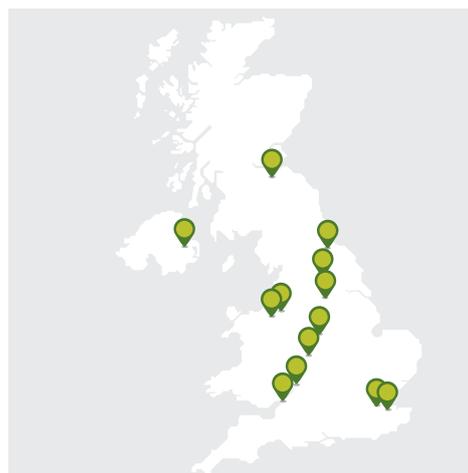


## Executive summary

The Sustainable Finance Team of the UK Green Investment Bank Limited ('GIB') has assessed the forecast landfill avoided, materials recycled and recovered, and renewable energy generated ('Green Impact') by waste sector projects into which GIB has directly invested (the 'Projects') and is pleased to set out its assessment in this Report.



### Projects summary

Technologies:	Waste recycling, Energy from Waste (EfW), Combined Heat and Power (CHP)
Location:	United Kingdom
Commercial operations date:	from 2016
Design life:	20-25 years
Waste treatment capacity:	3.2m tonnes / yr
Remaining lifetime electricity generation:	55,454 GWh
Forecast average annual generation:	2,160 GWh / yr

### Green Impact Forecast Accuracy Level 3 (Good)



### Introduction

This Report sets out the forecast Green Impact (as defined above) performance of the Projects. This Report does not consider localised aspects or potential negative impacts on, for example, biodiversity or other considerations of the wider natural environment.

The actual performance of the Projects has not yet been reported because the two operational projects in the portfolio have not yet been fully operational long enough to have reported performance data. Actual performance data would be reported in subsequent editions of this Report.

### Green Impact forecasts

**GIB's forecasts for waste to landfill avoided by the Projects, taken together, are in summary:**

- A total of 70.6 million tonnes of waste to landfill avoided over their remaining lifetimes
- Equating to average annual waste to landfill avoided of 2.6 million tonnes

Further Green Impact metrics are set out in the table below and subsequent pages of this Report.

### Green Impact Forecast Accuracy:

- GIB has assessed at Level 3 (Good) its level of confidence in the accuracy of these Green Impact forecasts.

More details of this assessment are on page 4.

### Forecast Green Impact metrics

Landfill avoided	
Remaining lifetime	70,636 kt
Average annual	2,583 kt / yr
Materials recycled and recovered	
Remaining lifetime	19,157 kt
Average annual	730 kt / yr
Renewable energy generated	
Remaining lifetime	39,411 GWh
Average annual	1,540 GWh / 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 v1.0 assumptions, limitations and other terms set out in Appendices 2 and 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.

**Green Impact forecasts: Landfill avoided, materials recycled and recovered, and renewable energy generated**

In this Report we use the term “Green Impact” to refer to waste to landfill avoided, materials recycled and recovered, and renewable energy generated avoided by any given Project. Green Impact as a broader term is described further in Appendix 2. The forecasts in this section are those environmental benefits estimated to be achievable by the Projects. The actual performance of the Projects against the generation forecast will be monitored for the lifetime of the Projects. Each of the 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 forecasts and Green Impact Forecast Accuracy are subject to the methodology, assumptions, limitations and methods set out in Appendices 2 and 3.

