Hull Wind

A Community Gets Green

Community Wind Power
National Renewable Energy Laboratory
September 18, 2012

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www. ActionforCleanEnergy.org

"A non-profit helping citizens and communities get green…"

1990 GM SunRayce WPI Starduster

1990 GM SunRayce WPI Starduster

1 kW solar array

5 kWh AgZn battery

Top speed: 70 mph

80+ mpg equivalent

1650 miles

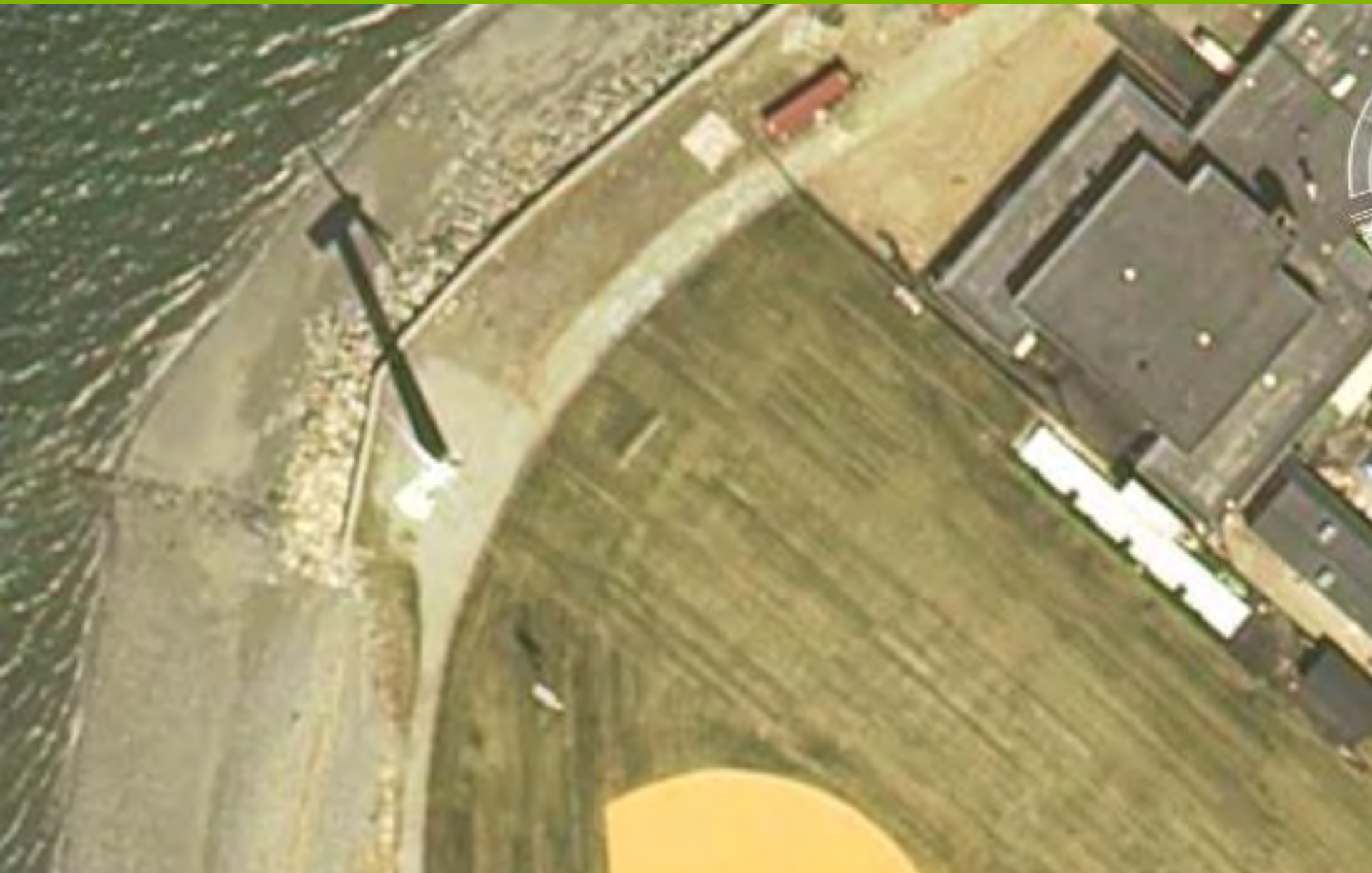
32 colleges

MIT Solar House -2007 DOE Solar House

- Competed in 2007 in Washington DC
- 800 sq ft -2 br, full bath
- 9 kW of solar PV
- Solar thermal heating/hot water
- Passive cooling elements
- Radiant floor heating
- Recycled & quick growth building materials –bamboo and wheat board

