APPENDICIES TO WIGTON WIND FARM PROJECT
DESIGN DOCUMENT

Appendix A: Letter of Approval from Host Party – Jamaican Interim Designated National Authority

Appendix B: Environmental Impact Assessment

Appendix C: Local Stakeholder Consultation Report
Appendix A: Letter of Approval from Host Party – Jamaican Interim Designated National Authority
MINISTRY OF LAND AND ENVIRONMENT
1 DEVON ROAD, P.O. BOX 372; KINGSTON 6, JAMAICA
Telephone 927-9941; Fax 929-7349

Letter of Approval

The Undersigned, as a legal and authorized representative of Jamaica,

Recalling that Jamaica is a party to the United Nations Framework Convention on Climate Change and the Kyoto Protocol,

Bearing in mind that Article 12 of the Kyoto Protocol provides that the purpose of the Clean Development Mechanism shall be to assist Parties not included in Annex I to the Convention, in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3 of the Kyoto Protocol,

Recalling that The Netherlands is a party to the United Nations Framework Convention on Climate Change and the Kyoto Protocol, and is included in Annex I to the Convention,

Referring to:

Project No. CER 01/11, named the Wigton Wind Farm Project, hereinafter referred to as "the CDM project", located at Wigton in the Parish of Manchester, Jamaica, a 70 MW generation project developed by Renewable Energy Systems Ltd. (RES), hereinafter referred to as "the Contractor",

decides that:


2. Jamaica recognizes the CDM project to be a Clean Development Mechanism project in accordance with Article 12 of the Kyoto Protocol and its underlying decisions.

3. Jamaica confirms that the CDM project contributes towards the realization of the country's sustainable development goals.

4. Jamaica authorizes the Contractor and any future owner of the CDM project to generate certified emission reduction units (CERs), by the realization and operation

5. Jamaica accepts the transfer of 100% of verified CERs, generated through the CDM project, to the Government of The Netherlands during the crediting period of the CDM project 2003 - 2013, through issue of CERs by the CDM Registry under
the CDM Executive Board, cf. FCCC/CP//CRP.11, Annex to Decision -/CMP.1 (Article 12) Part J or through any other mechanism accepted by the Conference of the Parties/Meeting of the Parties.

6. The transfer of CERs is irrespective of any legal or other transfer of the CDM project to third parties.

7. In case the Kyoto Protocol will not enter into force, Jamaica and the Netherlands consider the transfer to The Netherlands as a transfer of greenhouse gas emission reduction on a bilateral basis.

Done the day of September 2002, at Kingston, Jamaica

For Jamaica

Horace W. Dalley, M.P.,
Minister of Land and Environment
Appendix B: Environmental Impact Assessment
Wigton Wind Farm - Jamaica

Document: 096/RES/1011  
Issue No: 3

Classification:

Distribution: PQ

Prepared: Richard Lord

Checked: PQ

Approved: PQ

Date: 2 October 2000

Revision

Nature & Location of Change

Date

Environmental Solutions Limited

The entire document has been reorganised. Changes have been made to the layout as well as technical sections added.

15-7-02
Environmental Impact Assessment

Wigton Wind Farm

Submitted to:
Renewable Energy Systems Ltd.
Beaufort House, 23 Grosvenor Road
St.Albans, Herts. AL1 3AW, UK
C/o Petroleum Corporation of Jamaica
36 Trafalgar Road, Kingston 10

Revised by:
Environmental Solutions Ltd.
20 West Kings House Road
Kingston 10

July 2002
PREFACE

This document is the Environmental Impact Assessment (EIA) for the planning application for a wind farm consisting of 23 turbines and associated infrastructure at Wigton in the Parish of Manchester, Jamaica.

It discusses the rationale and need for the wind farm development and describes the proposed development and the background to the selection of the site. It then examines policies that are relevant to wind farm developments. The document goes on to assess in detail the potential environmental impacts of the proposed development, including; pollution, landscape and visual, noise, highways and traffic, socio-economic aspects, electromagnetic interference, geology, soils and hydrology. Mitigation measures have been incorporated in the wind farm design to minimise the potential impacts identified. Technical and supporting information is included in the Appendices.

The EIA can be viewed during normal opening hours at the following locations:

The Planning Office
32 Hargreaves Avenue
Mandeville
Jamaica

The Library
National Environment and Planning Agency
2 Caledonia Road
Kingston 5

Renewable Energy Systems Ltd
Beaufort House
23 Grosvenor Rd
St Albans
HERTS AL1 3AW
United Kingdom

Copies of the EIA are available from Renewable Energy Systems Ltd, priced J$1500 each. Requests for the document should be made in writing (including payment) to Renewable Energy Systems Ltd. at the St. Albans address listed above.
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0</strong></td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1</td>
<td>Purpose</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Project Rationale</td>
<td>1</td>
</tr>
<tr>
<td>1.3</td>
<td>Study Area</td>
<td>3</td>
</tr>
<tr>
<td>1.4</td>
<td>Terms of Reference</td>
<td>4</td>
</tr>
<tr>
<td><strong>2.0</strong></td>
<td>METHODOLOGY</td>
<td>6</td>
</tr>
<tr>
<td>2.1</td>
<td>Study Area</td>
<td>6</td>
</tr>
<tr>
<td>2.2</td>
<td>Physical Survey</td>
<td>6</td>
</tr>
<tr>
<td>2.3</td>
<td>Baseline Noise Assessment Survey</td>
<td>6</td>
</tr>
<tr>
<td>2.4</td>
<td>Baseline Air Quality Survey</td>
<td>10</td>
</tr>
<tr>
<td>2.5</td>
<td>Biological Survey</td>
<td>10</td>
</tr>
<tr>
<td>2.6</td>
<td>Socio-economic Survey</td>
<td>10</td>
</tr>
<tr>
<td><strong>3.0</strong></td>
<td>DESCRIPTION OF THE PROJECT</td>
<td>11</td>
</tr>
<tr>
<td>3.1</td>
<td>Site Selection and History</td>
<td>11</td>
</tr>
<tr>
<td>3.2</td>
<td>Wind Resource</td>
<td>12</td>
</tr>
<tr>
<td>3.3</td>
<td>Separation criteria</td>
<td>12</td>
</tr>
<tr>
<td>3.4</td>
<td>Grid Connection</td>
<td>13</td>
</tr>
<tr>
<td>3.5</td>
<td>Environmental criteria/designations</td>
<td>13</td>
</tr>
<tr>
<td>3.6</td>
<td>The Proposed Development</td>
<td>13</td>
</tr>
<tr>
<td>3.7</td>
<td>Wind Turbines</td>
<td>14</td>
</tr>
<tr>
<td>3.8</td>
<td>Land Acquisition</td>
<td>14</td>
</tr>
<tr>
<td>3.9</td>
<td>Construction</td>
<td>15</td>
</tr>
<tr>
<td>3.9.1</td>
<td>Site Access Tracks</td>
<td>16</td>
</tr>
<tr>
<td>3.9.2</td>
<td>Foundations</td>
<td>16</td>
</tr>
<tr>
<td>3.9.3</td>
<td>Cabling and Sub-station</td>
<td>16</td>
</tr>
<tr>
<td>3.9.4</td>
<td>Anemometry Mast</td>
<td>17</td>
</tr>
<tr>
<td>3.9.5</td>
<td>Grid Connection</td>
<td>17</td>
</tr>
<tr>
<td>3.10</td>
<td>Operation</td>
<td>17</td>
</tr>
<tr>
<td>3.11</td>
<td>Decommissioning</td>
<td>17</td>
</tr>
<tr>
<td><strong>4.0</strong></td>
<td>DESCRIPTION OF SITE ENVIRONMENT</td>
<td>18</td>
</tr>
<tr>
<td>4.1</td>
<td>Topography</td>
<td>18</td>
</tr>
<tr>
<td>4.2</td>
<td>Geomorphology and Geology</td>
<td>18</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

1.1 Purpose

The Petroleum Corporation of Jamaica (PCJ) and Renewable Energy Systems Ltd (RES) are applying for a permit, from the National Environment & Planning Agency (NEPA) of Jamaica, to construct a 20 MW wind farm on land at Wigton in the parish of Manchester (Ref the location map appendix 1). This document has been prepared as part of the requirement for the permitting and licencing process of NEPA, and sets out the findings and recommendations of the Environmental Impact Assessment (EIA) conducted for the proposed project.

1.2 Project Rationale

There is growing evidence that the world’s climate is changing as a result of human activities, primarily as a result of burning fossil fuels. Gaseous emissions from conventional coal and oil power stations are known to cause acid rain and contribute towards global warming. The concentration of carbon dioxide (CO₂) in the atmosphere is already 30% higher than in pre-industrial times and if emissions continue to grow at their present rate, concentrations are expected to double by the end of the next century (WHO/UNEP, 1995).

"Human activities are directly increasing the atmospheric concentrations of several greenhouse gases, especially CO₂". (IPCC, 1998).

Studies undertaken by an international team of scientists and presented at the Buenos Aires Conference were co-ordinated by the Hadley Centre in the UK. The Centre’s climate model now predicts that global temperatures would rise by a further 3°C over the next 100 years. This compares with a rise of just 0.6°C over the past 140 years. This would threaten habitats such as tropical forest and grassland, put pressure on global water resources and results in flooding of coastal areas (Wind Directions, 1999).

Given the fact that renewable energy sources, i.e. wind, solar and hydro power, produce no gaseous emissions, they do not contribute to climate change (global warming) or acid rain and are therefore a viable, renewable and non-polluting alternative source of electricity generation.

The United Nations Conference on the Environment and Development (the Earth Summit) was held in Rio de Janeiro in June 1992 to address global environmental concerns and particularly climate change. One of the outcomes was the establishment of an action plan, known as Agenda 21 (UN, 1994), to guide and encourage the achievement of sustainable development, particularly at the local level. Agenda 21 calls for a switch to environmentally sound energy sources, particularly renewable energy, in order to achieve sustainable development:

"The need to control atmospheric emissions of greenhouse and other gases and substances would increasingly need to be based on efficiency in energy production, transmission, distribution and consumption, and on growing reliance on environmentally sound energy systems, particularly new and renewable sources of energy" (United Nations, 1994).

