

# Jamaica's Wind Energy and Development

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October 2007

# RENEWABLE ENERGY TARGETS - JAMAICA

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



# 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 PPA
  - with Jamaica Public Service Company (JPSCo.) 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

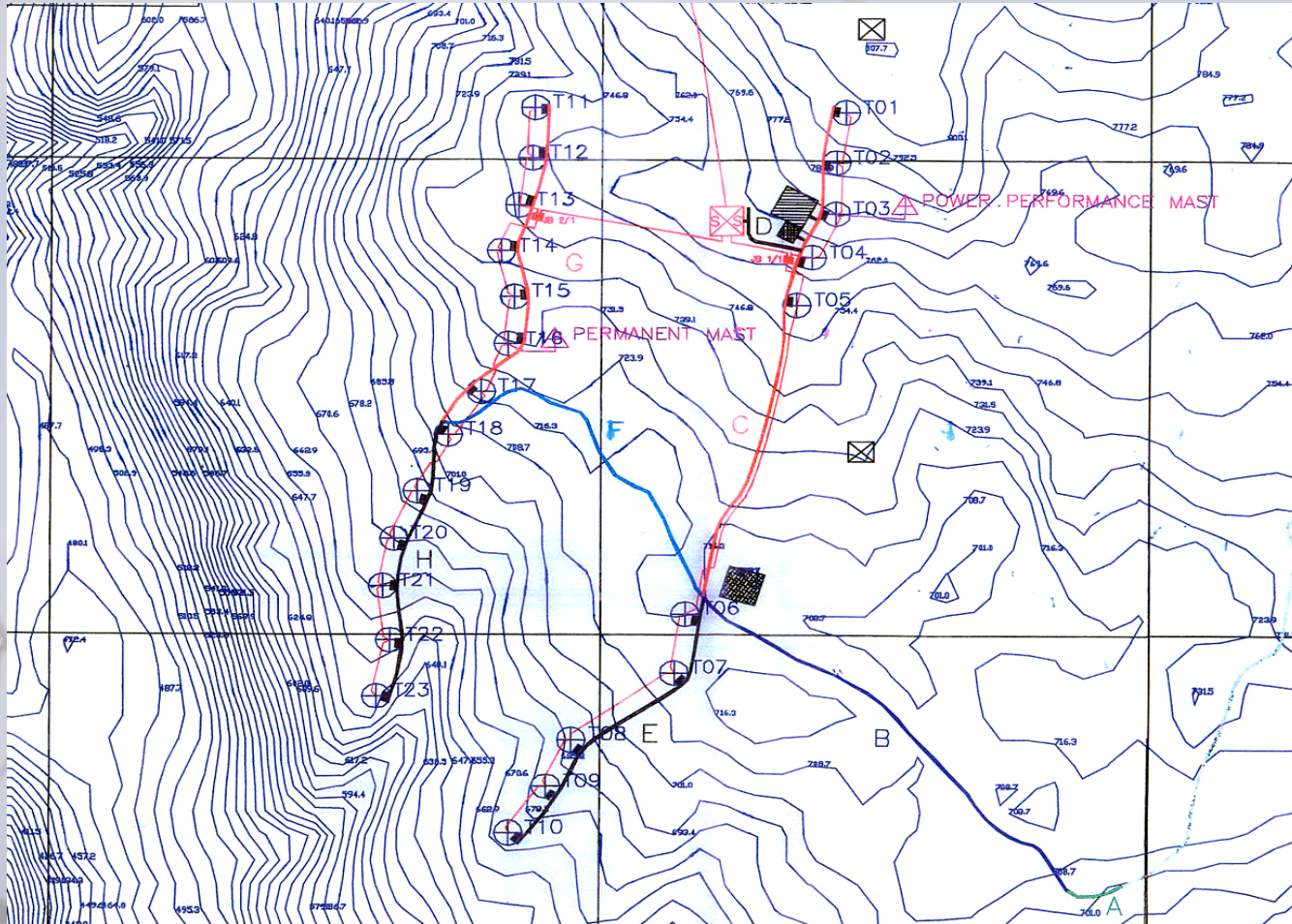


# WIGTON SPECIFICATIONS

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



# WIGTON LAYOUT



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# WIGTON WINDFARM

## The Project



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# Wind Resources Investigation