Hull Wind 1

Hull Wind 1 – Google Earth



Hull Wind 1 – from an airplane

Hull wind project started in 1997

CARE – Citizen Advocates for Renewable Energy

Hull 1 - 660 kW – Dec 27, 2001

- 1,500 MWh/year – 16,311 MWh to date
- Equivalent to 250 home's usage
  - ~ 3% of Hull
- Annually Offsets:
  - 1,200 tons CO2
  - 7 tons SO2
  - 5 tons NOx

Hull 1 - 660 kW – Dec 27, 2001

- Cost: $780,000.00
- Town Paid Cash
- Paid for itself in under 5 yrs through energy costs saved and incentives
- Incentives
  - Federal REPI ~ 1.9 ¢ /kWh
  - Voluntary mkt RECs ~ 3.0 ¢ /kWh

Hull Wind 2

Hull Wind 2– constructed 2006

- Hull 2 commissioned in May 2006
- 95% approval of the residents of Hull, MA
- 4,200 MWh/year – 22,967 MWh to date

Hull Wind 2 – Vestas V80 1.8MW

- $3,000,000.00 cost to install atop a landfill
- Hull and Harvard U. ink 10-year REC deal
  - 42,000 MWh RECs = $1,500,000.00

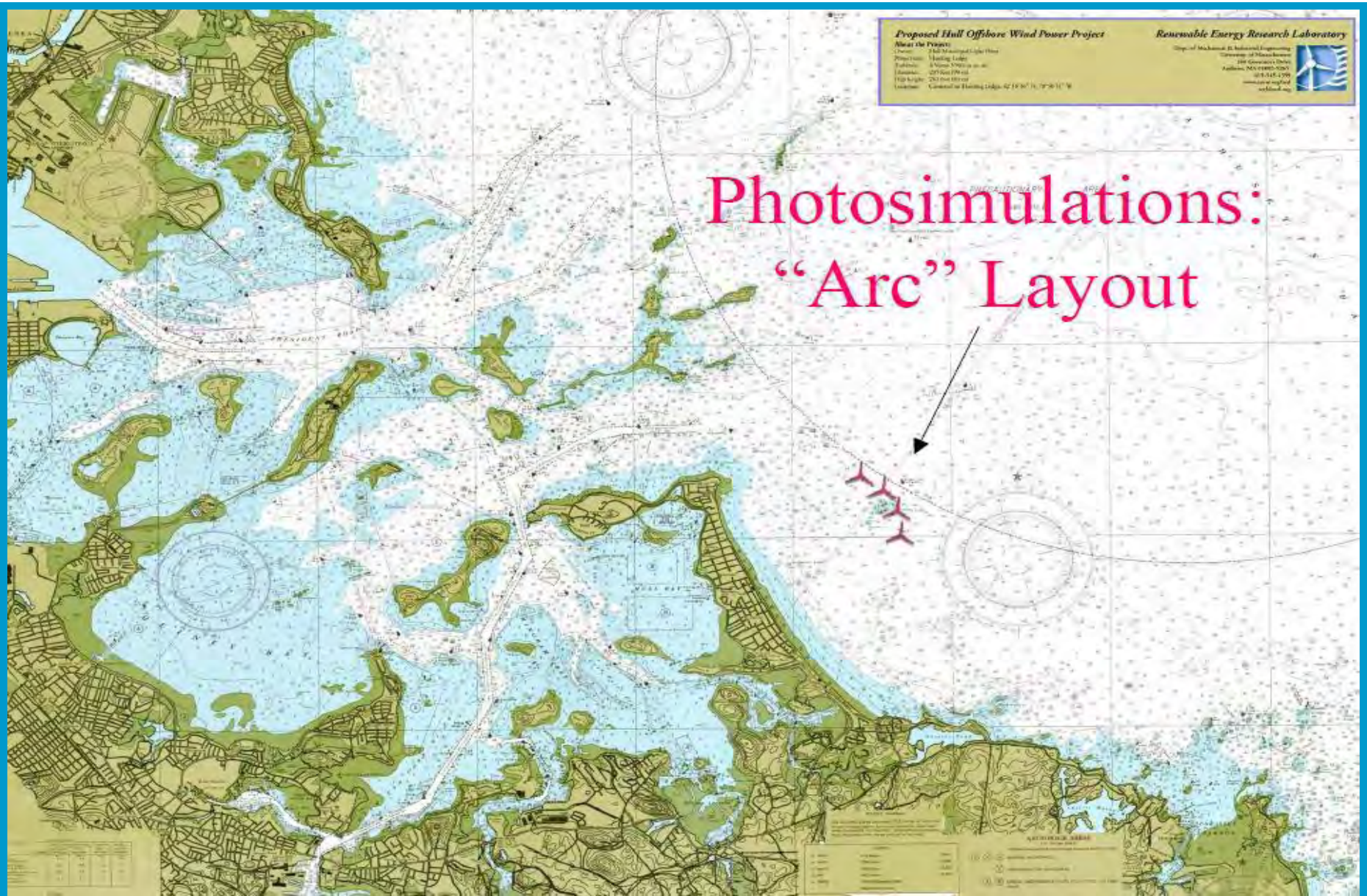
Hull Wind 1 and Hull Wind 2 contribute over 11% of Hull's entire electric load !

