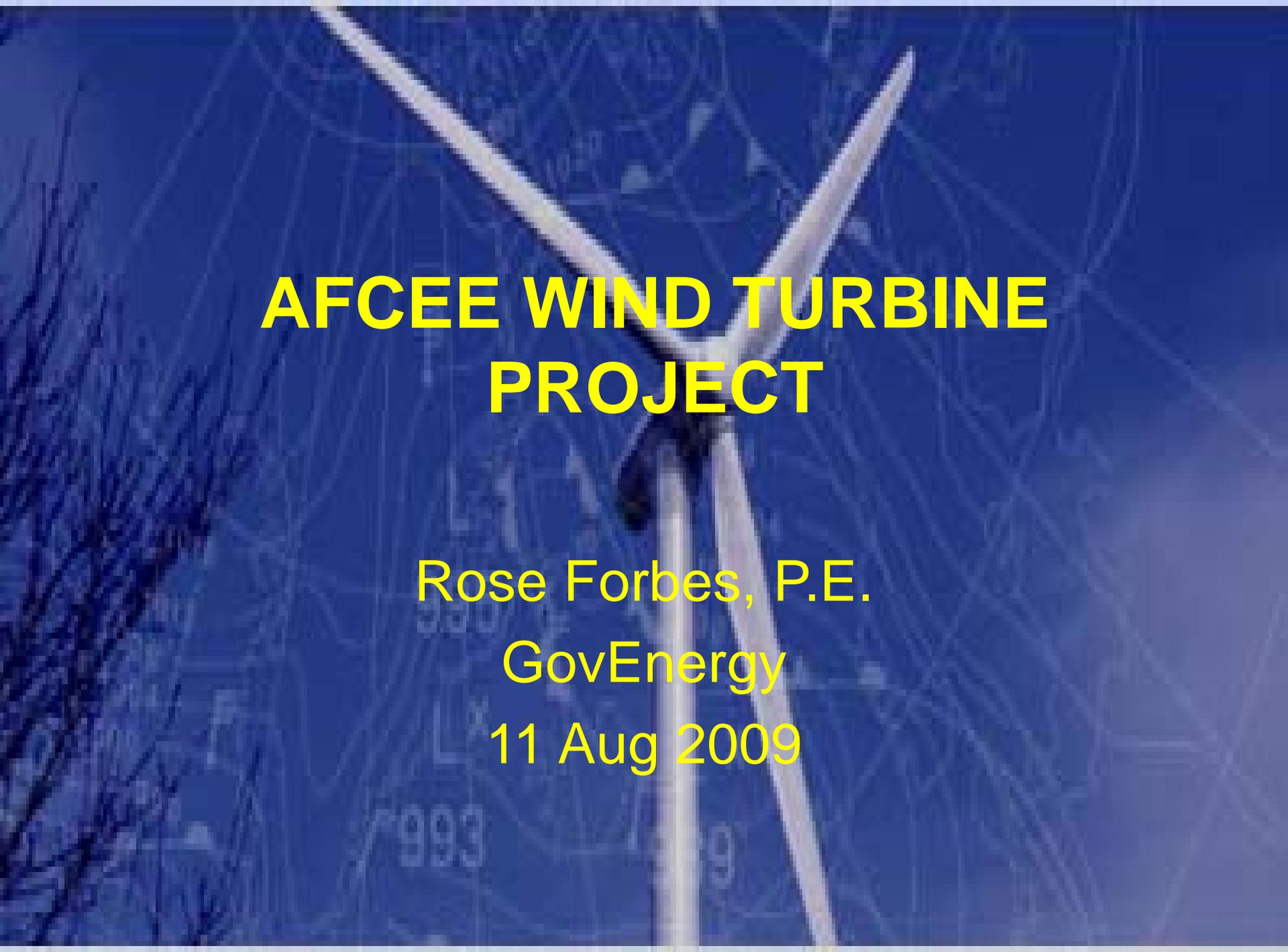


Charting a Course to Energy Independence

Providence, RI
August 9-12, 2009



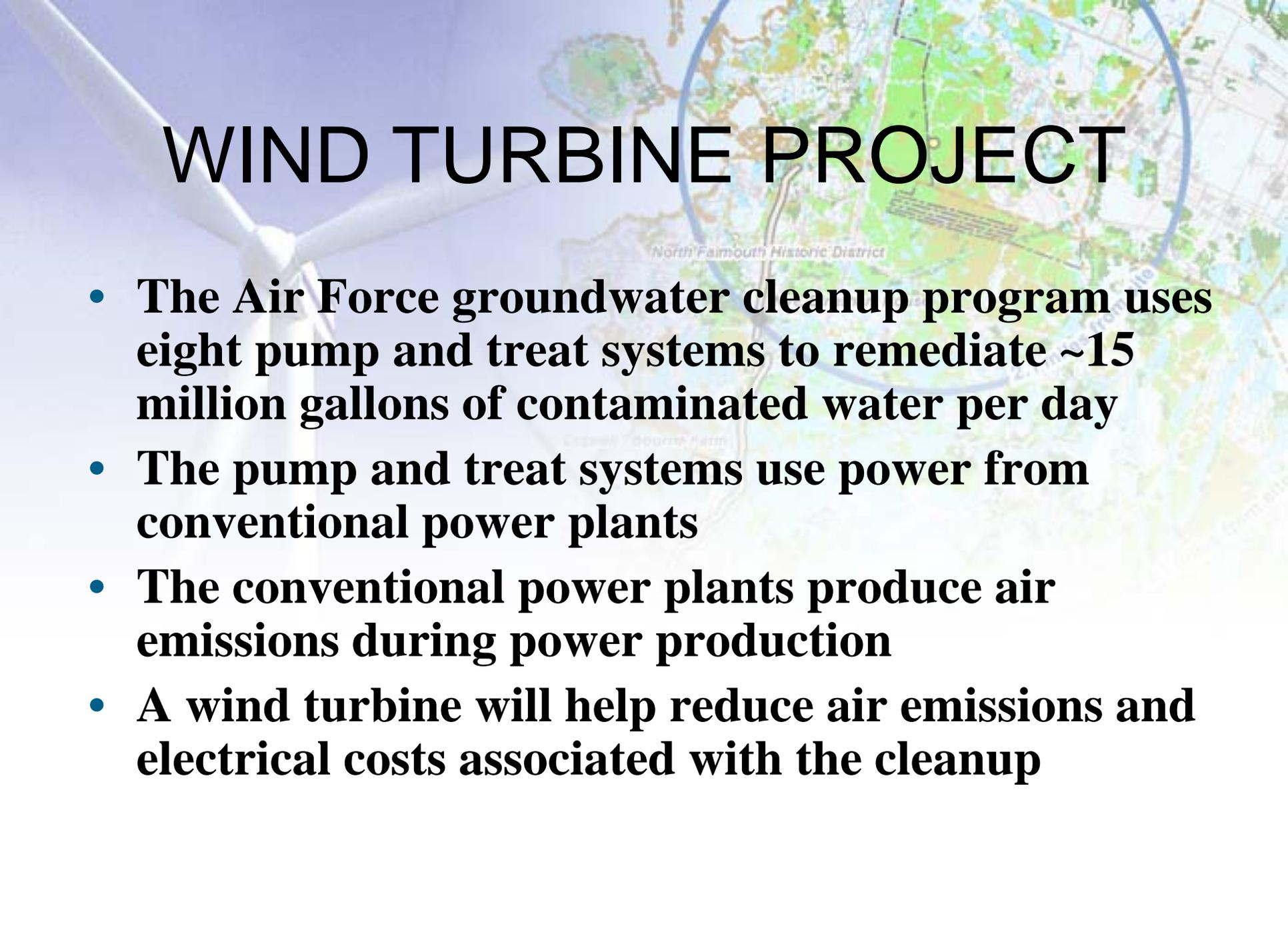


AFCEE WIND TURBINE PROJECT

Rose Forbes, P.E.

GovEnergy

11 Aug 2009

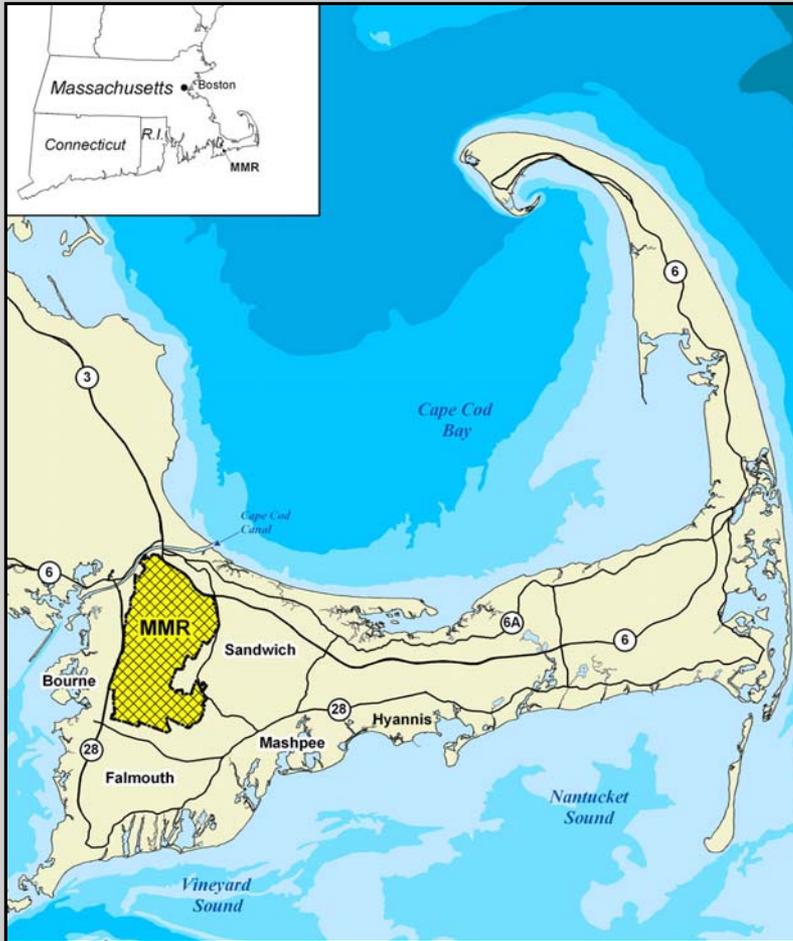


WIND TURBINE PROJECT

- **The Air Force groundwater cleanup program uses eight pump and treat systems to remediate ~15 million gallons of contaminated water per day**
- **The pump and treat systems use power from conventional power plants**
- **The conventional power plants produce air emissions during power production**
- **A wind turbine will help reduce air emissions and electrical costs associated with the cleanup**



