



Jamaica's Wind Energy and Development

2009 ARPEL CONFERENCE

Sustainable Development The Role of the Oil and Gas Industry
in Latin America and the Caribbean



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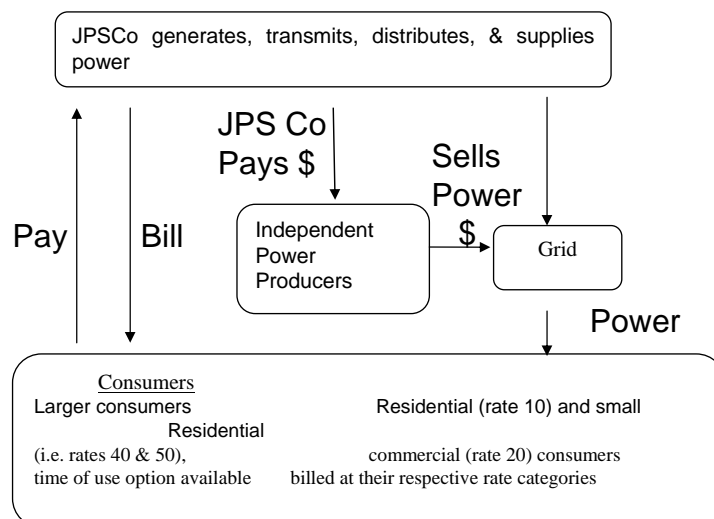


Road Map

- Electricity Sector
- Government Policy
- Wigton Project
- Wigton challenges
- Wigton Opportunities
- Wigton Performance
- Jamaica's benefit

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Jamaica's Electricity Sector



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Electricity Sector (cont.)

- Stakeholders of Electricity
 - Ministry of Energy
 - OUR
 - JPS Co
 - IPPs
- Laws governing the sector
 - OUR Act
 - Electric Lighting Act
 - All-Island Electricity License 2001

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Electricity Sector (cont.)

- In recognition of the importance of energy to economic development, the GOJ, through the Ministry of Energy developed the energy policy in the past and for the future with a view to direct the nation to develop and the manage its use of energy; sustainable, efficient and "green".....The National Energy Policy 2006-2020

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RENEWABLE ENERGY TARGETS - JAMAICA

YEAR	CUMULATIVE TARGET
2005	5%
2010	10%
2015	15%

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WIGTON WINDFARM LIMITED

- Wholly owned subsidiary of The Petroleum Corporation of Jamaica (PCJ), a state owned agency
- Incorporated on April 12, 2000, under the Companies Act as a Limited Company
- Operates at Wigton in the parish of Manchester, 12 km SSW of the parish capital Mandeville (\approx 70 km W of Kingston)
- Entered into a 20 year PIA with Jamaica Public Service Company (JPS Co.) to sell all the electricity generated by the wind farm to the power company

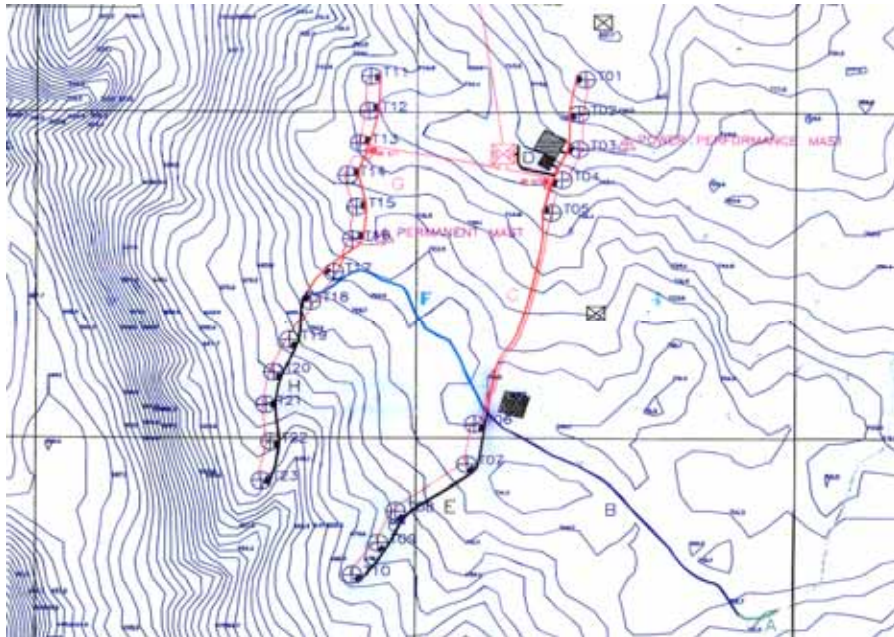
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Wigton Windfarm