Hull 1

Hull 2

Hull plans on 4 off shore turbines for approx 100% of entire town load ~ 2009.

Hull offshore started permitting 2008



Hull's proposed offshore project ~ 15MW

- Four wind turbines
- 3-5 MW (295' - 417' rotor diameter)
  - Hull Wind 2: 1.8 MW, 262' rotor
- Installed in vicinity of Harding Ledge
- 12 -20 MW total generating capacity
- Energy production (on average) could approach 100% of Hull's annual electricity consumption

Photo Simulation: (Clarion)

Photo Simulation of Hull Offshore Wind Power Project

Renewable Energy Research Laboratory

About the Project:

Owner:	Hull Municipal Light Plant
Project site:	Harding Ledge
Turbine:	Vestas V90
Diameter:	295 feet (90 m)
Hub height:	262 feet (80 m)
Location:	42°18'16.2" N, 70°50'50.5" W

About the Photo:

Viewpoint:	Clarion Hotel, second floor
Distance to turbine:	~2.2 miles
Angle of View:	~38 degrees
Location:	42°16'29.8"N, 70°51'41.6" W
Base Photo:	Taken Dec. 20, 2006, #30

Apparent size and location of the turbine from this viewpoint is determined geometrically using EMD WindPro software.

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Hull has won several awards

AWEA

EPA

Mass Municipal Assoc.

Mass Congressional Award

Clean Air – Cool Planet

DOE

Challenges for Community Wind

- Community Support & leadership
- Site
- Resource: Wind
- Assessment: Economic & Technical
- Financing & Investment
- Project Ownership

Challenges for Community Wind

Community Support & leadership

- Local champions – educated leaders
- Favorable community support
- Outreach meetings

Challenges for Community Wind

Site

- Municipally owned?
- Access to roads, electricity
- Not sensitive to wildlife, wetlands