Jamaica signed the UN Framework Convention on Climate Change (FCCC) on 12 June 1992, and subsequently ratified it on 6 April 1995. Jamaica ratified the Kyoto Protocol on 28 June 1999. However, Jamaica, as a non-Annex 1 country, has no specific legally binding stabilisation or reduction targets for greenhouse gas emissions, though it is required to submit a national communication on its implementation of the FCCC.
Jamaica has an energy policy which states that the Government will continue to foster, facilitate and encourage the development of all new and renewable energy sources where feasible, but especially in the areas of:

- Hydropower
- biomass
- solar
- wind.

In 1995, the PCJ was mandated to develop indigenous renewable energy resources, to prevent adverse effects on the environment and to assist the government in realizing the goals of the Jamaica Energy Sector Policy.

The PCJ is committed to the reduction of the nation’s heavy dependence on imported petroleum to meet its energy requirements. In seeking to diversify Jamaica’s energy sources, the Corporation, has over the years, undertaken initiatives in

- Oil and gas exploration
- The economic viability of peat for fuel
- The construction of hydropower plants
- Solar energy
- Biomass
- Wind energy
- The potential for Ocean Thermal Energy Conversion (OTECC)
- Ensuring the highest standards of environmental standards in its operations

In keeping with the mandate of the Jamaica Energy Sector Policy, the PCJ is pursuing the development of wind energy to provide clean electricity using renewable, indigenous resources with minimal or no impact on the environment. Since, 1995, the PCJ has been studying the feasibility of a wind farm project. Wind speed assessments have been conducted at various sites across the island including the proposed Wigton wind farm site. In collaboration with Renewable Energy Systems (a UK Company) the PCJ is in the process of developing a 20 MW wind farm at Wigton in Manchester. There is potential for wind energy to provide significantly more electricity for Jamaica.

Studies have shown that for each unit [kilowatt hour (kWh)] of electricity generated by the Wigton Wind Farm, Jamaica can expect to prevent 862g of carbon dioxide (CO₂), 10g of Sulphur dioxide (SO₂) and 3g of Nitrogen Oxide (NOₓ) from entering the atmosphere. The total amounts of CO₂, SO₂ and NOₓ, prevented from entering the atmosphere annually through operation of the Wigton wind farm, are shown below in Table 1. These figures have been taken from the BWEA report and account for the intermittent nature of the wind by assuming a load factor of 33%.

**Table 1. Atmospheric Pollutants Saved**

<table>
<thead>
<tr>
<th>Pollutants Saved</th>
<th>CO₂</th>
<th>SO₂</th>
<th>NOₓ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per kWh ‘unit’ generated</td>
<td>862g</td>
<td>10g</td>
<td>3g</td>
</tr>
<tr>
<td>Wigton farm, per annum</td>
<td>53 thousand tonnes</td>
<td>610 tonnes</td>
<td>20 tonnes</td>
</tr>
</tbody>
</table>

(Source: BWEA, 1998)
It is in this context that PCJ and RES Ltd. plan to construct a 20 MW wind farm (comprising 23 wind turbines, a sub-station and access roads) on land at Wigton in the parish of Manchester. The development would also involve the erection of an overhead, pole mounted, grid connection line from the Wigton site sub-station to the JPS sub-station at Spur Tree.

Every year the wind farm would feed into the local grid system about 63 million kWh, enough to meet the overall electrical energy requirements of around 25,000 homes.

The project is being developed jointly by:

- Petroleum Corporation of Jamaica (PCJ) which is the Jamaican national oil company which also has responsibility for renewable energy developments in Jamaica.
- Renewable Energy Systems (RES) which is a member of the Sir Robert McAlpine group of companies, a major UK construction company.

RES is one of the leading and broadest based companies in the wind energy industry. Since 1980, RES has played a central role in the development of the wind energy market in the United Kingdom and, more recently, has had significant success in the international market. RES skills and expertise encompass all aspects of development - site prospecting and assessment, wind farm design, through the planning stage (including environmental assessment and financial engineering) right up to the construction and operation & maintenance of a generating wind farm.

RES has successfully completed over twenty wind energy projects. Recent projects include King Mountain wind farm in Texas. This 280 MW wind farm was completed at the end of 2001 utilising 1.3 MW Bonus wind turbines. A similar 200 MW project in Texas was completed earlier in the year using Vestas wind turbines and has brought the total capacity RES has installed to nearly 700 Megawatts. With an ownership interest in 7 wind farms, comprising over 50 MW of operating assets, RES maintains a flexible approach to this growing industry.

With a substantial background in wind energy technology and its implementation, RES is able to offer an unrivalled level of capability to those seeking to harness the clean, abundant, sustainable and economically competitive power that the wind can provide.

1.3 Study Area

The wind farm site is located in the middle of the island near the south coast, about 6 km south east of Newport and approximately 15km south south west of Mandeville. The land in the area has been designated for bauxite mining, though currently it is mainly used for agricultural purposes. The area is a plateau of gently rolling hills rising to 800m above the sea. The wind turbines would be on the top of the west facing escarpment of this plateau, and to the east of the area which is likely to be mined for bauxite.

Population density is very low in this part of the island, and there is a separation distance of at least 300m from any dwellings to the nearest wind turbine. The majority of local dwellings straddle the local roads which are to the north and east of the site. They are generally up wind of the machines, the direction where there is least propagation of any noise.
Access to the site would be from the road from Mandeville through Newport to Alligator Pond on the coast approximately 2 km south of the Rose Hill junction, using the track which runs past the Wigton House Ruins. Improvements to the junction would be required to allow access for the vehicles delivering the wind turbine components. Existing farm tracks can be used to provide some of the site access tracks, but these will need to be improved and extended to reach all the turbines.

1.4 Terms of Reference

The Terms of Reference for conducting the EIA for the Wigton Wind Farm are as follows:

1. **Introduction** – Identification of the project to be assessed and explanation of the executing arrangements for conducting the Environmental Impact Assessment.

2. **Background Information** – A description of the major components of the proposed project, the implementing agents, and a brief history of the project and its current status.

3. **Study Area** – Specification of the boundaries of the study area for assessment as well as any adjacent or remote areas, which should be considered with respect to the project.

4. **Scope of Work** – Standard environmental impact assessment techniques will be used including site reconnaissance, literature review, desktop research, field work, data analysis and interviews with appropriate personnel, in order to satisfy the Terms of Reference. The following tasks will be performed:

**Task 1: Description of the Proposed Project.** A full description of the project and its existing setting, using maps as appropriate. This is to include general layout, size, location, physical characteristics, biological environment and socio-cultural setting.

**Task 2: Description of the Environment.** Assemble, evaluate and present data on the relevant characteristics of the study area. Information will include the following:

**Terrestrial Environment**

- Physical environment: geology, topography, soils
- Natural drainage features: surface drainage, flood risk
- Air quality: particulates and noise levels
- Biological environment: forest/vegetation cover, existing wildlife (flora and fauna), rare or endangered species, sensitive habitats, species of commercial importance, migratory path of birds, nuisance species, pests and vectors
- Socio-cultural environment: land use, traffic patterns, proposed developments, public health issues, demographics, employment and solid waste management.

**Task 3: Legislative and Regulatory Considerations.** A description will be given of the pertinent regulations, standards and regulatory bodies governing environmental quality, health and safety, protection of endangered species, parks and protected areas, siting and land use control.
Task 4: Determination of Potential Impacts of the Proposed Project. Impacts will be determined as significant positive or negative, direct or indirect, short-term or long-term, unavoidable or irreversible. Cumulative of the proposed development will also be highlighted. Special emphasis will be placed on:

- Land use management
- Terrestrial ecology
- Visual Resource
- Energy Transmission
- Air quality
- Noise

Task 5: Mitigation and Management of Negative Impacts. Recommendations will be made for feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels.

Task 6: Recommendations for the development of an Emergency Response Management Plan. Recommendations will be made for the development of an Emergency Response Plan to ensure that procedures are in place to handle any emergency.

Task 7: Recommendations for the development of a Monitoring Plan. Recommendations will be made for the development of a Monitoring Plan to ensure implementation of the mitigation measures and long-term minimization of negative environmental impacts.

Task 8: Assist in Inter-Agency Coordination and Public Participation. As, and if required by the NEPA, ESL will assist in the public participation/review process through meetings with relevant governmental agencies, in obtaining the views of civil society and participating in a public consultation if required.

5. Report – the Environmental Impact Assessment report will be concise and limited to the significant environmental issues. The main text will focus on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting those data. The report will be organized according to, but not necessarily be limited by, the outline below:

- Executive Summary
- Description of the Proposed Project
- Policy, Legal and Administrative Framework
- Description of the Environment
- Significant Environmental Impacts and Proposed Mitigation Measures
- Analysis of Alternative
- Recommendations for Monitoring Plan
- List of References
- Photographs, Maps and Plans as appropriate
2.0 METHODOLOGY

2.1 Study Area

The study area for the assessment included the proposed development site and communities within a 5 km radius of the site.

Field work included an assessment of physical features, noise, air quality, vegetation, avifauna and land use/socio-economy. The methods employed to conduct these various assessments and surveys are described below.

2.2 Physical Survey

The physical assessment of the project site and its immediate environs was carried out using a combination of data sources and field work investigations.

A review of existing studies was done by way of desk-top research. Field work included assessment and confirmation of the physical characteristics of the site - topography, geomorphology, land-use and hazard vulnerability. Drainage channels (in terms of their density, clasts composition and size) and areas prone to flooding; were also identified.

