Distributed Wind Workshop for Federal Agencies

Washington Marriott at Metro Center
February 27, 2018
PNNL-SA-132419
Introductions

Name

Agency

What is one thing you like to do in your spare time?
Welcome

- Patrick Gilman
  U.S. Department of Energy Wind Energy Technologies Office
Agenda

- Distributed Wind Overview - *What is Distributed Wind?*
- Project Development and Implementation Process
  - Initial Screening
  - Form Project Team
  - Project Validation
- *Networking Break*
- Project Development and Implementation Process Continued
  - Procurement
  - Construction and Performance Period
- FEMP Resources
- Joint Base Cape Cod Case Study
- Civilian Agency Case Studies
- Wrap up / Feedback / Final Questions
What is Distributed Wind?

Project Types

David Schulz

Jeff Lederman / Minnesota
Pollution Control Agency

Stephen Mellin / Joint Base Cape Cod

Lauren Powell / One Energy LLC

Jake West / Van Wall Energy

Weaver Wind Energy
What is Distributed Wind?

Behind the meter and local vs. wind farms

Wind Farm

Behind the meter
What is Distributed Wind?

Installed Capacity

Distributed Wind Capacity by State
2003-2016 Cumulative
What is Distributed Wind?

Installed Capacity

Distributed Wind Capacity
by Turbine Size
2003-2016
What is Distributed Wind?

Benefits

- Resiliency and energy security
- Avoids transmission constraints
- Displace high or rising energy costs
- Multi-purpose land use
- Meet federal renewable energy goals, mandates, and targets
Small Wind Manufacturing
U.S. Supply Chain
On-Site Project Implementation Process

Phase 1: Initial Screening
Phase 2: Form a Strong Project Team
Phase 3: Project Validation
Phase 4: Procurement
Phase 5: Construction and Performance Period

Courtesy of FEMP
Initial Screening
Wind Resource, Electricity Rates, and Policy Environment
Initial Screening
Wind Resource Assessment

▶ Wind resource maps (free)
   https://windexchange.energy.gov/maps-data

▶ Wind Prospector (free)
   https://maps.nrel.gov/wind-prospector

▶ Work with an Installer (cost)
   https://openei.org/wiki/Distributed_Wind_Installers

▶ AWS Truepower (cost)
   https://www.awstruepower.com/software/wind-data-reports/
Initial Screening
Policy Environment
http://www.dsireusa.org/
Initial Screening
Retail Electricity Rate

- Review site utility bills
- U.S. Utility Rate Database
  https://openei.org/apps/USURDB/
- U.S. EIA
  https://www.eia.gov/electricity/data.php
Initial Screening

Other Considerations

- Land Availability
- Project Purpose / Mission Compatibility
- Stakeholder buy-in
  - On-site, internal to agency, and other relevant agencies
  - The public / surrounding community
Initial Screening
Objectives

- Is this wind resource sufficient? Go / No Go decision.
- Does the project have the potential to be cost effective?
Initial Screening

Does the Project have the Potential to be Cost Effective?

https://wind.pnnl.gov/pdf/PTP_PolicyTool.swf
Initial Screening

Does the Project have the Potential to be Cost Effective?

https://wind.pnnl.gov/pdf/PTP_PolicyTool.swf
On-Site Project Implementation Process

Phase 1
Initial Screening

Phase 2
Form a Strong Project Team

Phase 3
Project Validation

Phase 4
Procurement

Phase 5
Construction and Performance Period

Courtesy of FEMP
Form a Strong Project Team

Agency Team

- Energy Champion
- Contracting Officer
- FEMP, RE Expert
- Utility Representatives
- External Experts
- DLA Energy, GSA, WAPA, other
- Other Stakeholders
- Finance Accounting
- Legal
- Real Property
- Environmental Sustainability
- Site Operations Planners
- Electrical Engineer Technical Staff

Form a Strong Project Team

- Leadership
- Agency Team
- External Experts
- Utility Representatives
- Other Stakeholders
- Finance Accounting
- Legal
- Real Property
- Environmental Sustainability
- Site Operations Planners
- Electrical Engineer Technical Staff