**Green Impact forecast: Landfill avoided**

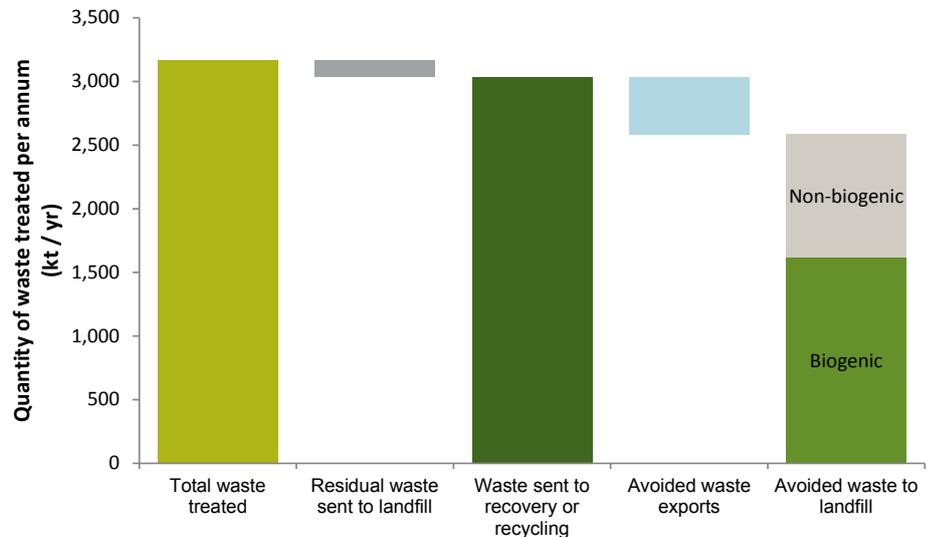
The Projects are forecast to divert 2.6m tonnes of waste from landfill per annum

**GIB has assessed the Projects, taken together, as having the potential to prevent 1,619 kt of biogenic waste and 964 kt of non-biogenic waste annually from being sent to landfill.**

The primary purpose of waste management facilities is to treat waste in a way that minimises harmful environmental effects. The Waste Hierarchy<sup>1</sup> ranks waste management options according to what is best for the environment. In the UK, waste disposal such as landfill is seen as the least environmentally desirable option for waste management.

The Projects will therefore achieve Green Impact by diverting waste from landfill to waste treatment options higher up the Waste Hierarchy, such as recycling and energy recovery.

The waste processed by the Projects can be subdivided into biogenic and non-biogenic waste. Biogenic waste is waste that originally derives from plant or animal matter (e.g. wood, food waste), and breaks down anaerobically in landfill sites to form landfill gas, which contains potent greenhouse gases.



**Quantity of waste processed**

Total waste treated	3,163	kt / yr
Residual waste sent to landfill	126	kt / yr
Waste sent to recycling or recovery	3,038	kt / yr
Avoided waste exports	454	kt / yr
<b>Avoided waste to landfill</b>	<b>2,583</b>	<b>kt / yr</b>
– of which biogenic	1,619	kt / yr
– of which non-biogenic	964	kt / yr

<sup>1</sup> See [www.gov.uk/guidance/waste](http://www.gov.uk/guidance/waste) for details.

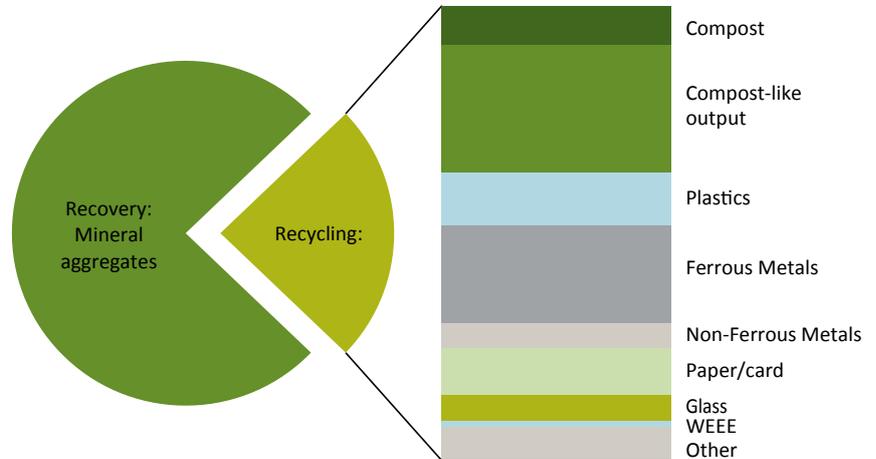
**Green Impact forecast: Materials recycled and recovered**

The Projects are forecast to recycle and recover 730 kt of materials per annum

**GIB has assessed the Projects, taken together, as having the potential to recycle 178 kt of materials and recover 553 kt of materials annually.**

Waste management options other than disposal include recycling and recovering from the waste stream. This reduces the need for natural resources to be utilised to manufacture new products.