2.3 Baseline Noise Assessment Survey

Twenty (20) noise monitoring sites were selected to evaluate ambient noise levels in the project area (Figure 2.1). Noise level readings, wind direction and any unusual local noise sources were recorded. Measurements were taken using Quest Electronics sound level meters, which conform with ANSI S1.4 - 1983, TYPE 2 and IEC 651 - 1979, TYPE 2 standards. The meter was calibrated before and after each set of readings. In addition, before and after the survey, the instrument was checked with a calibrator, which was pre-calibrated at the factory. Table 2.3 below gives the date of sampling and location of the noise sites.
Table 2.3: Date and location of the noise sampling stations

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE 1 (approximately 100 meters west of meteorological mast)</td>
<td></td>
</tr>
<tr>
<td>SITE 1-N (30 - 40 meters north of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 1-W (30 - 40 meters west of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 1-S (30 - 40 meters south of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 1-E (30 - 40 meters east of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 2 (approximately 100 meters south east of meteorological mast)</td>
<td>July 11, 2002</td>
</tr>
<tr>
<td>SITE 2-W (30 - 40 meters west of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 2-N (30 - 40 meters north of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 2-S (30 - 40 meters south of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 2-E (30 - 40 meters east of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 3 (approximately 100 meters north of meteorological mast)</td>
<td></td>
</tr>
<tr>
<td>SITE 3-S (30 - 40 meters south of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 3-N (30 - 40 meters north of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 3-W (30 - 40 meters west of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 3-E (30 - 40 meters east of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 4 (meteorological mast)</td>
<td></td>
</tr>
<tr>
<td>SITE 4-N (30 - 40 meters north of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 4-S (30 - 40 meters south of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 4-E (30 - 40 meters east of site)</td>
<td></td>
</tr>
<tr>
<td>SITE 4-W (30 - 40 meters west of site)</td>
<td></td>
</tr>
</tbody>
</table>
Figure 2.1: Air Quality and Noise Sampling Stations
2.4 Baseline Air Quality Survey

The air quality assessment involved the determination of ambient levels of respirable particulates, PM10(<10µm). Particulates were measured using Sensidyne (BDX 530) personal vacuum pumps (suction 2-3 l/min), attached to pre-weighed millipore filters. The pumps were placed at the approximate respiratory height of pedestrians for a specified period of time, after which the filters were stabilised and weighed to determine a Time Weighted Average (TWA) value for the particulates.

The pumps were placed at four sites (Figure 2.1). Table 2.4 gives the date of sampling and locations of the pumps.

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE 1</td>
<td>July 11, 2002</td>
</tr>
<tr>
<td>SITE 2</td>
<td></td>
</tr>
<tr>
<td>SITE 3</td>
<td></td>
</tr>
<tr>
<td>SITE 4</td>
<td></td>
</tr>
</tbody>
</table>

2.5 Biological Survey

A simple ‘walk through’ terrestrial survey of flora and fauna was conducted on 10 July 2002. Plant species were identified and an indication of biodiversity at the sites was obtained. Avifauna observed during the terrestrial survey were also recorded, based on actual sightings and bird calls. Species not immediately identifiable were noted and field guides were used to verify their identity.

2.6 Socio-economic Survey

A landscape and visual assessment survey was conducted to determine the nature of impacts upon both the landscape resource and the visual environment arising from the proposed introduction of the Wigton Wind Farm. The employed methodology made use of photomontage drawings to indicate the potential visual impacts of the wind farm. The viewpoints chosen for the assessment are listed in Table 2 below:
Table 2. Location of Viewpoints – Wigton Wind Farm

<table>
<thead>
<tr>
<th>Location of Viewpoint</th>
<th>Jam Grid Ref</th>
<th>Distance from site</th>
</tr>
</thead>
<tbody>
<tr>
<td>View point 1, from the Wigton Rd, approx half km south west of Wigton</td>
<td>1934 1389</td>
<td>0.7 km</td>
</tr>
<tr>
<td>View point 2, from the wind monitoring mast at Wigton</td>
<td>1942 1391</td>
<td>1.5 km</td>
</tr>
<tr>
<td>View point 3, from the Rose Hill road junction, south west bank</td>
<td>1941 1412</td>
<td>1.3 km</td>
</tr>
<tr>
<td>View point 4, from the road a half km west of Rose Hill road junction</td>
<td>1938 1414</td>
<td>0.8 m</td>
</tr>
<tr>
<td>View point 5, from the New Forest cross road</td>
<td>1890 1394</td>
<td>3 km</td>
</tr>
</tbody>
</table>

With regards to the potential impact of wind turbine noise on the surrounding communities RES used independent experts to measure the noise output from their turbines. The manufacturer’s noise level measurements for the wind turbine, coupled with the layout of the wind farm has been used to generate an isobel map showing the noise level contours from the turbines in the vicinity of the wind farm. For this calculation, the noise level from the tropicalised version of the NM900/52 with 49m hub height wind turbine is taken to be 102 dB(A) at a 10m height wind speed of 8m/s. The isobel map is attached as Appendix 12.

Finally, consultations were held with Television Jamaica (TVJ), CVM Television, Digicel Ltd, Centennial Digital Jamaica Ltd, Cable and Wireless Jamaica Ltd, and the Civil Aviation Authority to assess the potential impacts of constructing and operating the proposed wind farm at Wigton and ensure that there would be no adversely negative impacts on the operations of the latter, commercial television, cellular and aviation entities.

3.0 DESCRIPTION OF THE PROJECT

3.1 Site Selection and History

In the mid 1990’s, PCJ and RES formed a joint venture to develop wind farms in Jamaica. As a result of a general review of available wind data, Jamaica was expected to provide a suitable environment for wind farming but a suitable site had to be located. The first step was to erect wind monitoring masts at potentially suitable locations.

Wind monitoring was undertaken at several sites, including:

- The Palisadoes Strip near Norman Manley Airport
- Green Castle on the north coast
- Spur Tree on the Manchester Plateau
- Blenhiem on the Manchester Plateau
- Wigton on the Manchester Plateau

Initially, Blenhiem was selected as the site to be developed for wind farming. However as more wind measurements were taken, the conclusion was that the higher wind speed at Wigton would be needed to produce a high enough electrical output to make a viable project.

11
In addition to having a sufficient wind speed, other parameters were instrumental in selecting the final site. These were:

- Environmental impact
- Proximity (& distance from) to population centres
- Proximity to the JPS electrical distribution grid
- Site area large enough to accommodate about 25 wind turbines
- Access for construction of the wind farm
- Land ownership
- Surface roughness – no major obstacles causing excessive wind turbulence
- Soil conditions suitable for foundation construction
- Slopes insufficient to cause problems during construction.

The Wigton site fulfilled all the main criteria and was chosen for the development of the wind farm.

Discussion with the land owners and the Jamaica Bauxite Institute has revealed enthusiasm for the project and resulted in a proposed layout of wind turbines which will not inhibit future mining operations.

3.2 Wind Resource

For a successful wind energy project, the availability of an adequate wind resource is of paramount importance and so to provide confirmation that the wind speed is sufficient, an anemometry mast was installed at Wigton in January 1996. Data has been recorded since then and has been used to give reliable indication of the long term wind speed for the site.

Wind speeds were measured at 10 and 40m height, and the long term wind speed at the mast at 40m height is estimated to be 8.3m/s. As wind speed generally increases with height, the hub height wind speed for the wind turbines will be at least this.

The original mast at Wigton was about 2 km from where the wind turbines would be sited, and so two additional masts were installed for a short period of time to measure the local differences in wind speed and to give confirmation that the wind turbine layout was optimal. The results of these measurements confirmed the suitability of the site for wind farming and that the proposed layout was satisfactory.

For the majority of the time, the wind speed was predicted to be in the range 4 to 14 m/s, blowing from the east or east south east. Turbulence was relatively low, and was actually at its highest at the lower wind speeds when it will have minimal effect on the wind turbine. A low wind regime turbine could be specified for this site based upon the measured wind regime. However, because Jamaica is in the hurricane zone, a class 1 turbine or its equivalent has been specified which means that its survival wind speed will be in excess of a 70m/s (156 mph) gust.

3.3 Separation criteria

Proximity to habitation - a guideline separation of 300m is applied. This is to ensure that dwellings are not overshadowed, and that noise levels at houses nearest to a wind farm do not cause a nuisance.
Proximity to roads - good access to a site for the construction is important, but sites with poorer access were also considered. This site is well clear of any main public roads.

Proximity to airports and radar - all long range radar stations are surrounded by safeguarded areas within which planning applications must be subject to consultation with the Authorities. These areas are typically 5km radius from the radar station.

Avoidance of line of sight paths between television, radio and microwave transmitters/receivers - wind turbines have the potential to reflect electromagnetic waves causing signal interference to television, radio and microwave transmissions. Transmission paths are therefore identified and avoided.

As a general rule a 50m separation distance from roads and public footpaths is applied.

When these constraints are taken into account, the site at Wigton is one of few land areas where all can be satisfied.

3.4 Grid Connection

Research was carried out into the technical availability of suitable electricity export points for a potential site. The grid connection can be a limiting factor in the development of wind farms, either due to the distance to a suitable connection point or where the grid line is not capable of accepting the new capacity.

The site of the wind farm at Wigton is about 11km from the Spur Tree sub-station of JPS which has the appropriate capacity for the wind farm to be connected to it. An overhead link from the wind farm to this sub-station would be required at 69kV.

3.5 Environmental criteria/designations

The location and boundary of nationally designated areas were identified and sensitive areas of designated land avoided.

Contact was also made with the Planning Office to establish policy with respect to wind farm development including identification of any preferred areas of search. The site area has been designated for bauxite mining, and therefore it is not a sensitive area.

3.6 The Proposed Development

Appendix 1 shows the location of the site, with the grid reference of the original anemometry mast being 1942 1391. The site, approximately 2 km west of the mast, is located in parish of Manchester, approximately 6km south west of Newport and 15 km south south west of Mandeville. It is on the west facing escarpment of this plateau, and to the east of the part which is likely to be mined for bauxite.