Challenges for Community Wind

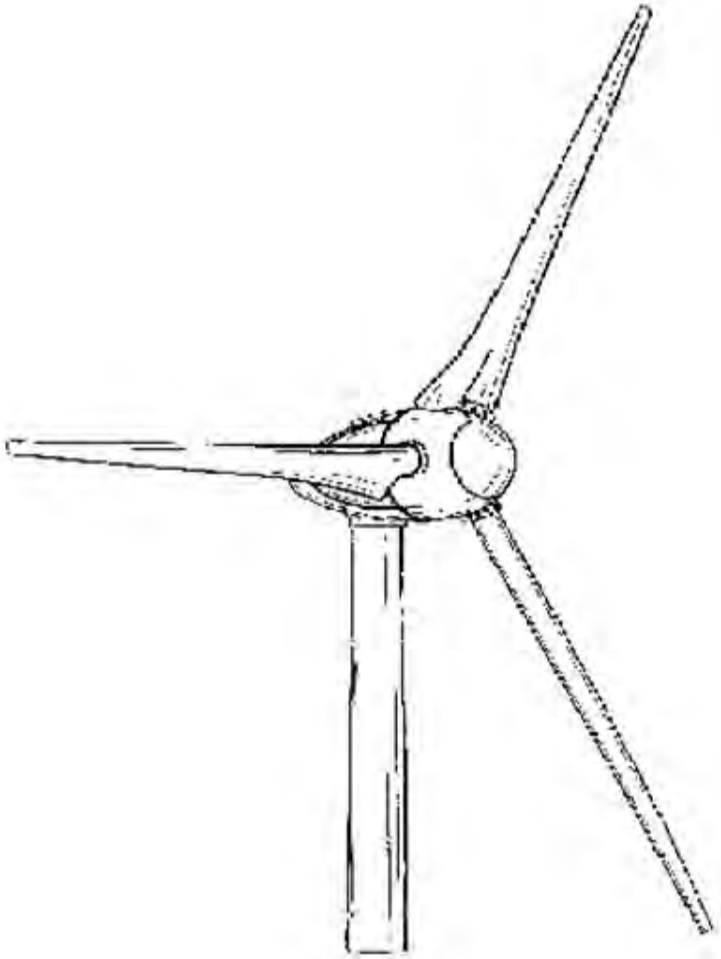
Resource

- 6.5 m/s annual average wind speed
- 1+ years of wind data @ hub height
- Not sensitive to wildlife, wetlands