The Projects will recycle materials by extracting them prior to energy recovery, and following energy recovery the ash will be used for mineral aggregates.



**Materials recycled or recovered**

Recovery: Mineral aggregates	553 kt / yr
<b>Recycling:</b>	
– Compost	16 kt / yr
– Compost-like output	50 kt / yr
– Plastics	21 kt / yr
– Ferrous metals	38 kt / yr
– Non-ferrous metals	10 kt / yr
– Paper/card	18 kt / yr
– Glass	10 kt / yr
– Waste Electrical and Electronic Equipment (WEEE)	3 kt / yr
– Other	13 kt / yr

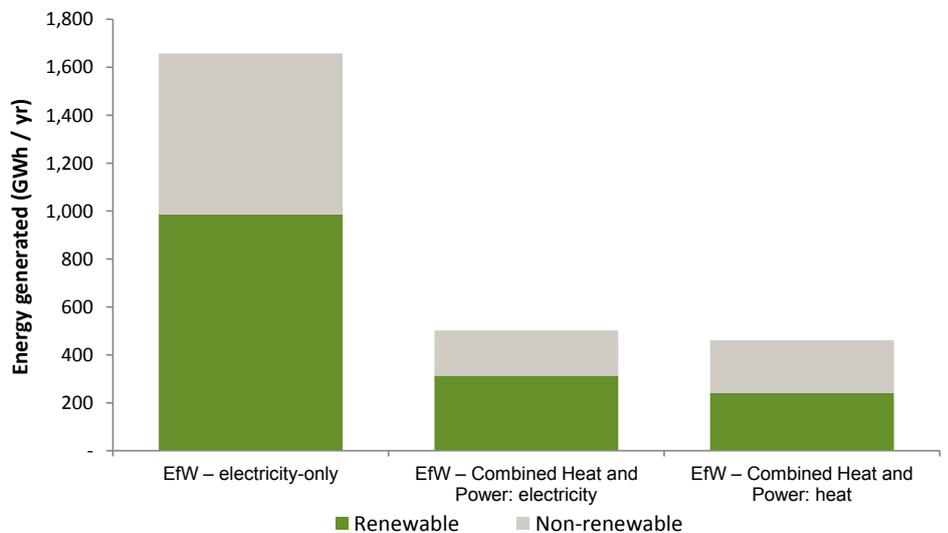
**Green Impact forecast: Renewable energy generated**

The Projects are forecast to generate 1,540 GWh of renewable energy annually

**GIB has assessed the Projects, taken together, as having the potential to generate 39,411 GWh of renewable energy over their remaining lifetimes, equivalent to the generation of 1,540 GWh of renewable energy for each year of operation.**

The Energy from Waste (EfW) Projects will export electricity and heat recovered through combustion of the waste. The energy generated through this process is a mix of renewable and non-renewable energy – the renewable component is that generated from biogenic waste (e.g. wood), and the non-renewable component is generated from non-biogenic waste.

The graph to the right shows the forecast annual renewable energy generation, with non-renewable generation also shown for context.