The site itself is approximately 2 km in length and 1 km wide, and the wind turbines have been laid out in two rows running north/south along ridge lines as shown in appendix 2. The access tracks which are adequate only for agricultural purposes will need to be extended to reach all the turbines and need to be upgraded to take wind farm construction traffic. The nearest habitations are mainly to the north side of the site with a few on the road to the east.
The proposed development comprises 23 wind turbines, associated underground cabling, access tracks, a sub-station/control building, an anemometry mast and a temporary compound for storage during construction. Additionally permission is sought for a 69kV overhead pole mounted line to take the wind farm output to the JPS sub-station at Spur Tree. The layout of the proposed development has been designed effectively to capture the wind’s energy whilst minimising the local environmental impact of the wind farm wherever possible. However, permission is being sought to retain the flexibility to move the location of each turbine by up to 50m to accommodate sensibly any local difficulties which may be found during detailed site surveying etc.

In optimising the energy output of the site the site terrain was digitised and wind flow and wind turbine modelling used to predict the following:

- Wind speed characteristics across the site
- Energy yield of individual turbines
- Array losses within the wind farm

Following the application of appropriate constraints, the optimised layout for the wind farm was produced and then the predicted energy yield was calculated.

### 3.7 Wind Turbines

The wind turbine industry is one of improving designs and developments and the best possible turbine to use in environmental, technical and economic terms for any particular site can change over time. A three bladed turbine of 900 kW capacity with a tubular tower is the favoured option for the site, with a hub height of up to 50 m and a rotor diameter of up to 53 m. All assessments within the EIA have been based on this specification.

These turbines begin generating electricity automatically at a wind speed of about 3.0 m/s and shut down when the wind speed reaches 25 m/s. Initially output increases with wind speed until the turbine generates its full rated power output at a wind speed of about 15 m/s. There after up to shut down, output is close to this level. A diagram of a typical 900 kW wind turbine is illustrated in appendix 3. Although not illustrated on this Figure, the tower base transformer unit is located at the base of each turbine.

The colour and finish of the wind turbines would be agreed with the Planning Office. A significant amount of research has been undertaken into turbine colour and finish to minimise visual impact, with off-white or pale grey is generally accepted as the most appropriate. The tower base transformer units would normally be a dark green.

The wind turbines have been specified to be IEC Class 1, which means that they have to be designed to survive a wind gust of 70 m/sec (156mph). Design and manufacture of the wind turbines will be certified by an independent authority such as Det Norsk Veritas. Additionally, site certification will be given by a similar independent body to confirm that the layout of the wind turbines is satisfactory given the site topography and wind conditions.

### 3.8 Land Acquisition

Ownership of the site is through ALCOA Minerals of Jamaica LLC who have agreed a license with Wigton Wind Farm Ltd for the right to develop and operate this wind farm for a 25 year
period. The plots utilised in part for this development are shown in the Jamaican Land Registry as being:

939/96
980/135
878/60
946/134
913/45

The land take from a wind turbine development is small. The wind turbines need to be spaced apart, so that they do not interfere aerodynamically with one another (array losses). The actual land utilised is only 1-2% of the site area, being limited to the area of the towers themselves and the access tracks leading to them. Apart from the land actually used, farming activities can continue undisturbed by the wind farm.

Generally the turbines are positioned on the ridge lines where the underlying limestone is almost at the surface and topsoil is so thin that there is no cultivation. At each wind turbine location, the foundation is overburdened with soil approximately 1m deep, leaving only the concrete plug to which the steel tower is attached (appendix 4). The plug is approximately 4m in diameter (13m²). Movement is then unrestricted around the tower. Additionally a small transformer with its switchgear, approximately 2x2x2 metres in size is sited adjacent to each tower. These use approximately 4m² of land per turbine.

The access tracks would be a maximum of 4.5m wide. The total length of new access tracks is approximately 2 km, which translates to an estimated land take of the access roads of 9900m² (less than 1 hectare).

The substation compound would take up an area of approximately 35x15m (ref appendix 5 for the sub-station layout drawing). The main construction compound (for use while the wind farm is built) would temporarily require an area of approximately 50 x 50 m. however, this area would be fully reinstated after construction

3.9 Construction

The construction phase of the wind farm lasts approximately 9 months. This period is somewhat weather dependant and can be affected by ground conditions found at the site.

The normal sequence of events for the construction programme would be:

- Carry out any necessary improvements to the road network which is to be used as the access route to the site. Upgrade the site entrance and existing track to the site and install the site accommodation and temporary compound.
- Construct the site access tracks with field gates and temporary fencing (if required)
- Excavate the foundations.
- Construct the wind turbine foundations.
- Construct the substation and install the grid connection.
- Lay power and instrumentation cables.
- Erect and connect the turbines.
- Commission the turbines.
- Carry out land reinstatement, remove the temporary compound and clear the site.
3.9.1 Site Access Tracks

The route of the new site access tracks is shown in appendix 2. The tracks would permit access by construction vehicles and would be required throughout the life of the project for maintenance purposes. The route of the site access tracks has been chosen in order to minimise environmental disturbance whilst working within technical constraints. The original track past Wigton House Ruins will be upgraded, and from it new tracks constructed to give access to each of the turbines.

The access tracks would have a maximum overall width of 4.5m, with some local widening on bends and at passing bays. They would be constructed using local hard-core/marl to replace the base to ground level.

The access tracks would be designed to allow drainage of rainwater. Lateral drains would be used where appropriate and existing drainage ditches would be culverted. Any new openings across existing fences would be fitted with suitable gates and/or stock grids in consultation with the landowner.

The junction between the original track past Wigton House Ruins and the main road will require improvement to allow access for the crane and vehicles carrying the wind turbine components.

3.9.2 Foundations

The foundations for each wind turbine comprise approximately 85m$^3$ of concrete reinforced by 8.5 tonnes of steel bar, in a tapered cylindrical block of 11m diameter and 2.25m deep. The foundation surface lies up to 2m below the normal ground surface and is back filled with soil and reinstated. Approximately 200 m$^3$ of spoil is excavated per turbine base. All rock and most spoil that is excavated is put back on top of the foundations. Any excess spoil will be spread in areas agreed with the landowner.

An alternative design may be used if ground conditions permit. This is to excavate a deeper (4 to 6m) but smaller diameter hole (circa 4.5m) into the sub surface rock and backfilling with a pile and concrete, which has the advantage that it creates a smaller volume of spoil and requires less concrete – thus reducing vehicle movements required.

3.9.3 Cabling and Sub-station

All cabling between the turbines and the sub-station will be underground. The only new overhead cables within the wind farm site are for the grid line leading from the sub-station north to Spur Tree. All power and control cabling on site from the substation and between the turbines will be laid in trenches approximately 0.5m wide by 0.75 m deep located adjacent to the access tracks. These trenches will be partially backfilled with adjacent topsoil that has been sieved/graded to remove stones where applicable. The vegetation and top 100 mm of soil will be stripped and laid beside the trench, and used to reinstate to original ground level immediately after the cables have been installed.

Between the turbines, 24 kV cable is used to connect together the individual turbine transformers at the tower bases. The underground cabling between turbines will follow the routes of the access tracks wherever possible. All cables will be buried according to current best practice, and well below cultivation depth. Cable routes will be agreed with the landowner to avoid the possibility of future interference with mining operations.
A new sub-station will be required to house the main wind farm switch gear, metering and associated equipment. This building, to be located circa 200m west of turbine 3, has dimensions of around 18m x 6m x 5.5m to the apex of the roof. It will be constructed with locally available materials and house switchgear etc, computer control equipment and small spares. The position of the sub-station is indicated on the site layout (appendix 2).

A toilet with absorption pit will be included within the sub-station. As this facility is not normally manned, an adequate water supply will be provided by collecting water drainage from the roof.

3.9.4 Anemometry Mast

The anemometry mast will be a guyed tower approximately 50m tall with its main column of galvanised steel tube of approximately 150mm diameter. It will be located approximately 150m to the east of turbine 16.

3.9.5 Grid Connection

The grid connection will run from the site sub-station to the JPS sub-station at Spur Tree, approximately 11km to the north. The connection is operated at 69kV and is likely to be 4 cables mounted on timber or concrete poles. The route can follow the roads from the northern boundary of the wind farm site.

3.10 Operation

Wind Farms are operated remotely through a computer system. Because of this a large infrastructure to accommodate operatives is not required. The wind farm is not permanently manned, and thus requires only a small control building which will also house spare parts for the wind farm.

The wind farm computer system incorporates a sophisticated supervisory control system which continually interrogates each of the turbines and the high voltage (HV) connection. In normal operation this system operates the wind farm. If a fault were to develop which required an operator to intervene then the supervisory control system would make contact with a permanently manned operational centre via one of two telephone lines using a modem.

The operators would then take the appropriate action dependent on the nature of the fault. Through this modem/line the operators will be able to shut down one or all of the wind turbines. If the fault warranted the wind farm being disconnected from the grid then the operators would disconnect and then make contact with JPS.

Signs would be permanently located around the site giving details of whom to contact in an emergency. This information would also be made available to the local police station and JPS.

3.11 Decommissioning

The expected operational life of the wind farm is in excess of twenty five years from the date of commissioning.

At the end of this period a decision would be made as to whether to refurbish, remove, or replace the turbines. If a decision were to be taken to remove the turbines this would entail the removal of all the turbine components, transformers, substation and associated buildings. It is
not usual to remove the concrete foundations from the site, as this could cause more damage than leaving them in situ. The exposed concrete plug would be removed and the entire foundation buried. The cost of decommissioning can usually be balanced against its scrap value.

4.0 DESCRIPTION OF SITE ENVIRONMENT

4.1 Topography

The wind farm site is located in the middle of the island near the south coast, about 6 km south east of Newport and approximately 15km south south west of Mandeville. The area is a plateau of gently rolling hills rising to 800m above the sea. The wind turbines would be on the top of the west facing escarpment of this plateau, and to the east of the area which is likely to be mined for bauxite.