- Constructed in 7.5 months instead of the budgeted 12 months
- Twenty-three 900 kW wind turbines supplied by NEG Micon
 - NEG Micon now merged with Vestas Wind Systems
- The wind farm capacity output is approximately 20.7 MW
- Turbines are located along two ridges

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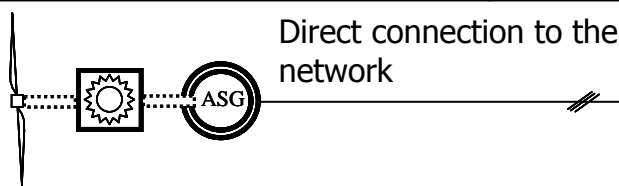
WIGTON LAYOUT



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WIGTON SPECIFICATIONS

Turbine Type	NEG-Micon NM 52/900
Hub Height	49 m
Rotor Diameter	52.2 m
Mean Wind Speed @ hub height	8.3 m/s
Leased Land Area	683 acres
Site Elevation	750 m
New Over-Head Line to JPS Spur Tree Substation	11.315 km



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Wind Resources Investigation

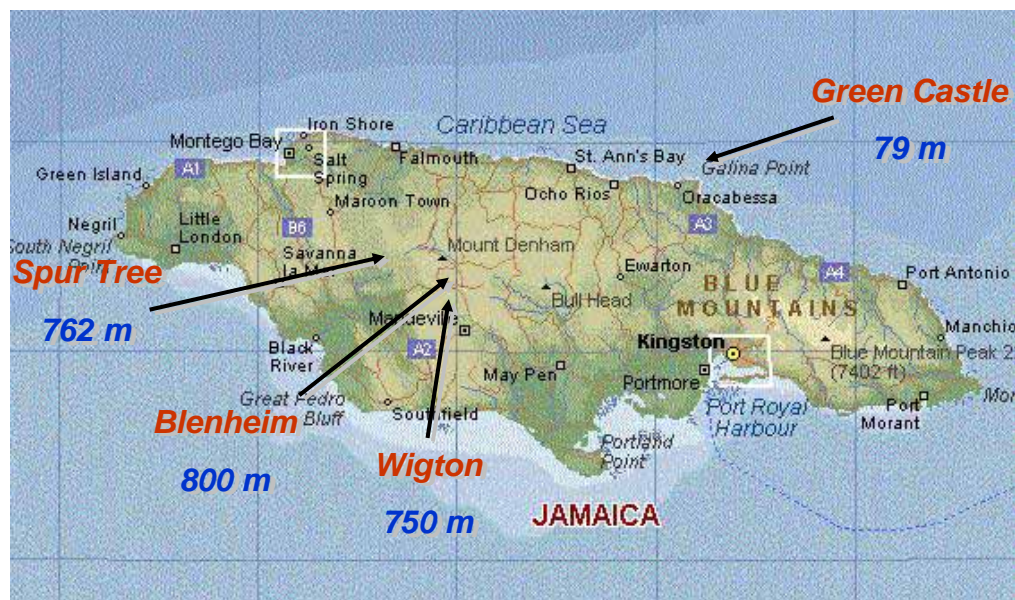
- NRG 9200 loggers used to collect wind data at 4 sites

Green Castle, (St. Mary)	March 1995 – February 1996 Average Wind Speed 7.2 m/s (25.92 km/h)
Wigton, (Manchester)	January 1996 – February 2003 Average Wind Speed 8.3 m/s (29.88 km/h)
Blenheim, (Manchester)	June 1996 – February 1998 Average Wind Speed 7.3 m/s (26.28 km/h)
Spur Tree, (Manchester)	March 1996 – September 1998 Average Wind Speed 7.7 m/s (27.72 km/h)