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

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

PCJ data projected to hub height of 49m



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# The Wind Potential Sites



# 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



# 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

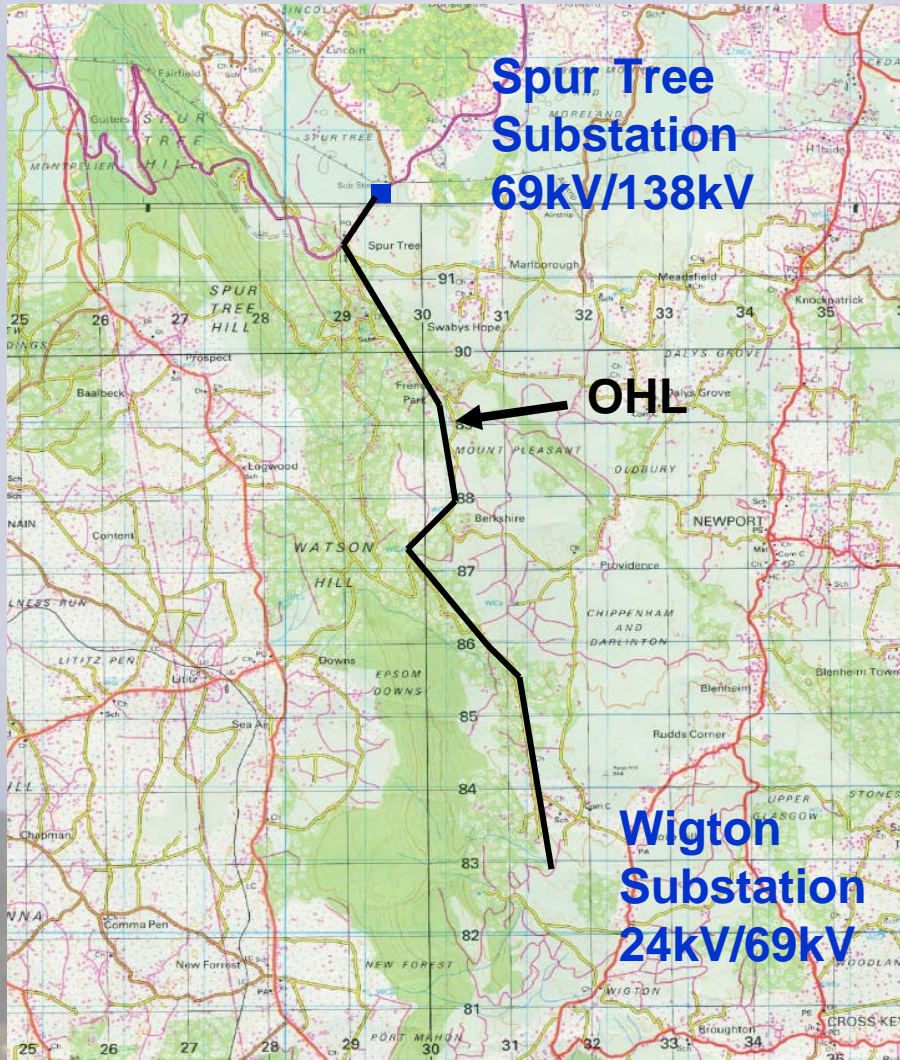


# Permits and Approvals

- 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



# Transmission Lines



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



# Power Purchase Agreement

- 20 years power purchase agreement
- Monthly payments
- Joint Operations Committee meets monthly
- 2 billing meters – main and backup
- Meter maintenance and calibration performed by JPSCo.



# 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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**HURRICANE!!!**



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# 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