4.2 Geomorphology and Geology

The wind farm is to be built on the western ridges of the site where the underlying limestone rises close to the surface. Road construction can therefore be achieved with a modest amount of topsoil removal and backfilling, and foundation excavation depths kept to a minimum. In comparison with the impacts of mining operations, any wind farm impact would be small.

4.3 Baseline Noise

Levels of noise determined in the Wigton area revealed that all sites assessed had noise readings above the recommended World Health Organisation community noise equivalence standard of 50 dBA. The data are presented in Table 4.2. The area is very windy and the noise levels are a result of the wind passing through the vegetation in the area.

Table 4.2: Wigton Wind Farm Noise Level Results

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>NOISE (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE 1 (approximately 100 meters west of meteorological mast)</td>
<td>64.8</td>
</tr>
<tr>
<td>SITE 1-N (30 - 40 meters north of site)</td>
<td>63.2</td>
</tr>
<tr>
<td>SITE 1-W (30 - 40 meters west of site)</td>
<td>60.9</td>
</tr>
<tr>
<td>SITE 1-S (30 - 40 meters south of site)</td>
<td>64.3</td>
</tr>
<tr>
<td>SITE 1-E (30 - 40 meters east of site)</td>
<td>58.2</td>
</tr>
<tr>
<td>SITE 2 (approximately 100 meters south east of meteorological mast)</td>
<td>61.2</td>
</tr>
<tr>
<td>SITE 2-W (30 - 40 meters west of site)</td>
<td>59.5</td>
</tr>
<tr>
<td>SITE 2-N (30 - 40 meters north of site)</td>
<td>60.8</td>
</tr>
<tr>
<td>LOCATION</td>
<td>PARTICULATE CONCENTRATION/mg/m³</td>
</tr>
<tr>
<td>----------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>SITE 2-S (30 - 40 meters south of site)</td>
<td>62.3</td>
</tr>
<tr>
<td>SITE 2-E (30 - 40 meters east of site)</td>
<td>59.3</td>
</tr>
<tr>
<td>SITE 3 (approximately 100 meters north of meteorological mast)</td>
<td>58.1</td>
</tr>
<tr>
<td>SITE 3-S (30 - 40 meters south of site)</td>
<td>52.9</td>
</tr>
<tr>
<td>SITE 3-N (30 - 40 meters north of site)</td>
<td>59.9</td>
</tr>
<tr>
<td>SITE 3-W (30 - 40 meters west of site)</td>
<td>59.9</td>
</tr>
<tr>
<td>SITE 3-E (30 - 40 meters east of site)</td>
<td>62.2</td>
</tr>
<tr>
<td>SITE 4 (meteorological mast)</td>
<td>62.7</td>
</tr>
<tr>
<td>SITE 4-N (30 - 40 meters north of site)</td>
<td>62.3</td>
</tr>
<tr>
<td>SITE 4-S (30 - 40 meters south of site)</td>
<td>62.3</td>
</tr>
<tr>
<td>SITE 4-E (30 - 40 meters east of site)</td>
<td>61.4</td>
</tr>
<tr>
<td>SITE 4-W (30 - 40 meters west of site)</td>
<td>60.0</td>
</tr>
</tbody>
</table>

### 4.4 Baseline Air Quality

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>PARTICULATE CONCENTRATION/mg/m³</th>
<th>WHO Standard mg/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE 1 (approximately 100 meters west of meteorological mast)</td>
<td>0.19</td>
<td>0.3</td>
</tr>
<tr>
<td>SITE 2 (approximately 100 meters south east of meteorological mast)</td>
<td>0.24</td>
<td></td>
</tr>
<tr>
<td>SITE 3 (approximately 100 meters north of meteorological mast)</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>SITE 4 (meteorological mast)</td>
<td>0.16</td>
<td></td>
</tr>
</tbody>
</table>

Key: mg/m³ - milligrams per cubic meter air;

Air quality levels measured at two sites are within the national guideline of 0.15 mg/m³. Sites 3 and 4 are presently higher than the national guideline. The Levels are however within the World Health Organisation’s Standard for developing countries of 250 mg/m³.
The elevated levels are as a result of the natural windy conditions in the area. The proposed wind farm should improve the ambient air quality within the project area, as the wind farm will take energy from the air/wind by slowing it down.

4.5 Terrestrial Ecology

The vegetation community at the Wigton site is best described as open pastureland and is part of an area zoned for bauxite mining. Approximately 80% - 90% of the site was covered by *Paspalum virgatum* grass. The remaining 10% - 20% of the site was characterised by hedgerow vegetation and isolated stands of low-relief dry limestone shrub. Most of the observed tree species were restricted to the hedgerows and included *Cecropia peltata* (Trumpet tree), *Leucaena leucocephala* (Lead Tree), *Mangifera indica* (Mango), *Miconia laevigata* (White Wattle) and *Bambusa vulgaris* (Bamboo).

Table 3 lists the bird species observed during the avifauna survey. A total of nine species were recorded, one of which was endemic: *Euneornis campestris* (Orangequit).

**Table 3. Bird species observed on the proposed Wigton wind farm site.**

<table>
<thead>
<tr>
<th>FAMILY</th>
<th>SPECIES NAME</th>
<th>COMMON NAME</th>
<th>STATUS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apodidae</td>
<td><em>Tachornis phoenobia</em></td>
<td>Antillean Palm Swift</td>
<td>VCR</td>
</tr>
<tr>
<td>Ardeidae</td>
<td><em>Bubulcus ibis</em></td>
<td>Cattle Egret</td>
<td>VCR</td>
</tr>
<tr>
<td>Columbidae</td>
<td><em>Columba leucocephala</em></td>
<td>White-crowned Pigeon</td>
<td>CR</td>
</tr>
<tr>
<td>Columbidae</td>
<td><em>Columbina passerina</em></td>
<td>Common Ground Dove</td>
<td>VCWR</td>
</tr>
<tr>
<td>Columbidae</td>
<td><em>Zenaida asiatica</em></td>
<td>White-winged Dove</td>
<td>VCR</td>
</tr>
<tr>
<td>Cuculidae</td>
<td><em>Crotophaga ani</em></td>
<td>Smooth-billed Ani</td>
<td>CR</td>
</tr>
<tr>
<td>Emberizidae</td>
<td><em>Euneornis campestris</em></td>
<td>Orangequit**</td>
<td>CR</td>
</tr>
<tr>
<td>Tyrannidae</td>
<td><em>Tyrannus dominicensis</em></td>
<td>Gray Kingbird</td>
<td>CSR</td>
</tr>
<tr>
<td>Vireonidae</td>
<td><em>Vireo altiloquus</em></td>
<td>Black-whiskered Vireo</td>
<td>VCSR</td>
</tr>
</tbody>
</table>

**KEY:**

<table>
<thead>
<tr>
<th>Status*</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CR</td>
<td>Common Resident</td>
</tr>
<tr>
<td>CSR</td>
<td>Common Summer Resident</td>
</tr>
<tr>
<td>VCR</td>
<td>Very Common Resident</td>
</tr>
<tr>
<td>VCSR</td>
<td>Very Common Summer Resident</td>
</tr>
<tr>
<td>VCWR</td>
<td>Very Common Winter Resident</td>
</tr>
</tbody>
</table>

**Endemic species

Local subsistence farmers, who visit and use the site on a daily basis, also claim that migratory flocks of *Columba leucocephala* (White-crowned Pigeon – Bald Pate) and *Zenaida asiatica*
(White-winged Dove) overfly the site on a regular basis throughout the summer. The number of birds within these flocks generally range between 5 to 10 individuals. None of these species are considered rare, threatened or endangered.

4.6 **Socio-economic Environment**

4.6.1 Existing Land Use

The land on the proposed Wigton site is currently designated as bauxite mining land. It is a plateau of gently rolling hills (rising to 800m above the sea.) and is currently used for agricultural by small farmers. Most of the site is grassed pastureland and the latter would be the main land use directly impacted by the proposed development. A few cows were observed grazing the site, however, their numbers were low and the proposed site does not appear to be used extensively for the large-scale grazing of cattle.

Small plots of land, less than 3000 m², have been cultivated and were being used for subsistence farming of carrots, sweet potato, sweet pepper and tomatoes. These plots, however, do not lie within the area earmarked for erection of the wind turbines and would therefore not be directly impacted by their construction.

Population density is very low in this part of the island, and there is a separation distance of at least 300m from any dwellings to the nearest wind turbine. The majority of local dwellings straddle the local roads which are to the north and east of the site. They are generally up wind of the proposed site and therefore should not be adversely impacted by wind-turbine-generated noise.

Access to the site would be from the road from Mandeville through Newport to Alligator Pond on the coast approximately 2 km south of the Rose Hill junction, using the track which runs past the Wigton House Ruins. Improvements to the junction would be required to allow access for the vehicles delivering the wind turbine components. The proposed site is currently accessed via existing farm tracks which would need to be improved and extended to reach all the turbines.

5.0 **LEGISLATIVE AND REGULATORY FRAMEWORK**

5.1 **Responsible Authorities**

Several authorities are responsible for regulating and facilitating environmentally sound development in Manchester and will have jurisdiction over the proposed project. These are as follows:

The **National Environmental Planning Agency (NEPA)**. NEPA is the new Government Executive Agency and represents a recent merger of the Natural Resources Conservation Authority (NRCA), the Town Planning Department (TPD) and the Land Development and Utilisation Commission (LDUC). NEPA is responsible for administering the Town and Country Planning Act (1958; amended 1993) and the Natural Resources Conservation Authority Act (1991). It is the principal agency responsible for national physical planning and the management, conservation and protection of natural resources.

The Natural Resources Conservation Authority Act (1991) permits NEPA to request an environmental impact assessment for developments or construction works considered likely to
have adverse effects on the environment. Failure or refusal to submit such a document is an offense under the law. NEPA is also responsible for administering the Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order (1996) and the Wildlife Protection Act (1945; amended 1988).