Wind Development

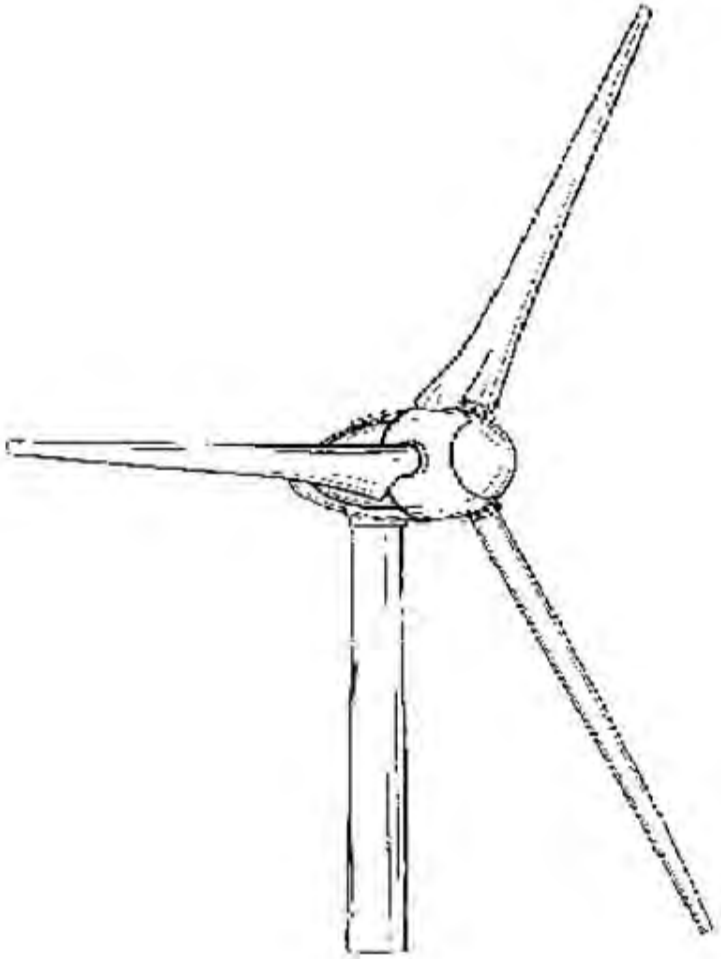
✓Overview of the Development Process

Overview of the development process



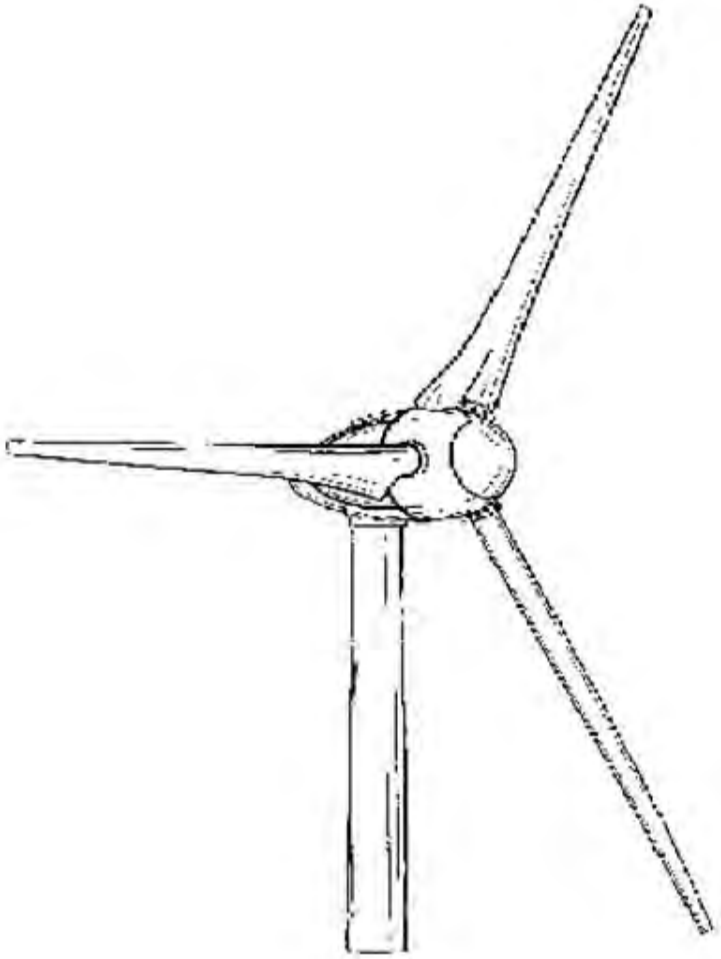
- Conduct Preliminary Site Characterization
- Analyze the wind resource
- Review the available wind data to determine the wind speed and reliability within the proposed project site which is ascertained through meteorological towers installed on the project site.
- Establish the economics of the project
- Inputs such as wind analysis, PPA price
- Conduct critical environmental issues analysis and identify regulatory framework and other considerations

Overview of the development process



- Conduct transmission capacity analysis
- Critical Environmental Issues Analysis
- Required permits, licenses, and regulatory approvals
- Threatened or Endangered Species or Habitat
- Avian and Bat Species or Habitat
- Wetlands and Protected Areas

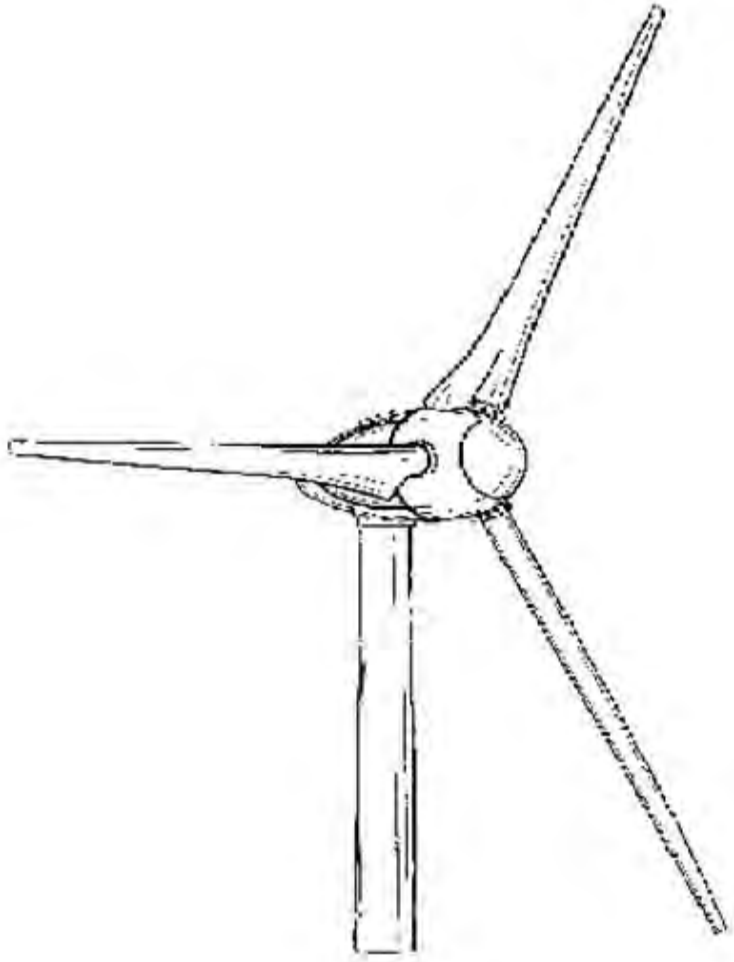
Overview of the development process



Land development constraints (state and local standards)