# Hurricane Procedures

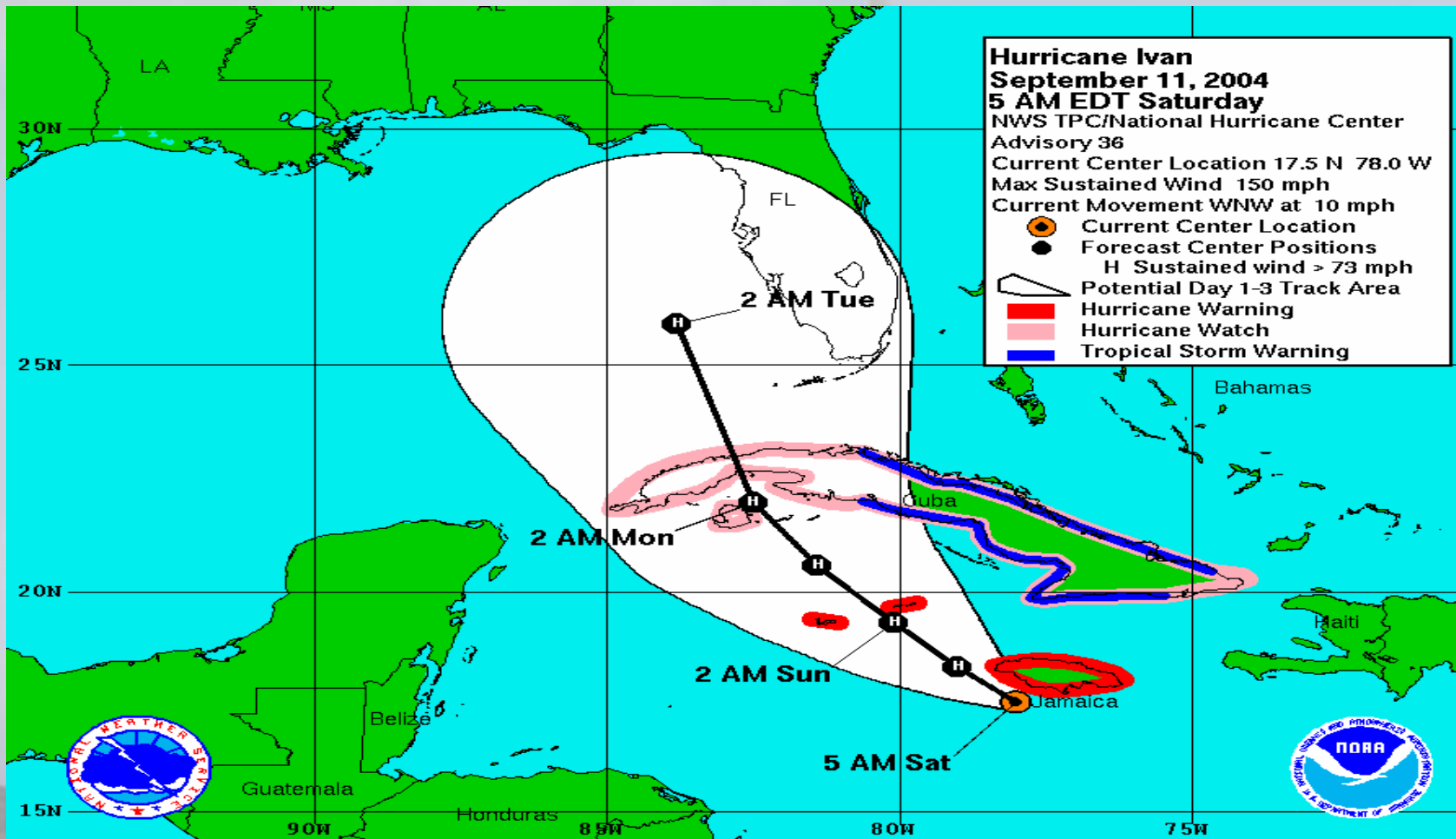
- **SHUT DOWN**
- **Monitor hurricane for direction and wind speed**
- **Ensure ratchet straps on nacelle covers**
- **12 hours after a hurricane warning issued manually yaw turbines 90o clockwise (CW) out of the wind**
- **Freewheel turbines to 'rabbit ears' position to minimize stress**
- **Open main circuit breakers for the turbines**
- **Liaise with JPSCo. System control**
- **Secure site**