**Renewable energy generated**

Remaining lifetime	39,411 GWh
Average annual	1,540 GWh / yr

### Green Impact Forecast Accuracy

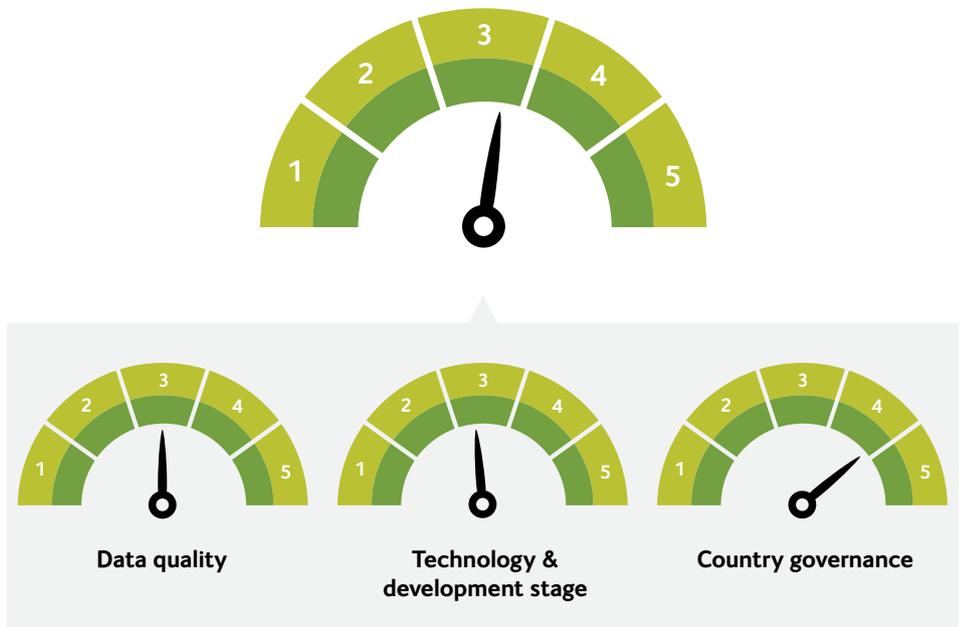
**GIB has assessed the average Green Impact Forecast Accuracy for the Projects at Level 3 (Good).**

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 provided by Technical Advisers 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. Each of the Projects is separately rated, and the weighted average forms the overall Green Impact Forecast Accuracy for the portfolio. For example, waste sector projects that are in the commissioning phase are rated Level 3 (Good) for Technology & development stage.

The Data quality assessment of Level 3 for the portfolio reflects that the Green Impact forecasts for all of the Projects are based on pre-operational modelling; this measure of forecast accuracy is expected to increase once the models are validated against actual performance data. The Technology & development stage assessment of Level 3 reflects the development status of the Projects, with two currently operational, three in commissioning, and the remaining nine under construction.

**Green Impact Forecast Accuracy:  
Level 3 (Good)**



## Appendix 1

### User input: Project data

Project Information	
<b>Name</b>	Wakefield Waste PFI
<b>Primary technology</b>	Waste recycling
<b>Country</b>	UK
<b>Stage</b>	Operational
<b>Remaining Life</b>	22 yrs
<b>Start date</b> Year in which commercial operations date was achieved	2015
<b>Waste treatment capacity</b>	201 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	Gloucester Waste PPP
<b>Primary technology</b>	EfW – municipal waste
<b>Country</b>	UK
<b>Stage</b>	Under construction
<b>Remaining Life</b>	25 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2019
<b>Waste treatment capacity</b>	158 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	West London Waste PFI
<b>Primary technology</b>	EfW – municipal waste
<b>Country</b>	UK
<b>Stage</b>	Operational
<b>Remaining Life</b>	25 yrs
<b>Start date</b> Year in which commercial operations date was achieved	2016
<b>Waste treatment capacity</b>	36 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	Birmingham BioPower gasification plant
<b>Primary technology</b>	EfW – waste wood
<b>Country</b>	UK
<b>Stage</b>	In commissioning
<b>Remaining Life</b>	19 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2017
<b>Waste treatment capacity</b>	70 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	Merseyside Waste PFI
<b>Primary technology</b>	EfW – municipal waste
<b>Country</b>	UK
<b>Stage</b>	In commissioning
<b>Remaining Life</b>	27 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2017
<b>Waste treatment capacity</b>	444 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	Derby EfW plant
<b>Primary technology</b>	EfW – municipal waste
<b>Country</b>	UK
<b>Stage</b>	Under construction
<b>Remaining Life</b>	25 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2018
<b>Waste treatment capacity</b>	191 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	North Yorkshire waste treatment plant
<b>Primary technology</b>	EfW – municipal waste
<b>Country</b>	UK
<b>Stage</b>	Under construction
<b>Remaining Life</b>	25 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2018
<b>Waste treatment capacity</b>	316 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	Widnes CHP plant
<b>Primary technology</b>	EfW CHP – waste wood
<b>Country</b>	UK
<b>Stage</b>	In commissioning
<b>Remaining Life</b>	20 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2017
<b>Waste treatment capacity</b>	143 kt / yr
<b>Data type</b>	Forecast