Courtesy of FEMP
On-Site Project Implementation Process

1. Phase 1: Initial Screening
2. Phase 2: Form a Strong Project Team
3. Phase 3: Project Validation
4. Phase 4: Procurement
5. Phase 5: Construction and Performance Period

Courtesy of FEMP
Project Validation

- Costs and project economics
- Project sizing and siting
- Turbine technology
- Compliance
- Evaluating project financing options
- Other considerations
Small Wind Turbine System Equipment and Balance of Station Costs on a per kW basis

- Residential: 448.4 kW, 57 projects
  - 0 – 20 kW
- Commercial: 1,083 kW, 13 projects
  - 21 - 100 kW

Costs include:
- Customer Acquisition and Qualification
- ZPII
- Engineering and Design
- Transportation and Logistics
- Foundation
- Electrical Infrastructure
- Installation
- Taxes
- Other Costs
- Overhead and Profit
- Turbine System Equipment
Small Wind Turbine System Equipment and Balance of Station Costs on a Percentage basis

- Residential: 0 – 20 kW (448.4 kW, 57 projects)
- Commercial: 21 - 100 kW (1,083 kW, 13 projects)

Cost Components:
- Customer Acquisition and Qualification
- ZPII
- Engineering and Design
- Transportation and Logistics
- Foundation
- Electrical Infrastructure
- Installation
- Taxes
- Other Costs
- Overhead and Profit
- Turbine System Equipment
### Project Validation

#### Installed Project Cost Examples

<table>
<thead>
<tr>
<th>100 kW turbine</th>
<th>Urban Recycling Plant 2014</th>
<th>New England Farm 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>120 ft (37 m) tower</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cost</td>
<td>$729,000 ($672,215)</td>
<td>$513,265 ($456,765)</td>
</tr>
<tr>
<td>Total Cost per kW</td>
<td>$7,290</td>
<td>$5,132</td>
</tr>
<tr>
<td>Turbine and Tower Equipment</td>
<td>$294,000</td>
<td>$294,000</td>
</tr>
<tr>
<td>Taxes</td>
<td>$7,000</td>
<td>$0</td>
</tr>
<tr>
<td>Transportation and Logistics</td>
<td>$8,400</td>
<td>$5,000</td>
</tr>
<tr>
<td>Zoning, Permitting, Inspection, Interconnection, and Incentives</td>
<td>$109,315</td>
<td>$7,315</td>
</tr>
<tr>
<td>Engineering and Design</td>
<td>$29,000</td>
<td>$2,200</td>
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<tr>
<td>Other Costs</td>
<td>$20,000</td>
<td>$11,000</td>
</tr>
<tr>
<td>Installation</td>
<td>$204,500</td>
<td>$137,250</td>
</tr>
</tbody>
</table>
Project Validation

Distributed Wind Installed Costs

Figure 42. Installed wind power project costs by project size: 2016 projects

Source: Berkeley Lab
Project Validation
Operations & Maintenance Costs

https://www.nrel.gov/analysis/tech-cost-om-dg.html
Project Validation

Project Sizing and Siting

- Project Sizing
  - Size to
    - Meet on-site load (net zero)
    - Net meter
  - Site and turbine suitability

- Siting rules of thumb
  - Site a small wind turbine a minimum of 30 feet higher than obstructions within 500 feet
  - Setbacks
  - Trees will grow, but the tower never will!
Site Suitability
Built environment and rooftops

Simulation of wind flow around a building
Estimated Monthly Generation: ~100 kWh
Actual Monthly Generation (March 2015): 0.11692 kWh
Cost: ~$100,000
Payback: NONE

Not recommended!
Turbine Suitability
Certification

What is Certification?

- The formal process through which an independent organization performs conformity assessment of a product to established criteria in industry standards.

Why is it Important?