MMR Site Overview

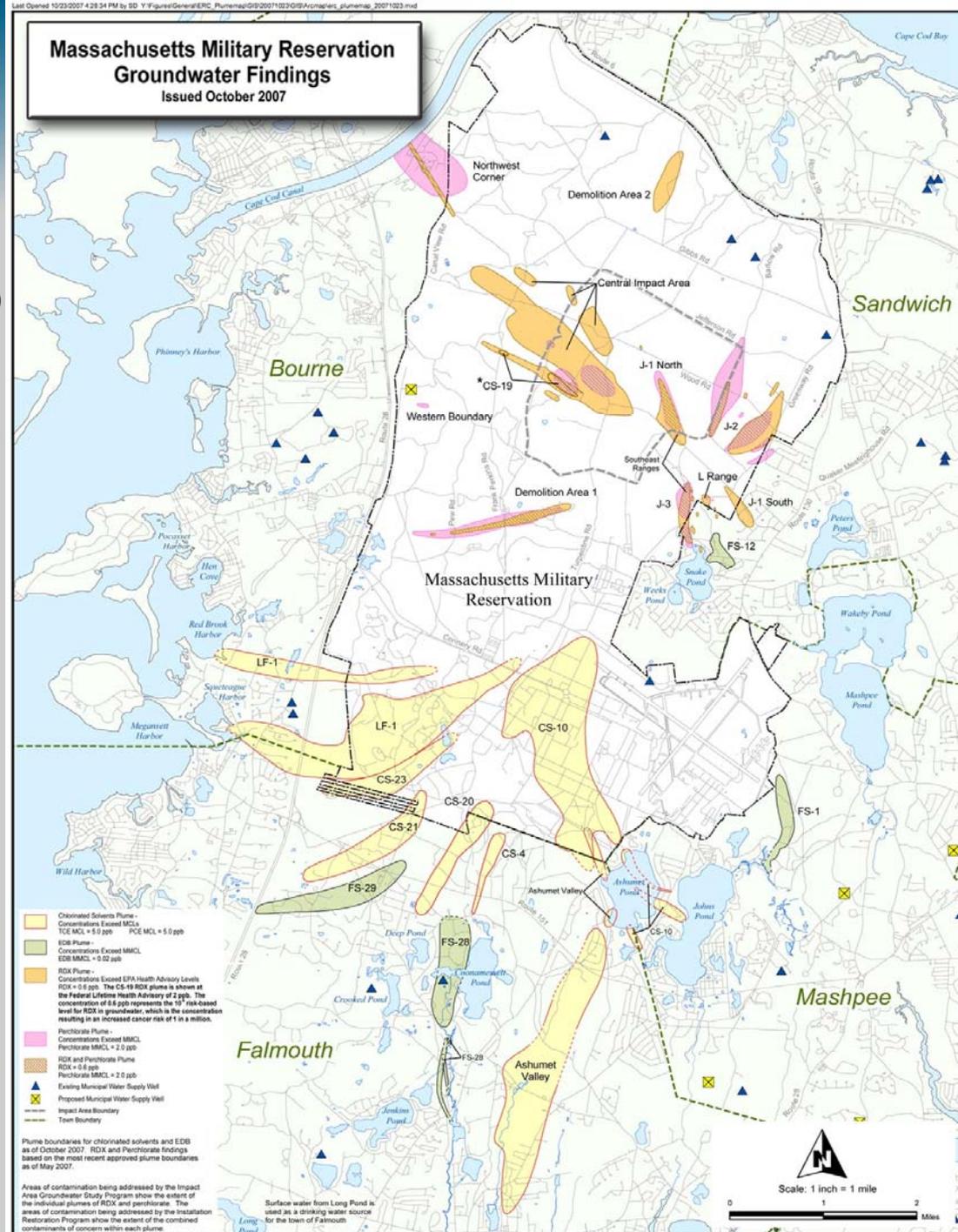


- Located on Cape Cod
- Multi-military and tenant installation
 - ❖ 6th Space Warning Squadron (PAVE PAWS)
 - ❖ USCG (Air Station Cape Cod)
 - ❖ Camp Edwards ARNG
 - ❖ Otis ANG
 - ❖ USDA, VA Cemetery
 - ❖ AFCEE, IAGWSP
- Otis – Superfund Site in 1989
- Cleanup On-going by AFCEE and IAGWSP



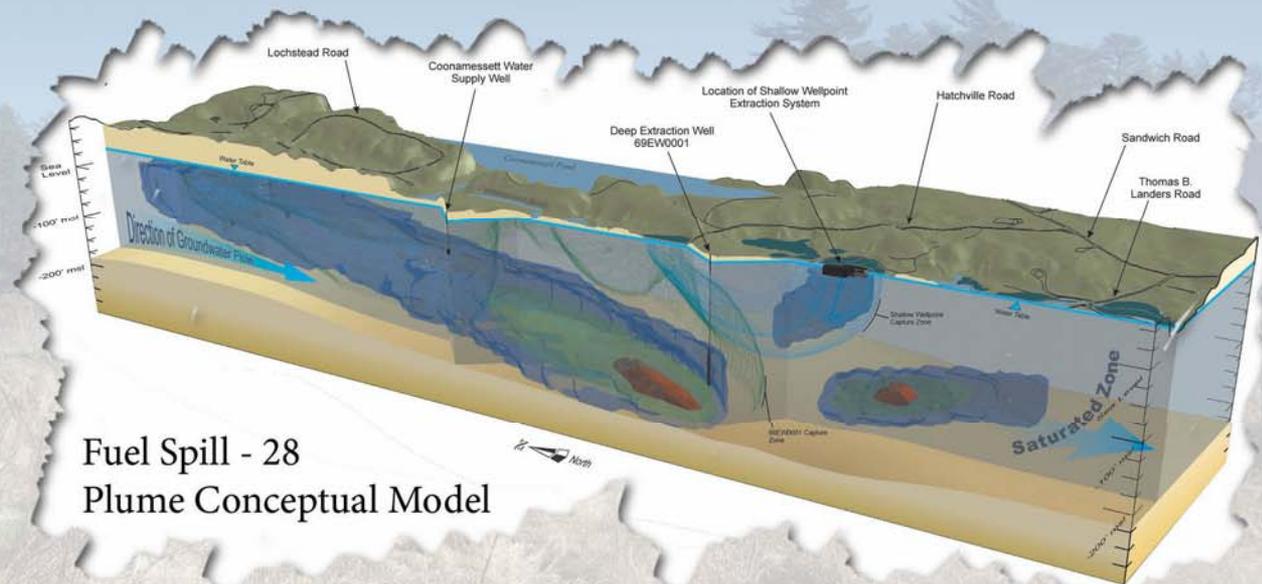
MMR Site Overview (cont)