---

**NEPA Environmental Review and Permitting Process**

The environmental Permit and License System (P&L), introduced in 1997, is a mechanism to ensure that all developments in Jamaica meet required standards in order to minimize negative environmental impacts. The P&L System is administered by the National Environmental and Planning Agency (NEPA), formerly the Natural Resources Conservation Authority (NRCA), through the Permit and License Secretariat. Permits are required by persons undertaking new developments, which fall within a prescribed category. Under the NRCA Act of 1991, the NRCA is authorized to issue, suspend and revoke permits and licences if facilities are not in compliance with the environmental standards and conditions of approval stipulated. An applicant for a Permit or License must complete an application form as well as a Project Information Form (PIF) for submission to the NRCA.

---

**The Parish Council.** The Manchester Parish Council is responsible for administering the Parish Council Act (1901; amended 1978) and the Local Improvements Act (1914). General approval under the Parish Council Act is needed for building permits. Section 11 of The Town and Country Planning Act also empowers the council to make decisions on approval of development projects (on behalf of the Town and Country Planning Authority).

### 5.2 Planning and Environmental Legislation

#### 5.2.1 The Town and Country Planning Act (1958; amended 1993)

The TCPA formulates and coordinates strategic plans for area development in the form of Development Orders consistent with the Town Planning Law (1975). Development Orders establish area-specific standards for land use, density and zoning. They cover most of the urban areas of Jamaica and several parishes.

Whereas Section 11 of The Town and Country Planning Act empowers local planning authorities (e.g. the Manchester Parish Council) to make decisions on approval of developments (based on the abovementioned Development Orders), Section 12 of the Act states that the Town and Planning Authority may require that any application for permission to develop land be referred directly to the Authority instead.

#### 5.2.2 Natural Resources Conservation Authority Act (1991)

Under the NRCA Act the whole island has been designated as a prescribed area and the law binds the Crown. This Act empowers the NRCA/NEPA to issue permits to persons undertaking any new development, construction or enterprise, anywhere in Jamaica, and licences for the construction or modification of any work causing the discharge of trade or sewage effluent into the environment. Under Section 9, designated or Prescribed Activities will require a permit from the NRCA/NEPA and the agency may request the preparation of an Environmental Impact Assessment of the proposed activity (Section 10 of the Act).
5.2.3 Natural Resources Conservation (Permits and Licences) Regulations, 1996, and Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order, 1996.

The Order prohibits the construction and development of a number of listed enterprises without a permit. The list of prescribed categories includes power generation plants, electrical transmission lines and substations 69 kV or greater, and sewage treatment facilities.

The application for a development permit requires submission and review of a Project Information Form (PIF). If an EIA is required the Terms of Reference (TOR) for the EIA are also reviewed by the agency to ensure that the relevant environmental issues are identified for analysis. This has been done for this project and the NRCA’s concerns are reflected in the TOR. A permit is issued once the project proponent has satisfied the requirements of the NRCA/NEPA and the permit fee has been paid. A permit and licence is also required for the construction and operation of a sewage treatment plant.

5.2.4 Land Acquisition Act (1947)

Section 3 of the Land Acquisition Act (1947) empowers any officer authorized by the Minister to enter and survey land in any locality that may be needed for any public purpose. This may also involve:

- Digging or boring into the sub-soil;
- Cutting down and clearing away any standing crop, fence, bush or woodland;
- Carrying out other acts necessary to ascertain that the land is suitable for the required purpose.

The Minister is authorized under Section 5 of the Act to make a public declaration under his signature if land is required for a public purpose provided that the compensation to be awarded for the land is to be paid out of the:

- Consolidated Fund or loan funds of the Government;
- Funds of any Parish Council, the Kingston and St. Andrew Corporation or the National Water Commission.

Once the Commissioner enters into possession of any land under the provisions of this Act, the land is vested in the Commissioner of Lands and is held in trust for the Government of Jamaica in keeping with the details outlined in Section 16. The Commissioner shall provide the Registrar of Titles with a copy of every notice published as well as a plan of the land. The Commissioner will also make an application to the Registrar of Titles in order to bring the title of the land under the operation of the Registration of Titles Act.

5.2.5 Solid Waste Management Act (Draft) (2000). This Act is to establish a Solid Waste Management Authority and to regulate the collection and disposal of solid waste across the island.

5.2.6 Jamaica National Heritage Trust Act (1985). The Jamaica National Heritage Trust Act of 1985 established the Jamaica National Heritage Trust (JNHT) The Trust's functions outlined in Section 4 include the following responsibilities:

- To promote the preservation of national monuments and anything designated as protected national heritage for the benefit of the Island;
• To carry out such development as it considers necessary for the preservation of any national monument or anything designated as protected national heritage;
• To record any precious objects or works of art to be preserved and to identify and record any species of botanical or animal life to be protected.

Section 17 further states that it is an offence for any individual to:
• willfully deface, damage or destroy any national monument or protected national heritage or to deface, damage, destroy, conceal or remove any mark affixed to a national monument or protected national heritage;
• alter any national monument or mark without the written permission of the Trust;
• remove or cause to be removed any national monument or protected national heritage to a place outside of Jamaica.

The NRCA/NEPA will require implementation of an environmental monitoring programme during construction works.

6.0 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION

6.1 Landscape and Visual Assessment

Impacts
The areas from which the wind turbines can be seen are shown on the ‘Zone of Visual Impact’ chart in appendix 6. The shaded areas are those from which a view of a turbine blade tip can be seen. These are colour coded to indicate how many of the 23 turbines can be seen from the area, as there are very few points from which all the turbines can be seen. A significantly smaller area would be highlighted if the parameter was to view a complete wind turbine including tower. It should be noted that in the vicinity of the wind farm, there are relatively few dwellings which will have views of more than part of a wind turbine.

The appendices 7 to 11 are photomontages of the views from the view points tabulated in Table 2. These were chosen to give a representative selection of close and near distance views of the wind farm which were likely to be visited with reasonable regularity by the local population. Photographs have been taken from the view points using a camera with a 50mm focal length and the wind turbines inserted by computer programmes which model their size and location in relation to these photographs.

Such is the nature of the landscape in the area, that there are virtually no view points from which the whole of the wind farm is visible and the partial visibility of the turbines allows them elegantly to blend in with the grandure of the scenery. From these simulations, it can be seen that the installation will not impose a significant visual impairment of the scenery in the area.

Mitigation Measures
The positioning of the turbines has been chosen to reduce the visual impact of the wind farm from the surrounding populated areas. This has been achieved by placing the wind turbines on the edge of the escarpment where it falls steeply to the west. They are generally below its highest ground and are thus generally hidden from the dwellings to the north, east, and south by the higher ground. The steep escarpment and the undulation in and around it means that there are no dwellings close on the west side, and it will thus only be seen from more distant locations. With the height of the escarpment above the ground to the west, the top of it and the wind turbines are out of the normal lines of sight of people in this area.
The route of the access track to the site uses the route of the existing track past the Wigton House Ruins, chosen to reduce environmental disturbance across a range of issues.

The tower height of the turbines at 50m has been kept to a reasonable minimum dimension and the number of turbines has been reduced as the scheme has evolved. The larger output from the current turbines has allowed fewer to be installed whilst retaining the same energy output.

6.2 Noise Assessment

As the mechanical noises from the wind turbine transmission are generally contained within its nacelle enclosure, audible noise is generally that from the rotor blades moving through the airflow. In many ways this noise is similar to that of the wind flowing blowing through the countryside.

RES has used independent experts to measure the noise output from their proposed turbines. These levels were relatively low and, at a short distance from the turbines, would be masked by background noises. As wind speeds increase, the wind noise in trees etc would increase and would tend to make them even less noticeable.

The manufacturer’s noise level measurements for the wind turbines, coupled with the layout of the wind farm, were used to generate an isobel map showing the noise level contours from the turbines in the vicinity of the wind farm. This isobel map is attached as Appendix 12. The figure shows that wind-farm-generated noise at Wigton would be below World Health Organisation (WHO) recommended community noise tolerance guidelines of 50dBA for daytime and 45dBA for night time-----at the nearest dwellings. The construction and operation of the Wigton wind farm is therefore unlikely to cause significant nuisance for surrounding communities with respect to noise generated by the wind turbines.

6.3 Electromagnetic Interference Assessment

Impacts
Generating equipment, such as a wind turbine, may interfere with communication systems which use electromagnetic waves as their transmission medium (e.g. television, radio or microwave links). In particular, a wind farm may affect television reception due to a scattering of the signal, essentially setting up a second path between the transmitter and receiver of the signal. If the second signal is strong enough, this can potentially lead to a “ghosting” effect on the screen.

Wind farms may also cause problems if they interfere with the ‘line of sight’ microwave communication paths of mobile/cellular phone networks. They could also be a hazard for local commercial aviation operations and air traffic.

Mitigation Measures
Consultations were held with the relevant bodies and local commercial operators (i.e. Digicel Ltd, Centennial Digital Jamaica Ltd, Cable and Wireless Jamaica Ltd, Television Jamaica, CVM Television and the Civil Aviation Authority) to ensure that there would be no outstanding problems with their activities during the construction and operation of the proposed Wigton Wind Farm. No ‘line of sight’ microwave communication and television broadcast paths are believed to cross the site and the contacted commercial operators all indicated that they would not experience any problems through the construction and operation of the proposed wind farm.
This would also suggest that there should not be any cumulative impacts as a result of the operation of the wind farm at this time.

The Civil Aviation Authority was contacted on Jan 23 2002 and has confirmed that the wind farm will not pose a hazard to aviation (ref appendix 13 for a copy of the letter from the CAA).

6.4 Pollution Control Measures

Care would be taken at all times to prevent contaminated run-off from excavations and workings from entering any watercourse or ditch. Earth spillages into any existing streams would be avoided, with mitigation measures developed as necessary. There would be no discharge of trade effluent, sewage effluent or contaminated drainage into any water course system or ditch.