'Rabbit ears'  
position



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# Hurricane Ivan Path

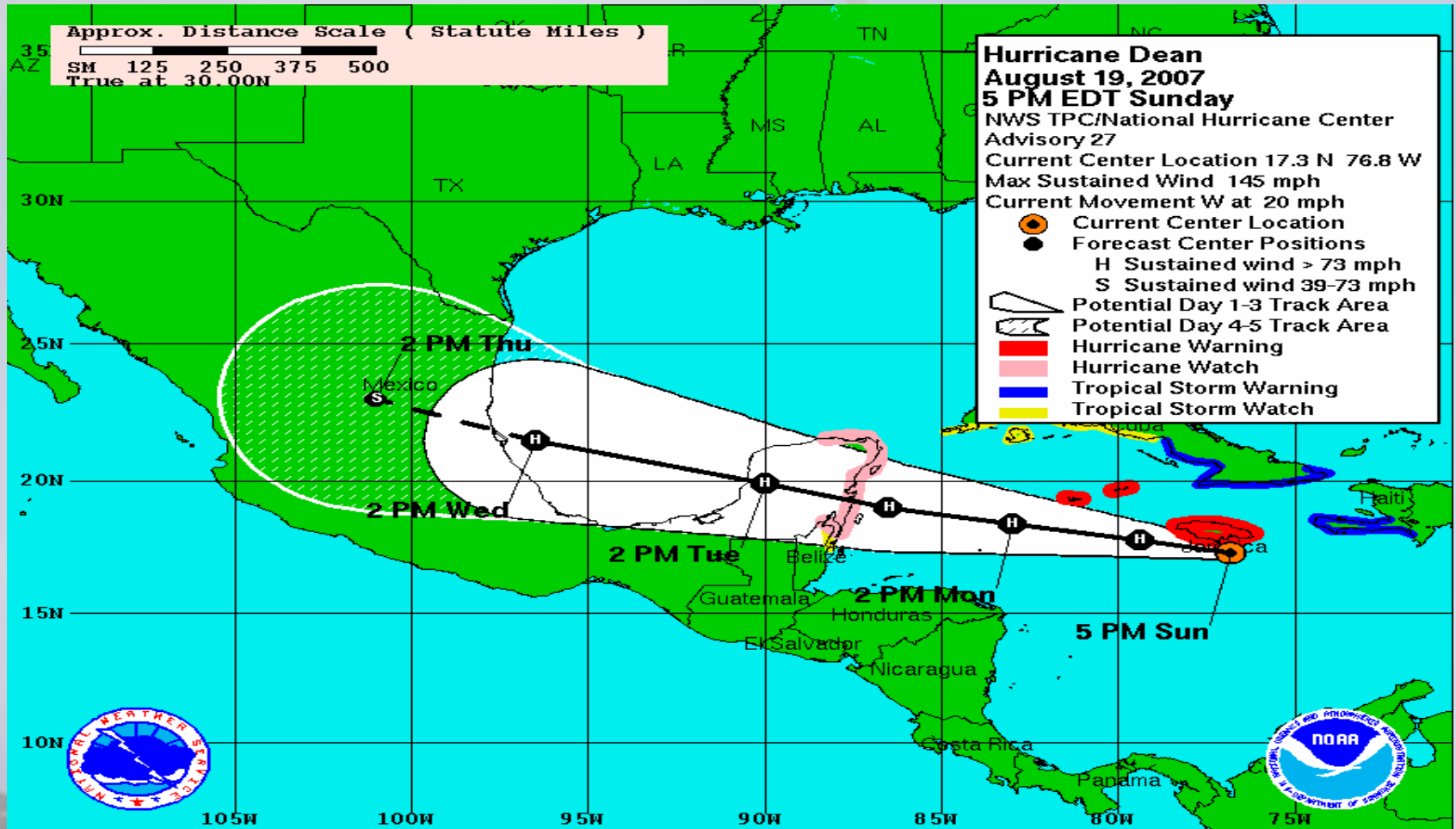


# Hurricane Ivan Experience

- Meteorological Office of Jamaica
- Issued a letter indicating that category 5 strength hurricane winds passed the Wigton area during hurricane Ivan in September 2004
- OHL
- Some damage to OHL poles and line (31 days to repair)
- TURBINES
- An inspection team comprising two fitters and one gearbox specialist was sent from overseas
- The foundation, towers, blades, and gearboxes were not damaged
- Stress testing of turbine bolts - some bolts needed to be changed
- 17 hatch doors blown out and were replaced
- Nacelle cover locks did not hold and some doors were blown open thus there was some water damage to electrical components such as rectifiers and magnetic brakes for yaw motors
  - 3 nacelle covers replaced with new covers, fiberglass repairs effected on 12 nacelle covers and 18 cover locks changed