- Site Sits Over Largest Recharge Area of the Sole Source Aquifer
- High Permeability Aquifer; Groundwater Flow Rates of Roughly 1 ft/day
- AFCEE: 12 plumes (primarily TCE, PCE and EDB)
- IAGWSP: 8 plumes (primarily explosives and perchlorate)



MMR Site Overview (cont)

- Relatively low concentrations
- Deep (>100 ft), Thick (>100ft), Long (>3 miles)
- Several migrating off-base
- Rivers, Cranberry Bogs, Ponds, Residential Wells, and PWS Wells in Area



Fuel Spill - 28
Plume Conceptual Model



MMR Site Overview (cont)

- AFCEE: 8 Groundwater Treatment Plants
 - ❖ ~100 EWs/RWs
 - ❖ Systems on and off-base
 - ❖ ~15 MGD (GAC)
- IAGWSP: 5 plants
 - ❖ ~20 EWs/RWs
 - ❖ 2 MGD (IX/GAC)
- High Level of Regulatory Oversight





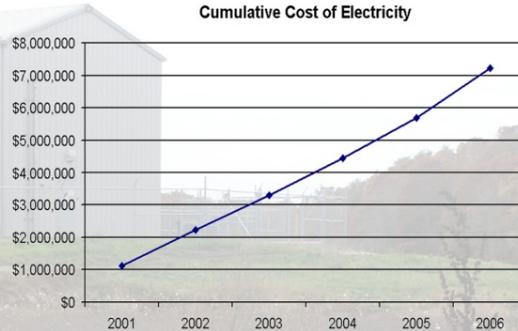
Program Energy Use and Impacts

Program Electricity Consumption

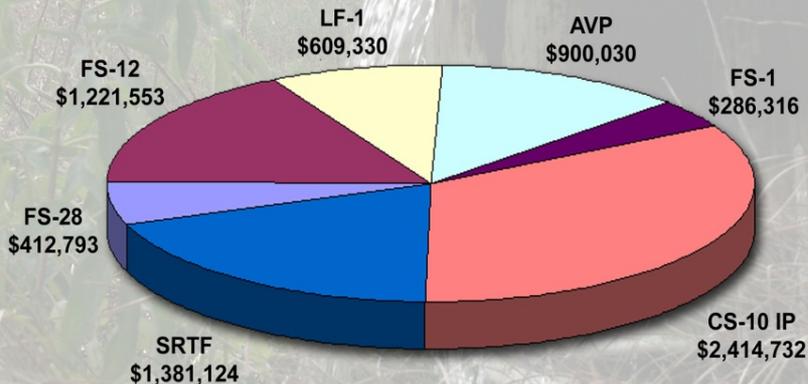
IRP Remedial System (2001-2006)

Electric Consumption:

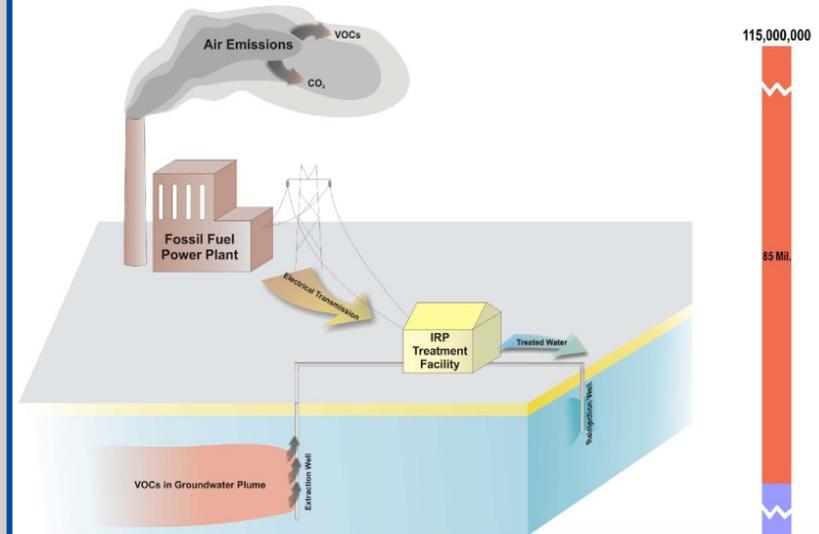
- 61 Million kW - hrs
- Electricity cost from 2001-2006: \$7.2 Million
- Electricity 2006: \$1.5 Million
- Program annual consumption equivalent to providing power to approximately 1,000 average American homes



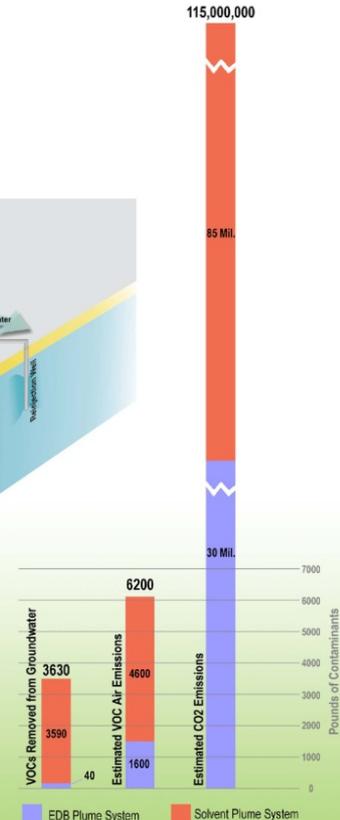
IRP Program Electricity Costs by Treatment System



Impacts of Electricity Generation



Electricity Generation to Power IRP Remedial Systems Results in Air Emissions Including Greenhouse Gases



Electrical Generation Emissions vs. Groundwater Contaminant Removal MMR Remedial Systems 2001-2006



- Expected to generate 25-30% of AFCEE's total electrical requirement

- Expected to reduce ~25-30% air emissions

Green Power: Wind Turbine Coming Soon !