The siting of the sub-station could represent a risk to groundwater pollution in the event of the unlikely accidental release of cooling oils and other chemicals from the transformer element. Contractors would be required to take precautions against spillages of chemicals during the construction and operational period.

Appropriate site management measures would be taken to ensure that surface runoff is not contaminated by fuel and lubricant spillages.

The operation of wind generators produces no discharges and, other than lubricants, uses no chemicals. Provided that reasonable care is taken during their routine maintenance and that vehicles using the access roads are well maintained, the effect of the operation of the wind turbines on surface and ground waters would be negligible.

RES have a policy that the no wind turbines, auxiliary and electrical equipment shall contain PCB’s. An emergency protocol to address any accidental pollution incident is established at all RES wind farm sites.

6.5 Ecological/Ornithological Assessment

The land to be used by the wind farm forms a small part of an area which has been designated for bauxite mining. Given the limited amount of land used in this wind farming activity, and the nature of a wind farm, any impact will be much less significant than those of the mining operations.

Negative impacts on existing terrestrial vegetation is expected to be small---given the small land-take of the proposed project. Impacts on terrestrial vegetation would be limited to the grassed (i.e. pastureland) sections of the site. Local subsistence farm plots would not be negatively impacted.

In a worst case scenario, during the operational phase of the project, the negative impact of loss of individual specimens is expected to be restricted to the locally common bird species (see Table 3) and the migratory flocks discussed under Section 4.4. Generally, however, the numbers of individuals and bird species observed and reported at the proposed site were small and it is felt that loss of specimens will not be a factor during the operation of the wind farm.
6.6 Highways and Traffic Assessment

Impacts
The abnormal loads which need transporting to Wigton are the turbine blades and towers. The main section of each blade is circa 22m long and weighs circa 4 tonnes. The tower is a tapered steel tube with a maximum diameter of 3.5m. It is normally supplied in 2 sections of similar length to that of the blades and a total weight of circa 63 tonnes.

The access route for abnormal loads would be from the Kingston docks along the main highway to the west towards Mandeville as far as Royal Flat, and thence along the road bi-passing Mandeville on its southern side, before turning south to Newport. Access to the site will then be from this road south of Rose Hill. A preliminary survey by the likely carriers has indicated that these loads can be carried satisfactorily over the public roads.

Entrance to the site will be from the road from Mandeville southwards to Alligator Pond on the coast. It will be about 2 km south of the Rose Hill junction utilising the existing track past the Wigton House Ruins. Some modification to the entrance from the road is envisaged to facilitate access for the larger loads.

During the 9 month construction phase, there would be an increase in vehicle movements. The nature and quantity of the traffic is estimated below. A journey includes trips to and from the site.

Table 4. Estimate of Traffic Movements During Construction

<table>
<thead>
<tr>
<th>Activity And Duration</th>
<th>Approx. Journeys Per Turbine</th>
<th>Total Journeys</th>
<th>Approx. Journeys Per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turbine Delivery - (6 weeks)</td>
<td>5</td>
<td>115</td>
<td>4</td>
</tr>
<tr>
<td>Turbine electric’s - (6 weeks)</td>
<td>1</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>Turbine Foundations - (11 weeks)</td>
<td>22</td>
<td>506</td>
<td>22</td>
</tr>
<tr>
<td>Access Track Construction - (4 weeks)</td>
<td>10</td>
<td>230</td>
<td>10</td>
</tr>
<tr>
<td>Other e.g. tracked plant, 2 cranes,</td>
<td>N/A</td>
<td>Approximately</td>
<td>&lt;1</td>
</tr>
<tr>
<td>fencing, site huts - (over 26 weeks)</td>
<td></td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

The second half of the access track construction period would be the busiest for traffic movements when stone trucks and foundation/concrete lorries could be making journeys at the same time. It should be noted that the above figures are estimates and that there would be days when there could be no traffic in one or all of the categories.

It is likely that at any one time approximately 10 cars/vans would be on site being used by site engineers and other construction staff. In addition, one journey would be made by a circa 250 tonne capacity mobile crane (travelling weight of approximately 90 tons on 8 axles, with an approximate axle load of 11.5t) which would be required to erect the turbines. A journey would also be made by a second smaller crane, which is required for general work and support of the erection of turbines. This would be a circa 70 tonne capacity mobile crane.
Traffic movements would generally be confined to normal working hours (7.00 a.m. - 7.00p.m.), though exceptions might be required for the movement of abnormally long wind turbine components. No increase in the night-time background noise level is anticipated.

The decommissioning phase would require access by heavy vehicles to and from the site to remove all items of plant, including turbines and associated infrastructure. However this would be for a short duration and should not require abnormal loads.

Once the wind farm is completed the associated vehicle movements would be very limited. The site would require vehicular access for maintenance and control purposes consisting of a visit utilising a ‘pick up truck’ several times per week.

Each machine will require two services per year, each requiring one man-day of effort. Thus there will be two periods of three weeks each year when staff will be on site on a full time basis. Unplanned maintenance may require additional attendance for limited periods throughout the lifetime of the wind farm.

Mitigation Measures
The police would be notified of the movement of long and abnormal vehicles along the access route. Warning signs to advise other road users would be erected approaching the site entrance from both ways during the temporary construction phase. To prevent dust and mud entering the public highway, the site entrance and access area on the public highway would be monitored daily and cleaned if necessary.

As noticeably increased traffic levels would only be experienced during the 9 months of construction, it is considered that the local transport network would be able to absorb the additional traffic movements associated with the construction of the wind farm. Sign posting and flagmen as required for movement of heavy duty machinery and equipment.

When considered over the life of the project, the short term impact of increased traffic levels is considered to be minimal. The overall effect of the wind farm on the highways and traffic is therefore considered to be minor.

6.7 Socio-Economic Assessment

6.7.1 National Economic Benefits

Many of the benefits of wind energy are strategic and long term and are therefore difficult to quantify. However, strong Government support shows that the economic rationale for developing wind energy is a central component of the overall strategy. The Government's energy policy objective is to ensure secure, diverse and sustainable supplies of energy at competitive prices.

The price per unit of electricity generated from renewable energy, particularly wind energy, is however falling as renewable technologies become more advanced. The average generating costs from wind are now similar to those of JPS with an oil price in the region of US $ 20 per barrel. Electricity price calculations often do not reflect full costs such as environmental externalities. Wind power may be even cheaper than rival schemes if other factors are included.
For instance, wind does not have big future decommissioning costs and it has the advantage of being an embedded generation source feeding directly into the regional grid network close to the end-user, thus avoiding the problem of long distance transmission losses and its associated costs.

The economic benefit of embedded generation in this region is estimated to be around 0.5 cents/kWh US for electricity produced by renewables.

The benefits of utilising renewable forms of energy are even greater when compared to conventional forms of energy if the avoided costs of pollution are taken into account. Such costs can include the health costs associated with poor air quality and the damage to the natural and built environment caused by acid rain. Renewable energy does not contribute to global warming, has a never-ending supply of, and uses, free fuel. It has no requirement for the transportation of fuel. The avoided cost of pollution has been estimated to be approximately 1 cent/kWh US for electricity generated by renewables.

As the wind energy displaces the use of imported fossil fuels, the Jamaican economy will benefit through a corresponding saving of imports. Annual savings of fuel are in excess of US $2 million at current oil prices.

6.7.2 Local Economic Benefits

The Wigton Wind Farm will endeavour to ensure that wherever possible local contractors and employees are used in all aspects of the wind farm development. Employment would be created during the construction phase when local firms would be invited to bid for a significant portion of the construction work on roads, foundations and the building. Construction materials would be sourced locally and local transport and plant hire companies used wherever possible. Up to 40 jobs would be created during the 6 month construction stage and 2 equivalent full-time jobs during operation. It is anticipated that over 80% of the construction jobs would be filled locally and the operation and maintenance jobs.

The wind farm will cost in excess of US$ 20 million to construct of which around a quarter would be invested in Jamaica through local contractors for civil engineering works, purchase of local materials, electrical installation and the grid connection. Local shops and hotels will also benefit from increased customers during the construction and operational phase.

Wind farm developments are an ideal form of farm diversification and an excellent environmentally beneficial use for an area designated for mining. It may well be of interest to tourists and their visiting will benefit the local economy. Economic benefit accrues to the local area both directly and indirectly and the effect of the wind farm on the local economy is considered to be a positive benefit.

6.7.3 Public Safety

The plant equipment and their enclosures incorporate the best available technology and access to the site should pose no danger to the public.

“With thousands of wind turbines around the world, there is no record of any member of the public having been injured as a result of their operation”. (BWEA, 1996).

Signs would be located around the site giving details of who to contact in an emergency. This information would also be given to the local police station, the landowner and JPS Co.
6.7.4 Public Rights of Way – Footpaths

The site would remain open farm land throughout the lifetime of the wind farm which would not in itself restrict access. There are public rights of way (tracks/footpaths) close to the site. These are all in excess of 50m from any turbine position and so should not suffer disruption, even during the construction period.

6.7.5 Tourism and Education

The evidence from operational wind farms in the UK and elsewhere suggests that the general public is interested in visiting wind farms, particularly in a tourist area. It may not always be appropriate to provide visitor facilities but several wind farms in the UK have provided car parks and interpretation boards for visitors. Delabole wind farm in Cornwall, the first operational wind farm in the UK, has parking, an information board and a visitor centre. Within its first year of opening the visitors centre recorded more than 35,000 adult visitors and this has levelled out to approximately 20,000 per year.

It is not envisaged that the Wigton Wind Farm would have any visitor facilities actually on the site, though no doubt it will be a feature of the island’s tours.

A wind farm can be a valuable educational resource. Most schools and colleges now have energy and the environment on the curriculum, and wind farms make an ideal study for technical, social and environmental projects. RES regularly hosts school and college groups at its existing wind farms in the UK, and similar arrangements could be made in Jamaica.