PCJ data projected to hub height of 49m

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The Wind Potential Sites



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Wind Resource Study Results

- Coastal areas such as Green Castle had a high diurnal variation
 - Wind speeds higher in the afternoon peaking at about 2:00 pm and very low between 12:00 am – 10:00 am
- Blenheim wind regime was found to be turbulent and gusty (near limit according to IEC safety standards for wind turbines)
 - Not ideal for wind power generation
- Wigton and Spur Tree are elevated areas where the wind from the sea is deflected by the cliff face up to these sites
 - More constant diurnal wind pattern experienced
 - Wigton speeds higher than Spur Tree

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Land Accessibility

- Land ownership established
- OHL was installed along parochial roads and private property
- 20 year lease arrangement made with bauxite companies ALCOA and ALPART for wind farm land
- Some farmers on-site were compensated for crop damage during site preparation, wind farm construction, and commissioning
- Agreements were signed mandating that farmers desist from further planting on the land now leased by WWF

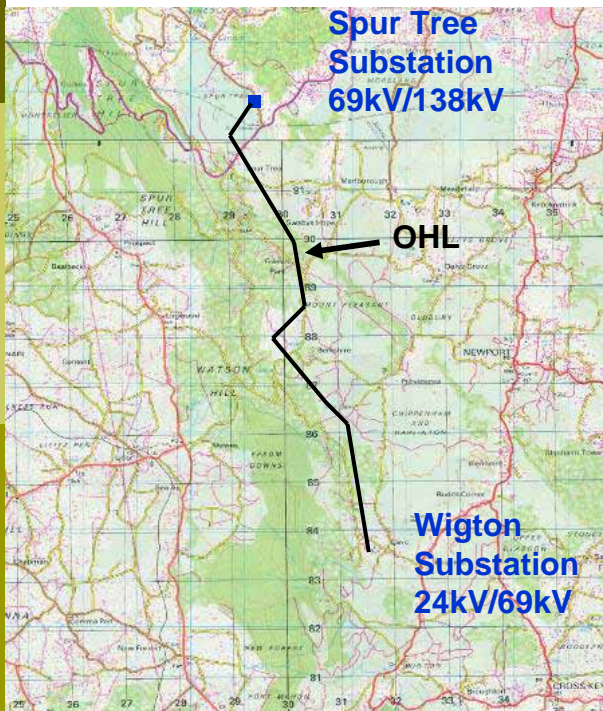
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Permits and Approvals

- Environmental Impact Assessment (EIA) report
- NEPA reviewed EIA then issued permit for construction
- Mining permit
- Dynamite blasting procedure for civil works (foundations)
- Manchester Parish Council Building Permit
- Power Generating License from Office of Utilities Regulation (OUR)
- Local stakeholder meeting held pre-construction

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Transmission Lines



- Interconnection with existing grid considered
- Wind farm connection made at Spur Tree substation
- OHL constructed by Wigton contractors (11.6 km)
- Maintenance and ownership transferred to JPSCo. after construction
- Guy wire supports used to secure transmission line poles

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Power Interchange Agreement

- 20 years power interchange agreement
- Monthly payments
- 2 billing meters – main and backup
- Meter maintenance and calibration performed by JPSCo.

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Wigton site development

- No endangered species harmed by construction or operation; minimal disturbance to vegetation
- Transmission line cable not run underground as the clay soil was unsuitable
 - Underground cabling offers protection from line disturbance in hurricanes
 - Jamaica electrical network only designed for category 4 hurricanes
- Turbines situated on areas without significant bauxite deposits; future mining will not affect wind farm operations
- Topography studied and turbines erected on knolls to maximize exposure to the highest wind speeds using GH Windfarmer software.
- Turbines spaced \approx 100m apart
- Rows are 350-500 m apart

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Challenges

- High Demand Charges (PIA)
- Low declaration of avoided cost
- No legislation for RE
- Project Financing
- Competition for land resource
- Proximity to the national Grid
- Transportation logistics in an island state
- Wind variability
- Grid instability
- Hurricanes