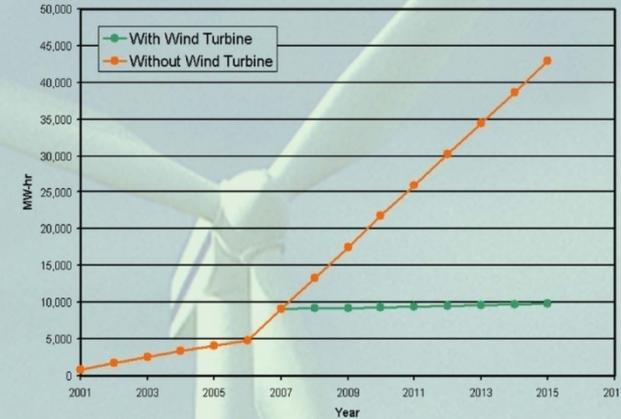
Purpose of Project:

- Generate electricity using renewable energy to reduce cost
- Offset air emissions from commercial plants
- Expected to provide 25% of Program electrical needs



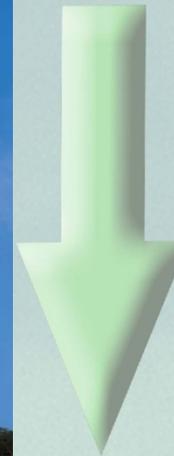
Artist rendering - not to scale

LF-1 & Hunter Avenue Treatment Facility Net Electricity Purchase Projections



Air Emission Reductions (Pounds Per Year)

- CO₂: 6,741,300
- NO_x: 11,833
- SO₂: 11,443
- CO: 1,112
- VOCs: 442
- PM₁₀: 418





Fuhrlander FL-1500

- Rating: 1.5 MW
- 80 m (~260 ft) hub height
- ~ 118 m (~390 ft) high from ground to tip of rotor blade
- Produce ~ 3,810 MWh yearly (29% capacity factor)
- Annual load from treatment systems ~ 12,300 MWh
- Anticipated return on investment: 6-8 years
- MA Technology Collaborative (MTC) Grant of \$300K





How the Project Started - 2005



- 2005: DERA funding applicable
- May 2005: Received preliminary approval from USCG (landowner)
- Jun 2005: Presented to 102 FW and E&RC (MA ARNG)





How It Progressed - 2006

- Feb 2006: Presented to base agencies
- Mar 2006: Plume Cleanup Team (PCT) public presentation
- Jun 2006: Wind turbine constructability assessment awarded to CH2M Hill
 - ❖ Economic analyses
 - ❖ Basis of Design
 - ❖ Environmental Assessment





Upper Cape Codder - 16 Mar 06

Base plans to construct turbine

Environmental officials overseeing the long-term cleanup of 12 pollution plumes emanating from Otis Air National Guard Base and Camp Edwards told selectmen Tuesday night that a wind turbine will be built in the hilly terrain at the installation's southern section.

The 268-foot high wind turbine would be constructed on the Massachusetts Military Reservation north of Route 151 and east of Route 25 above the Falmouth line.

"It's a high windy spot in a terrain filled with some keule holes," said Douglas Karson of the Air Force Center for Environmental Excellence. "It could generate \$100,000 in [electrical] cost savings."

Karson said the renewable project over five years would likely recoup initial capital construction costs.



A Work In Progress - 2007

- Jan 2007 – PCT and Senior Management Board (SMB) presentations
- Feb 2007 – Prepared Form 813 for EA
- 13 Mar 2007: News Release - Public comment period on MMR wind turbine project environmental assessment (EA)
- 13 Mar 2007: Paid Advertisements on 30-day public comment period for the EA in the Cape Cod Times and 4-town Enterprise Newspapers
- 19 Mar – 17 Apr 2007: EA comment period
- 2 April 2007: News Release – PCT meeting with EA presentation (The EA and directions for comment submissions placed on the IRP website).





Mashpee Enterprise (16 Mar 07)



MMR Wind Turbine Project Comment Period

Officials from the Air Force Center for Environmental Excellence are holding a 30-day public comment period, from Monday, March 19, to Tuesday, April 17, on the "MMR Wind Turbine Project Environmental Assessment, March 2007."

The environmental assessment describes AFCEE's plans to construct a wind turbine in the southwestern portion of the Massachusetts Military Reservation up to 400 feet in height.

A copy of the assessment will be available for 30-day review at the main libraries in all four Upper Cape towns. A copy is also available at AFCEE's website www.afcee.org under "Public Comment Periods."

All comments must be submitted in writing and, if mailed, post-marked no later than April 17. Only comments received during the 30-day public comment period will be considered. Comments will be responded to by letter or telephone, or in a summary document.

Those wishing to express their

view may mail written comments to HQ AFCEE/MMR, Douglas Karson, Attn: Wind Turbine E, 322 East Inner Road, Otis ANG Base, MA 02540-5028; or send their comments by fax to 508-968-4678 or by email to doug.karson@brooks.af.mil.

A public presentation on AFCEE's MMR Wind Turbine Project Environmental Assessment will be given at 6 PM on Wednesday, April 11, at Bourne Best Western, 100 Trowbridge Road, Bourne, in the downstairs function room. The presentation will be the first main agenda item of the Plume Cleanup Team's meeting. That team is a citizen advisory group to AFCEE on matters related to environmental cleanup activities under AFCEE's Installation Restoration Program.