- Certification helps prevent unethical marketing and false claims, ensuring consumer protection and industry credibility.
- Allows for apples-to-apples comparisons for consumers.
- Consumer can be individual or agency (public funds).
- Funding agencies and utilities have greater confidence that wind turbines installed with public funds have been tested for safety, function, performance and durability and meet requirements of consensus standards.
- Some incentive programs only fund certified turbines:
  - Federal investment tax credit (ITC)
  - Interstate Turbine Advisory Council (ITAC) list.
U.S. Framework for Turbine Certification
Previous DOE Investment to Establish Technical Quality Assurance

Standards

Test Facilities

Certification Bodies

International Harmonization

Certified Small Wind Turbine Model Ratings as of November 2017

<table>
<thead>
<tr>
<th>Applicant</th>
<th>Turbine</th>
<th>Certifier</th>
<th>Rated Annual Energy @ 5 m/s</th>
<th>Rated Sound Level @ 11 m/s</th>
<th>Certified Power Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bergey WindPower</td>
<td>Excel 10</td>
<td>SWCC</td>
<td>13,800 kWh</td>
<td>42.9 dB(A)</td>
<td>8.9 kW</td>
</tr>
<tr>
<td>Eocycle Technologies, Inc.</td>
<td>E020</td>
<td>SGS</td>
<td>64,920 kWh</td>
<td>44.3 dB(A)</td>
<td>22.5 kW</td>
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<tr>
<td>Eveready Diversified</td>
<td>Kestrel e400nb</td>
<td>WCC</td>
<td>3,930 kWh</td>
<td>55.6 dB(A)</td>
<td>2.5 kW</td>
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<tr>
<td>Kingspan Environmental</td>
<td>KW6</td>
<td>SWCC</td>
<td>8,950 kWh</td>
<td>43.1 dB(A)</td>
<td>5.2 kW</td>
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<tr>
<td>Lely Aircon B.V.</td>
<td>LA10</td>
<td>SWCC</td>
<td>17,500 kWh</td>
<td>41.1 dB(A)</td>
<td>9.6 kW</td>
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<tr>
<td>Lely Aircon B.V.</td>
<td>LA30</td>
<td>SWCC</td>
<td>48,800 kWh</td>
<td>49.8 dB(A)</td>
<td>27.2 kW</td>
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<tr>
<td>Osiris Technologies</td>
<td>Osiris 10</td>
<td>Intertek</td>
<td>23,700 kWh</td>
<td>49.4 dB(A)</td>
<td>9.8 kW</td>
</tr>
<tr>
<td>Pika Energy</td>
<td>T701</td>
<td>SWCC</td>
<td>2,420 kWh</td>
<td>38.3 dB(A)</td>
<td>1.5 kW</td>
</tr>
<tr>
<td>Sonkyo Energy</td>
<td>Windsport 3.5</td>
<td>Intertek</td>
<td>4,820 kWh</td>
<td>39.1 dB(A)</td>
<td>3.2 kW</td>
</tr>
<tr>
<td>Sumec Hardware &amp; Tools Co</td>
<td>PWB01-30-48</td>
<td>Intertek</td>
<td>2,920 kWh</td>
<td>41.1 dB(A)</td>
<td>1.2 kW</td>
</tr>
<tr>
<td>Sumec Hardware &amp; Tools Co</td>
<td>PWA03-44-48</td>
<td>Intertek</td>
<td>6,400 kWh</td>
<td>40.9 dB(A)</td>
<td>3.2 kW</td>
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<tr>
<td>Sumec Hardware &amp; Tools Co</td>
<td>PWB02-40-48</td>
<td>Intertek</td>
<td>4,660 kWh</td>
<td>36.9 dB(A)</td>
<td>1.7 kW</td>
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<tr>
<td>Sumec Hardware &amp; Tools Co</td>
<td>PWA05-50-280</td>
<td>Intertek</td>
<td>9,240 kWh</td>
<td>42 dB(A)</td>
<td>5 kW</td>
</tr>
<tr>
<td>Xzeres Wind Corp</td>
<td>442SR</td>
<td>SWCC</td>
<td>16,700 kWh</td>
<td>48.5 dB(A)</td>
<td>10.4 kW</td>
</tr>
<tr>
<td>Xzeres Wind Corp</td>
<td>Skystream 3.7</td>
<td>SWCC</td>
<td>3,420 kWh</td>
<td>41.2 dB(A)</td>
<td>2.1 kW</td>
</tr>
</tbody>
</table>