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HURRICANES

- Jamaica is situated in the Hurricane belt of the Caribbean
- The hurricane season: June to November
- Tropical Turbine Model
- IEC Class 1 turbines were used - rated up to a maximum of 69 m/s (248 km/h)
- Tropical model selected
 - No heaters
 - Additional cooling
 - Radiator on nacelle top cools generator only
 - Heat exchanger for gear oil cooling plus additional oil cooling radiator with fan
- Since the inception of the Windfarm, it has experience at least two hurricanes and one tropical storm wind conditions
 - 2004: Hurricane Ivan (Category 5) – Repair cost approx US\$640K
 - 2007: Hurricane Dean (Category 4) – Repair cost approx US\$106K
 - 2008: Tropical Storm Gutav – No repair cost

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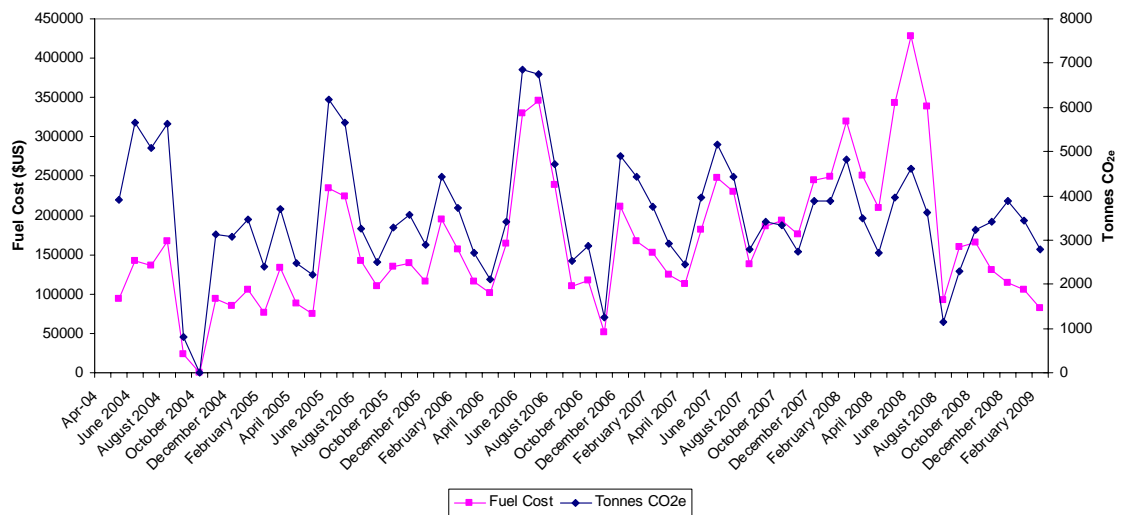
WIGTON Carbon Financing

- Project was assessed as a Clean Development Mechanism (CDM) project
- Wigton signed an Emissions Reductions Purchase Agreement (ERPA) with CAF on December 13, 2005
 - Purchase period from start of operation to Dec. 31, 2012
- Estimated annual CO₂ to be realized is 52,000 tons/ year
- Det Norske Veritas (DNV) audited the project in July, 2005 for CDM registration
- Project registered with the CDM Executive Board March 19, 2006
- Potential trading of CER's was evaluated and promoted by EcoSecurities
- Ministry of Land & Environment - Designated National Authority (DNA) for Jamaica
- The Project Design Document preparation and expenses were undertaken by the Andean Development Corporation, CAF
 - CAF is a multilateral, regional, development bank; Jamaica is a member country
 - CAF is acting as an agent of the Dutch government
 - CAF Netherlands CDM facility

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Wigton Performance

Avoided Carbon Dioxide Equivalent and Fuel Costs



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Jamaica's Benefits

- Contribution to sustainable development
- Environmentally friendly source of energy
- Up to February 2009 displaced 145,092 barrels of oil; reduction in 205,711 tonnes of CO_{2e} emission
- Educational and research development for tertiary institutions and other agencies
- A tourist attraction

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THANK YOU!

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