For more information or to request a CD of the environmental assessment, contact Mr. Karson at 508-968-4678, extension 2; or at the mailing/email addresses above.

Further information about the cleanup program is available by visiting www.nm2.org.



Bourne Enterprise - 16 Mar 07

PAYED ADVERTISEMENT

Public Comment Period on MMR Wind Turbine Project Environmental Assessment

Officials from the Air Force Center for Environmental Excellence (AFCEE) at the Massachusetts Military Reservation (MMR) are holding a 30-day public comment period on the "MMR Wind Turbine Project Environmental Assessment, March 2007." The 30-day public comment period will be held from March 19 to April 17, 2007. The Environmental Assessment describes AFCEE's plans to construct one wind turbine, up to 400 feet in height, on the southwestern portion of the MMR.

AFCEE is soliciting public review and comments on the MMR Wind Turbine Project Environmental Assessment. A copy of the document will be available for 30-day review at the main libraries in the towns of Bourne, Duxbury, Mashpee, and Sandwich. A copy is also available at AFCEE's website www.mmr.gov under "Public Comment Periods." All comments submitted must be in writing and post-marked no later than April 17, 2007. To submit comments:

By mail to:
100 AFCEE/AMMR
Doug Karson
MMR Wind Turbine EA
322 East Inter Road
Otis ANU Base, MA 025-10-5028

By fax to: 508-968-4673

By e-mail to: doug.karson@brooks.af.mil

NOTE: Only comments received during the 30-day comment period will be considered. Responses to comments will be provided by letter, telephone, or in a summary document.

A public presentation on AFCEE's MMR Wind Turbine Project Environmental Assessment will be given on April 11, 2007, at 6:00 p.m., at the Best Western Hotel, 100 Trowbridge Road, Bourne, in the downstairs function room as part of AFCEE's Plume Cleanup Team public meeting. For more information or to request a CD of the Environmental Assessment, please contact Doug Karson at 508-968-4678 extension 7 or at the mailing address above. To learn more about the cleanup program, visit www.mmr.gov.



Notification and/or Approvals

- Base Agencies
- Bourne Historical Commission
- Bourne Town Planning Board
- Bourne Conservation Commission
- Bourne Police Department
- EPA/MassDEP (program regulators)
- Falmouth Historical Commission
- Federal Aviation Administration (FAA)
- Mashpee Wampanoag Indian Tribal Council Board
- Massachusetts Historical Commission
- Massachusetts State Division of Fisheries and Wildlife
- Massachusetts Technology Collaborative - Grant
- Media
- Natural Heritage and Endangered Species Program (NHESP)
- NSTAR
- Plume Cleanup Team
- Senior Management Board
- US Fisheries and Wildlife Service
- Wampanoag Tribe of Gay Head (Aquinnah), Tribal HPO