# Hurricane Dean Path



# Hurricane Dean Experience

- Meteorological Office of Jamaica
- Issued a letter indicating that category 4 strength hurricane winds passed the Wigton area during hurricane Ivan in August 2007
- OHL
- Some damage to OHL poles and line (14 days to repair)
- TURBINES
- An inspection team comprising two fitters from overseas and three Wigton technicians
- The foundation, towers, blades, and gearboxes were not damaged
- There were fibreglass damage to 9 turbines
- Nacelle cover open thus there was some ingress of water damage. However, no damage to critical components
- 5 Damaged air traffic warning lights



# AN OPPORTUNITY



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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 CO<sub>2</sub> 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

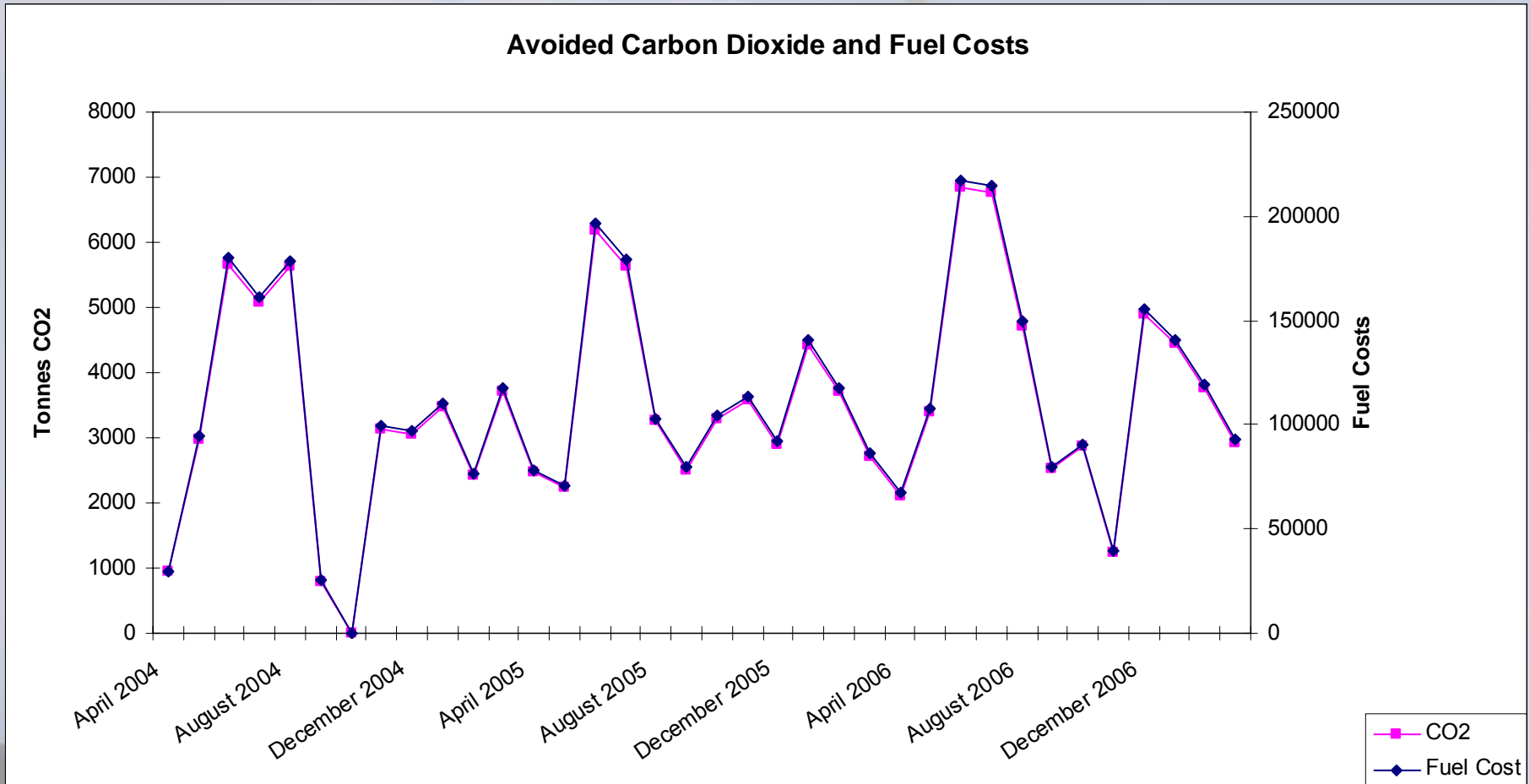


# PERFORMANCE



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# Wigton Performance



THANK YOU



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