is normalised to tonnes of oil equivalent (t oe).

The Project is forecast, on a whole project basis, to avoid an average of 2 tonnes of oil equivalent per year.

The Project is forecast to avoid 2 kt oil equivalent annually



Fossil fuels consumption avoided	
Remaining lifetime	43 kt oe
Average annual	2 kt oe / yr

### Green Impact Forecast Accuracy

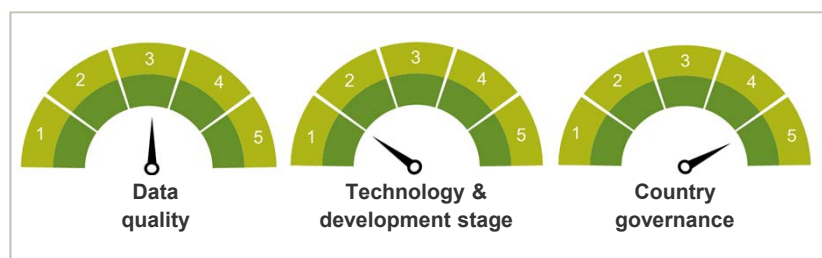
The weighted Green Impact Forecast Accuracy is our assessment of the level of confidence that can reasonably be placed on the accuracy of any quantified Green Impact Forecast. It is based on information provided to the GIR team (set out on page 1 and in the methodology referred to in Appendix 1).

We assess 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, according to our in-house experience of the sensitivity of each element. See Appendix 1 for further detail.

We have assessed the weighted average Green Impact Forecast Accuracy for the Project at Level 3 (Good).

The data quality and development stage scores are anticipated to increase when the Project becomes operational and actual performance is known. This will then result in an overall increase in Green Impact Forecast Accuracy.

#### Level 3 (Good)






### Contribution to the Sustainable Development Goals

The United Nations Sustainable Development Goals<sup>1</sup> (SDGs) are a set of 17 goals for sustainable development, defined by 169 SDG Targets to be achieved by 2030. The GIR team has considered the performance of the Project against the SDGs and their associated Targets. The assessment has identified those Targets to which the Project contributes directly (associated SDGs shown as full coloured icons below), and those Targets to which the Project contributes indirectly (inverted coloured SDG icons below).



### Direct contribution

Goal	SDG Target	Contribution
	<b>Target 3.9</b> <i>Reduce deaths and illnesses from air pollution</i>	According to the World Health Organization, air pollutants such as nitrogen oxides (NO <sub>x</sub> ), sulphur oxides (SO <sub>x</sub> ) and particulate matter (PM) can lead to premature death and illnesses such as stroke, heart disease, lung cancer and chronic respiratory diseases. <sup>2</sup> Avoidance of fossil fuel electricity generation due to renewable generation is forecast to avoid average annual emissions of harmful air pollutants of: <ul style="list-style-type: none"> <li>o 15 t NO<sub>x</sub> / yr</li> <li>o 38 t SO<sub>x</sub> / yr</li> <li>o 1 t PM<sub>10</sub> / yr</li> <li>o 2 t PM<sub>10</sub> / yr</li> </ul>
	<b>Target 7.2</b> <i>Increase substantially the share of renewable energy in the global energy mix</i>	The Project will add 43 MW of renewable energy generation capacity to the local electricity grid.
	<b>Target 9.1</b> <i>Develop quality, reliable, sustainable and resilient infrastructure</i>	

<sup>1</sup> <http://sustainabledevelopment.un.org/sdgs>

<sup>2</sup> World Health Organization, Ambient air pollution - a major threat to health and climate: <https://www.who.int/airpollution/ambient/en/>

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### Indirect contribution

Goal	SDG Target	Contribution
<p><b>12</b> RESPONSIBLE CONSUMPTION AND PRODUCTION</p>	<p><b>Target 12.2</b> <i>Achieve the sustainable management and efficient use of natural resources</i></p>	<p>Avoidance of fossil fuel electricity generation due to renewable generation results in the forecast avoidance of the consumption 2 kt oil equivalent / yr.</p>
<p><b>13</b> CLIMATE ACTION</p>	<p><b>Target 13.3</b> <i>Improve human and institutional capacity on climate change mitigation</i></p>	<p>The Project raises awareness and improves institutional capacity on climate change mitigation and negative impact reduction. The Project is forecast to avoid 5 kt CO<sub>2</sub>e of greenhouse gas emissions annually.</p>



## Appendix 1

### Terms and Conditions: Terminology and Methodology

#### Terminology

##### *Green Impact*

The Green Impact metrics covered by this Report are identified in the header and executive summary. "Green Impact" is a collective term referring to the environmental benefits which have been calculated in accordance with GIG's methodology to be, or to be reasonably likely to be, delivered by the project(s) to which this Report refers. The collective term can include defined metrics such as tonnes carbon dioxide equivalent avoided (t CO<sub>2</sub>e), tonnes oil equivalent avoided (toe), and tonnes (t) of other air pollutant emissions avoided.

##### *Green Impact Forecast Accuracy*

"Green Impact Forecast Accuracy" is an expression of the level of confidence that, in the opinion of GIG, 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 v 1.1*

The Green Impact and Green Impact Forecast Accuracy assessments presented in this Report are based on GIG'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 GIG, or by third party owners and made available under licence to GIG.

##### *Green Impact calculation*

GIG'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 GIG's proprietary reference sources or provided to GIG 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 GIG's formal Green Impact Report.

For grid-connected projects that generate electricity, the counterfactual is assumed to be marginal electricity generated from the local electricity grid, which includes resources consumed to supply grid electricity. GIG'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>.

GIG's methodology calculates results for likely Green Impact on an annual and lifetime basis. The Green Impact reported is 100% of the Green Impact of the underlying 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).

##### *Exclusions*

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>. GIG's assessment does not include a review of any underlying project's environmental and/or social, permitting, licencing or other compliance status.

##### *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 location of the project, together with GIG'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 Local governance<sup>5</sup>. The Forecast Accuracy scores for the three elements are weighted according to GIG's in-house experience of the sensitivity of each element and combined to derive an overall level of Green Impact Forecast Accuracy

##### *Carbon Score*

Our Carbon Score shows the quantified greenhouse gas emissions avoided combined with our Carbon Rating. The Carbon Rating is a measure of a project's lifecycle greenhouse gas emissions compared to the emissions of the lowest lifecycle emissions relative to the counterfactual would score the highest ratings from AAA to B. Projects with lifecycle emissions similar to the counterfactual would score a C, and projects with greater emissions would score a D or E. The missions of the counterfactual are derived from the IFI approaches to greenhouse gas accounting – please see above for details. Where we do not have project-specific information on lifecycle emissions, we use the median harmonised values from the US National Renewable Energy Laboratory's Lifecycle Assessment Harmonization<sup>6</sup>

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

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

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

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

<sup>5</sup> Local governance scores are determined from datasets of indicators from the World Bank, Transparency International and United Nations University Institute for Environment and Human Security

<sup>6</sup> [www.nrel.gov/analysis/sustain-lcah.html](http://www.nrel.gov/analysis/sustain-lcah.html)

## Appendix 2

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#### Reference data

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GIG 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 CO2 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.

GIG's method is designed to work with a limited number of key inputs and to be globally applicable, and makes some simplifying assumptions in order to achieve this degree of flexibility.

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# Green Impact Report

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