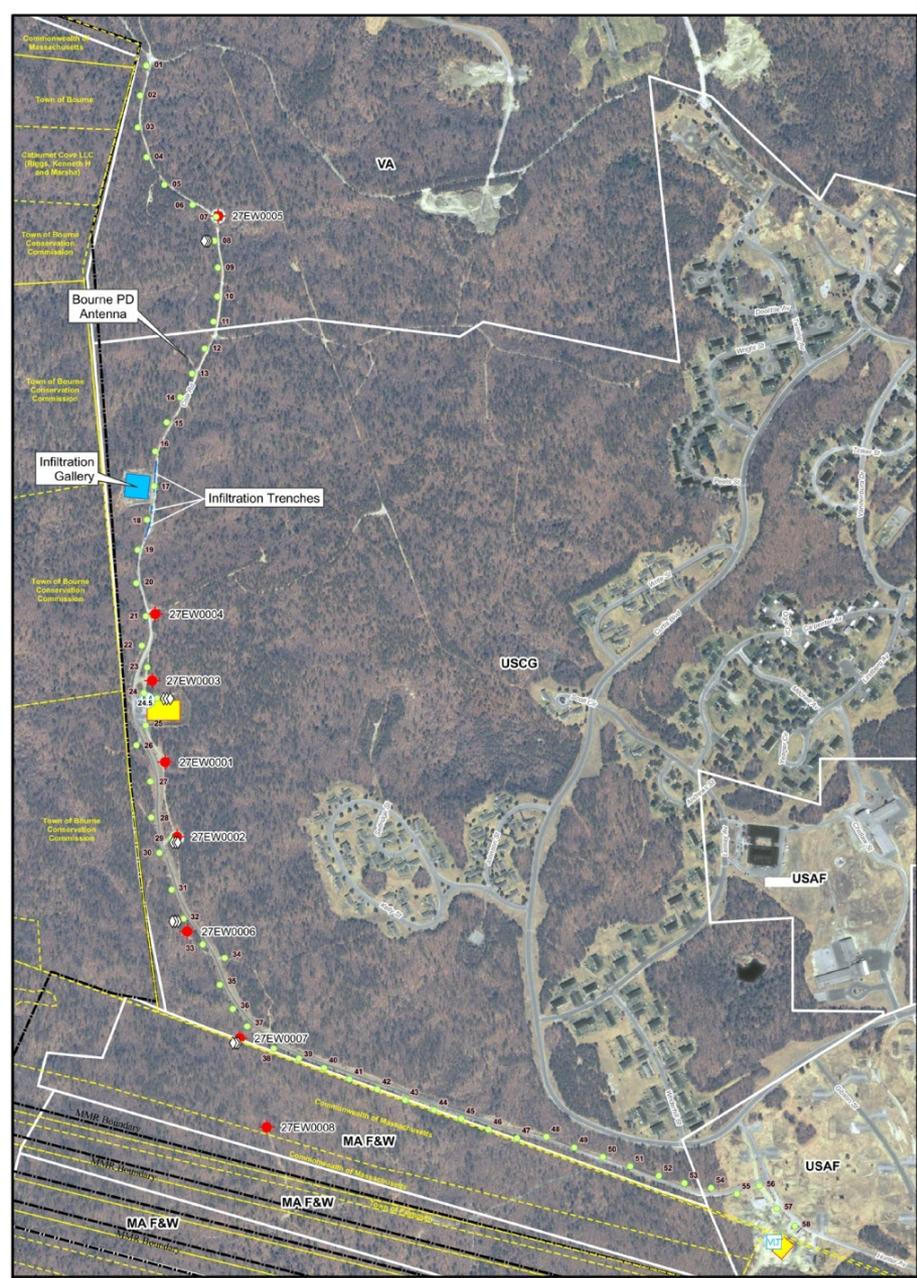




A Work in Progress (cont) – 2007/2008

- 21 Mar 2007: RFP for construction issued
- Sep 2007: Construction contract awarded to ECC
- 26 Sep 2007: News Release - contract awarded for wind turbine
- Sep 2007: PCT and SMB presentations
- May 2008: Pre-construction meeting
- 19 Nov 2008: Delivery of foundation insert





Legend

- ◆ Extraction Well
- Utility Pole
- Ⓜ Electrical Meter
- Transformers:**
- ◇ Pole-mounted Bank
- Ⓜ Pad-mounted Vault
- Infiltration Bed
- Massachusetts Military Reservation (MMR) Boundary
- ▭ Parcel
- ▭ MMR Internal Jurisdictional Boundary
- ▭ Treatment Plant

Data Source: AFCEE, MMR-AFCEE Data Warehouse
MMR boundary from MA ARNG 2004. Parcel boundaries provided by the towns of Falmouth and Bourne.
Parcel boundaries and internal MMR jurisdiction boundaries are representational and do not reflect an actual field survey.

**LF-1/HUNTER AVENUE AREA
UTILITY NETWORK**
AFCEE - Massachusetts Military Reservation

CH2MHILL

Legend Data Source: AFCEE, MMR-AFCEE Data Warehouse
2005 Aerial Photography from MassGIS

FIGURE 1-2
PROPOSED PROJECT SITE
AFCEE - Massachusetts Military Reservation
Wind Turbine Project

0 50 100 Feet

CH2MHILL



Foundation Construction

30 March 2009

57' diameter
3' to 8' high,
600 yd³ 5000 psi concrete





What's Left To Do

- Tower delivery end of July
- Blades: beginning of August
- Crane: early/mid August
- Nacelle: late Aug 2009
- Assembly in August
- Commissioning mid-September
- Celebrate





Notable Issues/Advice

- Never too soon to coordinate with stakeholders; communicate early and often – base missions, radar, FAA
- Understand net-metering, RECs, and state rules
- Utility Interconnection – build in time and \$ for the utility company (planning, equipment, changes)
- Logistics - room to haul and build (bridges, road width, corners, permits, Military Cargo Preference Act of 1904, etc)
- Explore additional grants - MMR project received \$300K from state renewable program



Notable Issues/Advice

- Construct foundation in cool weather and allow time to achieve strength
- Long lead time on turbines - explore interest from manufacturers
- Plan submittals and have a submittal register
- Use existing wind resource data and other studies if available
- Long Haul Project – better have a dedicated champion
- Evaluate warranties and service contracts in advance
- Consult experts (i.e. DOE) on funding mechanisms (EULs, ESPCs, tax credits)
- Take lots of photos and video ☺



QUESTIONS/COMMENTS?