6.7.6 Archaeological and Cultural Heritage

Consultation with the Jamaica National Heritage Trust (JNHT) has shown that there are no records at present to suggest there is anything of archaeological significance on the Wigton site. The JNHT have indicated that this statement will be confirmed after they have had an opportunity to inspect the site.

7.0 OUTLINE MONITORING PLAN

The major elements of the proposed environmental monitoring programme (EMP), for the construction and post-construction phases of the project, are set out below. Appendix 15 provides the details of the EMP.

• Site layout, site clearance and construction works would be monitored to ensure that they remain in compliance with the NEPA-approved landscape plan.
• Sourcing of earth materials would be monitored to ensure that they are obtained only from licensed and approved sources.
• The transport of material to the project site would be monitored to ensure that trucks are covered to prevent spillage and the generation of dust. If spills occur, corrective action would be taken.
• The location of hard standings at the site would be monitored to ensure that they are placed and materials stored away from drainage features.
• Solid waste disposal practices at the site would be monitored to ensure appropriate on-site management and final disposal at an approved dump.
• The construction camp would be monitored to ensure the installation of VIP toilets and the proper disposal of sewage and labour camp solid waste.
• Dust and noise levels on site would be monitored to ensure they are kept within acceptable limits.
• The storage, use and handling of chemicals, lubricants and fuels---during both the construction and operational phases of the project---would be monitored to ensure proper storage and use and the rapid and environmentally-sensitive remediation of any accidental spillages.

8.0 GENERAL REFERENCES


9.0 GLOSSARY

**CO₂**: (Carbon Dioxide) contributes about 60% of the potential global warming effect of man made emissions of greenhouse gases. Although living organisms naturally emits this gas, these emissions are offset by the uptake of carbon dioxide by plants during photosynthesis; they therefore tend to have no effect on atmospheric concentrations. the burning of fossil fuels, however, releases carbon dioxide fixed by plants many millions of years ago and thus increases its concentration in the atmosphere.

**dB(A)**: or decibel (A-scale), international weighted scale of sound levels or noise providing a good correlation with subjective impressions by individuals in most cases, of loudness and sense of annoyance. Nearly all audible sound lies between 0 and 140 dB(A).

**Ha**: 1 hectare = 10,000 sq. metres = 2.47 acres.

**Hub height**: height of a wind turbine tower from the ground to the centre-line of the turbine rotor.

**m/s**: metres per second - wind speed

**Gigawatts, Megawatts, Kilowatts and Watts**: a Gigawatt (GW) is equal to 1000 Megawatts (MW) which is equal to 1000 Kilowatts (kW) or 1,000,000 Watts (W). It is a measurement of electrical generating capacity. kWh: kilowatt hour = 1 unit of electricity.

**NOₓ**: (Nitrogen Oxide) A number of nitrogen compounds including Nitrogen Dioxide are formed in combustion processes when nitrogen in the air or the fuel combines with oxygen. These compounds can add to the natural acidity of rainfall.
**Photomontage:** computer aided process that incorporates a photograph of the existing site/view/landscape with a representation of the development to provide an impression of the visual impact of the proposed development.

**SO₂:** (Sulphur Dioxide) this is a gas produced by the combustion of sulphur containing fuels such as coal and oil.

**Zone of Visual Influence (ZVI):** representation (usually presented as a map with markings or colourings) of the area over which a site and/or a proposed development may be theoretically visible.
Appendix 1

Site Location Map

The wind farm site is at Wigton as shown on the map below:
Appendix 3

Diagram of NEG Micon NM900/52 Wind Turbine

<table>
<thead>
<tr>
<th>Main Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Power</td>
<td>900 kW</td>
</tr>
<tr>
<td>Rotor diameter</td>
<td>52 m</td>
</tr>
<tr>
<td>Swept area</td>
<td>2140 m²</td>
</tr>
<tr>
<td>Hub height</td>
<td>44,49,55 m</td>
</tr>
<tr>
<td>Rotational speed approx.</td>
<td>23.5/15.7 rpm</td>
</tr>
</tbody>
</table>
Appendix 12: Isobel map showing the noise level contours
Appendix 2: Site layout
Appendix C: Local Stakeholder Consultation Report
Wigton Wind Farm Public Consultation Exercise

Context

Under the terms of both national regulations (administered by National Environmental Planning Agency) and according to the rules of the CDM a consultation exercise was required.

1.0 Procedures & Results of the Exercise:

Advertising

The meeting was advertised in the national and local newspapers, and also a town-crier (mobile public address system) was used to inform all potential stakeholder of the consultation event.

Location, Timing, & Attendees

The public or local stakeholder event was held on the 25/7/2001, at the local school – Rose Hill All School, from 5.00 – 9.00 pm. Over 50 persons, including the local political and National Environmental Planning Agency (NEPA) representatives attended the event – a list of attendees with signatures is available.

Format for the event.

The consultation event entailed:

- AN EXHIBITION OF THE PROJECT TO ALLOW STAKEHOLDERS TO UNDERSTAND THE PROJECT AND ITS CONSEQUENCES.
- A series of presentation using overhead projections to present the project to the stakeholders.
- Following the presentation a question, answer and discussion process was initiated.

The presentations and question, answer and discussion session was chaired by Dr R Wright, Managing Director of PCJ Group. Refreshments were supplied at both beginning and end of evening because some stakeholders had to walk many miles to attend the event.

Exhibition

Exhibition of project information, including take-away leaflets on wind energy, information on the developers and the project, as well as information on the CDM and its consequences for Jamaica and the project. The exhibition information presented included information on:

- What a wind farm is
• Photomontages of what the wind farm will look like on the landscape from various surrounding locations
• Explanation about the CDM aspects of the project.

Presentations.

The series of 3 presentations involved - a). Introduction from Dr Wright, b) Explanation of project characteristics, by Richard Lord, RES Ltd, c) Explanation of the CDM and its role in the projects development by Paul Soffe, EcoSecurities Ltd.

1.1.1.1 General introduction

Dr Wright introduced the event with some comments, including:

• The project is now likely to include a hospitality centre as part of the overall project package. They thought a third party (hopefully local) would be brought in to run the centre, which would also serve refreshments etc.
• There will be increased employment in the area especially during the construction phase of the projects development, with a few maintenance jobs once the project was operational.
• The project would make Wigton a nationally known place once the project was being built because there would be a lot of media interest in the project because it will be the first of its kind in Jamaica. This will change the life of the community forever.

1.1.1.2 Wind energy and project presentation

Richard Lord explained the technical aspects of wind energy projects in general and more specifically in relation to the project. This included descriptions on:

• Erection of 23 turbines, their size,
• Upgrade of existing roads/tracks,
• Building of concrete pole linked transmission lines
• Building of a substation
• Construction of the foundations
• Transportation of turbines
• Noise impacts
• Visual impacts

1.1.1.3 CDM presentation

This presentation focused on:

• What the CDM is
• How the CDM affects Jamaica & what Jamaica can get out of the CDM
• What the CDM means for the project
• What the steps are in making the project into a CDM activity

Summary of Comments, Questions and Responses

1. Question - What was construction period?
Response – 1 year.
2. Question - How do local people see the money benefits from the project being a CDM project. How do they benefit from the carbon credits?
Response – They will get slightly lower electricity costs, but most of the benefits will be more national in nature, i.e. less reliant on imported fuels, and there is a capacity shortfall that the project can help solve.
3. Question - What harm will the project do to people in the region, is there any dangerous radiation?
Response – There is no radiation from wind farms.
4. Question - What are the equal opportunity measures with regards to the employment?
Response – The project company will be an equal opportunity employer and take this approach with regards to all jobs.
5. Question - Can existing farming activities continue on the site?
Response – Yes, there will be no pollution and the turbine take up very little space.
6. Question - The bauxite mining is likely to have a negative impact because landscape could be ruined?
Response – The bauxite company will restore the land.
7. Question - Will there be a tour guide to show visitors around?
Response – Depends on the number of the tourists visiting the site.
8. Question - The local visitor centre should be run by locals?
Response – Possibly, but it must be controlled and of a high standard – no dirty wooden shacks.
9. Question - How much will the electricity cost and will be get cheaper electricity?
Response – well, in the electricity contract the supplier will pay 5.6 US$ cents per MWh, with the following 15 years for 5 US$ cents per MWh. But the price the public has to pay is decided by the electricity supply JPS.
10. Question - Please elaborate on distribution?
Response – The electricity distribution or feed to the grid will mainly be along the Parish roads, which will be in total 11km from the project to the grid connection.
11. Question - Will the project reduce black outs and increase the reliability of electricity supplies?
Response – No guarantees on this can be supplied, this is up to JPS, but it should help.
12. Question - Will lightening be a problem?
Response – No, all the turbines are designed to cope with strikes.
13. Question - Will noise not be a problem - we have heard that cumulatively they can be noisy?
Response – No, not really, the background noise will be louder than the noise the turbines make.
14. Question - What about the safety? Could the turbines fall on anyone?
Response – Very unlikely, the turbines are class 1, which is the strongest class, which should withstand hurricanes.
15. Question - What are the benefits of the carbon payments to the local community?
Response - No direct benefits, they are indirect because the carbon helps finance the project, which will in turn supply cheaper electricity and supply local jobs too.
16. Question - Can there be a local education programme in the local school, to help educate the local children about the project, renewables, and the environmental problems of fossil fuels?
Response – This is a good idea and will be considered. RES offered to give some of the exhibition materials to the local schools, which was accepted by the Headmistress.
17. Question - NEPA (National Environmental Planning Agency) representative announced to the audience that should they have other issues they wanted to raise they could speak with him at anytime over next two weeks, by which time they would have decided on whether to issue the environmental and planning permit.

Conclusions

The event was successful in that there was a large turn out of people and no major concerns or objections were raised by the stakeholders. In addition NEPA were satisfied with the exercise, which can be demonstrated by the fact that it has issued a notice of intention to issue a permit.