## Appendix 1 (Continued)

### User input: Project data

Project Information	
<b>Name</b>	Tilbury renewable power facility
<b>Primary technology</b>	EfW – waste wood
<b>Country</b>	UK
<b>Stage</b>	Under construction
<b>Remaining Life</b>	20 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2017
<b>Waste treatment capacity</b>	270 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	Belfast EfW plant
<b>Primary technology</b>	EfW – municipal waste
<b>Country</b>	UK
<b>Stage</b>	Under construction
<b>Remaining Life</b>	20 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2017
<b>Waste treatment capacity</b>	120 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	Kemsley EfW CHP plant
<b>Primary technology</b>	EfW CHP – municipal waste
<b>Country</b>	UK
<b>Stage</b>	Under construction
<b>Remaining Life</b>	37 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2019
<b>Waste treatment capacity</b>	527 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	Edinburgh & Midlothian Zero Waste
<b>Primary technology</b>	EfW – municipal waste
<b>Country</b>	UK
<b>Stage</b>	Under construction
<b>Remaining Life</b>	25 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2019
<b>Waste treatment capacity</b>	15 kt / yr
<b>Data type</b>	Forecast

Project Information	
<b>Name</b>	North Wales Waste PPP
<b>Primary technology</b>	EfW – municipal waste
<b>Country</b>	UK
<b>Stage</b>	Under construction
<b>Remaining Life</b>	25 yrs
<b>Start date</b> Year in which commercial operations date will be achieved	2019
<b>Waste treatment capacity</b>	200 kt / yr
<b>Data type</b>	Forecast

## Appendix 2

### 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 GIB'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 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 v 1.0

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>.

#### 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>.

For the purposes of this Report, GIB'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 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

### Terms and Conditions: Assumptions, Limitations and other terms

#### Scope and distribution of this document

UK Green Investment Bank Limited ("GIB") has prepared this document (the "Report") for its own internal purposes in connection with the project or projects identified on page 1.

This Report has been prepared subject to the terms and conditions set out or referred to in the methodology and terms set out in Appendix 2.

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The forecasts and assessments expressed in this Report are not ratings: they are, and shall be construed solely as, statements of opinion as to the relative prospects that particular environmental benefits can be achieved by a specified project or other asset that is the subject of any securities or other investment, and not as statements of current or historical or scientific fact, or as an endorsement of the accuracy of any data or conclusion or as any assurance that any environmental impact (either positive or negative) or risk will or will not occur.

The contents of this Report may not be relied upon as being a conclusive, complete or accurate representation of all elements and factors relating to any project.

Furthermore, this Report is not, and shall not be interpreted or construed as, an assessment of the economic performance or creditworthiness of any person or project.

This Report is valid only as at the date of issue and shall not take account of any future information, events or changes with respect to any person, any business, any financial instrument, any relevant project or transaction, any financial market or any relevant sector or otherwise (unless this Report is specifically amended at GIB's discretion).

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#### Project data

For the purposes of this Report, GIB has relied in good faith on publicly available data and data and information made available in connection with the relevant project(s) by relevant third parties, and has assumed that such data and information is complete, accurate and up to date.

In preparing this Report, GIB has not conducted, and shall not be responsible for conducting, any audit or detailed review or assurance or any other verification exercise of any such data.

#### [New paragraph]

Furthermore, for the purposes of this Report no site-specific environmental or social due diligence has been, or is required to be, conducted by GIB, and GIB does not express any opinion on whether local site-specific environmental and/or social impact have been mitigated appropriately. In preparing this Report, GIB has not undertaken any review of any underlying project's environmental and/or social, permitting, licensing or other compliance status.

#### Reference data

In preparing this Report, GIB has relied upon various sources of data and information provided to GIB by relevant third parties or obtained through public information sources, the content of which no GIB Party has verified or controls.

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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- (c) providing investment or financial advice, making investment decisions or recommendations or evaluating financial performance of any person or financial instrument;
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