- Noise limits
- Setback requirements
- Floodplain issues
- Height restrictions
- Zoning constraints

Overview of the development process



Land development constraints (state and local standards)

- Noise limits
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- Floodplain issues
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- Zoning constraints

- Land acquisition
- Power contracts
- Financing
- Engineering Procurement Construction (EPC) contract negotiation
- Transmission issues
- Turbine specifications

Financial Pro forma

Nicea Project	Start Up	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year7	Year 8
Electricity produced KW Hours		4020840	4020840	4020840	4020840	4008777	3996751	3984761	3972807
Electricity rate PPA		0.085	0.08755	0.0901765	0.092881795	0.095668249	0.098538296	0.101494445	0.104539279
Elecricity Revenue		$ 341,771	$ 352,025	$ 362,585	$ 373,463	$ 383,513	$ 393,833	$ 404,431	$ 415,314
Green Tag Rate		0.02	0.0204	0.020808	0.02122416	0.021648643	0.022081616	0.022523248	0.022973713
Green tag revenue		$ 80,417	$ 82,025	$ 83,666	$ 85,339	$ 86,785	$ 88,255	$ 89,750	$ 91,270
Washington State Production Incentive		$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Sale of Depreciation	$ 128,520	$ 205,632	$ 123,379	$ 74,027	$ 74,027	$ 37,014			
Total Revenues	$ 128,520	$ 632,820	$ 562,429	$ 525,278	$ 537,829	$ 512,311	$ 487,088	$ 499,181	$ 511,585
Operating expenses									
Operation and maintiance		$ 50,000	$ 51,000	$ 52,020	$ 53,060	$ 54,122	$ 55,204	$ 56,308	$ 57,434
Project MGT fee		$ 36,000	$ 36,360	$ 36,724	$ 37,091	$ 37,462	$ 37,836	$ 38,215	$ 38,597
Contingency Fund		$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 40,000
Insurance		$ 10,000	$ 10,200	$ 10,404	$ 10,612	$ 10,824	$ 11,041	$ 11,262	$ 11,487
Property tax		$ 2,316	$ 2,235	$ 2,157	$ 2,081	$ 2,008	$ 1,938	$ 1,870	$ 1,805
Lease payments		$ 7,500	$ 7,650	$ 7,803	$ 7,959	$ 8,118	$ 8,281	$ 8,446	$ 8,615
Admin/financial/legal									
Warranty expense				0					
Total operating expenses		$ 145,816	$ 147,445	$ 149,107	$ 150,804	$ 152,534	$ 154,300	$ 156,101	$ 157,938
Net Operating Income	$ 128,520	$ 487,004	$ 414,984	$ 376,171	$ 387,025	$ 359,777	$ 332,788	$ 343,080	$ 353,647
Adjustments									
Installation	$ (1,000,000)								
Development	$ (500,000)								
Finance	$ (100,000)								
Turbine	$ (2,500,000)								
USDA Grant	$ 500,000								
Bridge financing	$ 3,600,000	$ (3,600,000)							

Resources for Community Wind

AWEA Wind Siting Handbook - Nixon Peabody & Tetra Tech

http://www.awea.org/sitinghandbook/downloads/AWEA_Siting_Handbook_Feb2008.pdf

A Handbook by the Environmental Law & Policy Center

http://elpc.org/wp-content/uploads/2009/11/ELPC-Community-Wind-Book-09.pdf

Land-based Wind Energy: A Guide to Understanding the Issues and Making Informed Decisions

http://www.clfventures.org/wp-content/uploads/Wind_Guide.pdf

Novo Co - Economic and Ownership Models (wind and solar)

http://www.novoco.com/events/retc/san_francisco/2011/manual/presentations/precon/SF%202011%20-%20Ownership%20Structures%20Rev1%20%282%29.pdf

http://www.windustry.org/resources/minnesota-flip

http://www.milbank.com/images/content/9/2/926/Equipment-Leasing-May11.pdf

http://www.windpowerengineering.com/construction/ridgewind-pioneering-leaseback-and-letting-the-community-in-on-the-cake/

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