rose.forbes@brooks.af.mil

www.mmr.org





- Backpocket slides



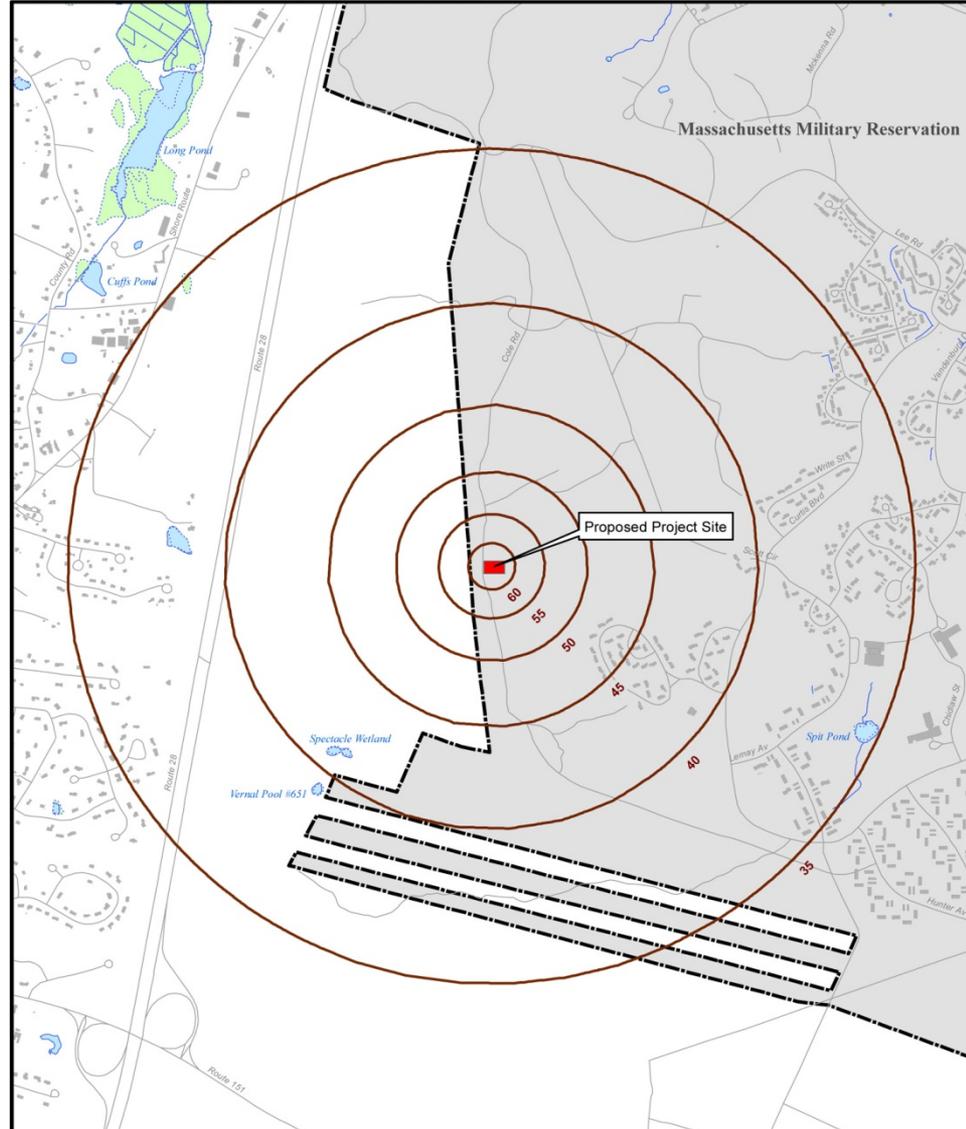
Fuhrlaender FL-1500

- 80 m (~260 ft) hub height
- ~ 118 m (~390 ft) high from ground to tip of rotor blade
- 77 m (~253 ft) rotor diameter (blades are 37.5 m long (123 ft); epoxy/glass fiber)
- Speeds:
 - ❖ Rotational speed: 9.7-19 rpm
 - ❖ Avg site wind speed ~ 6.5-7.0 m/s (14.5 – 15.7 mph) at 80 m hub height
 - ❖ Rated output @ 11 m/s (~25 mph)
 - ❖ Start wind @ 3 m/s (6.7 mph)
 - ❖ Stop wind @ 20 m/s (~45 mph)
 - ❖ Survival speed @ 59.5 m/s (133 mph)
- Weights:
 - ❖ Rotor: 34,000 kg (74,800 lbs; ~ 37 tons)
 - ❖ Nacelle: 66,225 kg (146,000 lbs; ~73.3 tons)
 - ❖ Tower: 243,714 kg (~536,000 lbs; ~268 tons)
 - ❖ Insert: 8181 kg (18,000 lb ; 9 tons)





- Noise Analyses in EA



Legend

- Proposed Wind Turbine Site Location
- Building
- Massachusetts Military Reservation Boundary
- Noise Contour (5 dBA Interval)
- Bog/Wetland

Data Source: AFCEE, MMR-AFCEE Data Warehouse

0 670 1,340 Feet

FIGURE 7-2
PREDICTED MAXIMUM NOISE CONTOURS (dBA)
AFCEE - Massachusetts Military Reservation
Wind Turbine Project



Visual Assessment - GIS

Last Opened 2/23/2007 2:04:45 PM by SD Y:\Figures\SP\EMLF12007\WindTurbine\GIS\Arcmap\F1_WindTurbine_Fig05-03.mxd



Legend

- Massachusetts Military Reservation
- Town boundary
- Proposed Wind Turbine Site
- Historic Location (Federal, State, or Local)
- Historic Area (Federal, State, or Local)

Potential Visibility Based on Viewshed Analysis to 120 Meter Tip Height

- Visible based on terrain elevation and limited land cover
- Not visible, line of sight blocked by terrain
- Potentially visible but with seasonal screening by deciduous forest cover
- Potentially visible but with year round screening by evergreen forest cover
- Potentially visible but with seasonal screening by mixed forest cover
- Potentially visible but with screening by low intensity development
- Potentially visible but with screening by medium intensity development
- Potentially visible but with screening by high intensity development
- Land cover and/or viewshed analysis data not available

Sinclair-Thomas Matrix Distance Bands*

- Band A, 0-2.1 miles distant
Potential for dominant impact due to large scale, movement, and proximity
- Band B, 2.1-4.1 miles distant
Potential for major impact due to proximity
- Band C, 4.1-6.7 miles distant
Potential for being clearly visible with moderate impact

*Extrapolated for 80m hub height



Data Source: AFCEE, November 2006, MMR-AFCEE Data Warehouse
Viewshed analysis based on 3 meter contour data provided by MassGIS.
Historic places also provided by MassGIS. MMR boundary from MA ARNG 2004.
State Historic Districts - Massachusetts Historical Commission. This is a beta version and does not reflect listings past 1997. Users should consult the most recent State Register of Historic Places (available at the State House Bookstore) for updates. Listings are regularly updated in the weekly State Register.
Land cover data and classifications from the National Land Cover Database 2001 land cover layer, zone 65, 30 meter resolution, produced by the MRLC (Multi-Resolution Land Characteristics) Consortium.

FIGURE 6-3

POTENTIAL PROJECT VISIBILITY
AFCEE - Massachusetts Military Reservation
Wind Turbine Project



Contracting Mechanisms

- Constructability Assessment, Environmental Assessment/FONSI, Design Package, Title II Oversight
 - ❖ AFCEE 4PAE Task Order awarded to CH2M Hill, Inc
 - ❖ Time and Materials
 - ❖ \$408K
- Construction and 6 months O&M
 - ❖ AFCEE Heavy Engineering, Repair and Construction (HERC) Task Order awarded to Environmental Chemical Company (ECC)
 - ❖ Competitive Firm Fixed Price
 - ❖ \$4.6M