Courtesy of Interstate Renewable Energy Council
Small Wind Certification
Example

Solar Rating & Certification Corporation
Small Wind Certification Program

Manufacturer: Bergey Windpower Company
Wind Turbine Model: Excel 10 (240 VAC, 1-phase, 60 Hz)
Certification Number: SWCC-10-12

Rated Annual Energy
Estimated annual energy production assuming an annual average wind speed of 5 m/s (11.2 mph), a Rayleigh wind speed distribution, sea-level air density and 100% availability. Actual production will vary depending on site conditions.

13,800 kWh/year

Rated Sound Level
The sound level that will not be exceeded 95% of the time, assuming an annual average wind speed of 5 m/s (11.2 mph), a Rayleigh wind speed distribution, sea-level air density, 100% availability and an observer location 60 m (~200 ft) from the rotor center.

42.9 dB(A)

Rated Power
The wind turbine power output at 11 m/s (24.6 mph) at standard sea-level conditions.

8.9 kW

Certified to be in Conformance with: AWEA Standard 9.1 – 2009
For SWCC Summary Report, Certificate and certification status visit: www.smallwindcertification.org

Power Curve
with Combined Standard Uncertainty
Bergey Excel 10
Reference air density: 1.225 kg/m³

Hub Height Annual Average Wind Speed (m/s) | AEP Measured (kWh) | Standard Uncertainty in AEP (kWh) | Standard Uncertainty in AEP (%) | AEP Extrapolated (kWh)
--- | --- | --- | --- | ---
4 | 7,135 | 503 | 7.05 | 7,135
5 | 13,842 | 884 | 6.39 | 13,842
6 | 22,300 | 1,281 | 5.74 | 22,300
7 | 31,342 | 1,604 | 5.12 | 31,342
8 | 39,755 | 1,824 | 4.59 | 39,755
9 | 46,652 | 1,944 | 4.17 | 46,652
10 | 51,626 | 1,982 | 3.84 | 51,626
11 | 54,685 | 1,961 | 3.59 | 54,685
Wind turbine standards assume specific conditions relating to the conditions of the wind in the proximity of the turbine that are important for loads analysis, noise, and safety.

In many cases, turbines installed in the built environment have wind conditions outside of what is stated in the standards.

Even if you use a certified turbine, you may be using it at a location outside of what the standards were designed to consider.
Project Validation

Project Economics

- Installed costs
- Yearly O&M costs
- Cash incentives (grants or rebates), tax credits, net metering benefits
- Wind energy production
- Avoided cost of electricity

Evaluation Tools

- CREST
  [https://financere.nrel.gov/finance/content/crest-cost-energy-models](https://financere.nrel.gov/finance/content/crest-cost-energy-models)
- System Advisor Model (SAM)
  [https://sam.nrel.gov/](https://sam.nrel.gov/)
- LCOE Calculator
  [https://www.nrel.gov/analysis/tech-cost-dg.html](https://www.nrel.gov/analysis/tech-cost-dg.html)
- PNNL
Project Validation

Compliance

- US Fish and Wildlife Service
- Federal Aviation Administration (FAA) / Obstruction Evaluation/Airport Airspace Analysis (OE/AAA)
- DOD Energy Siting Clearinghouse
- Other agency or state-specific regulations (e.g., NEPA)
Project Validation

Other Considerations

- Electrical interconnection
- Construction requirements (e.g., ground conditions)
- Legal and policy issues and approval
- Distribution system ownership
- Compatibility with mission, future land plans, and agency policies
- Utility coordination
- Site control

Courtesy of FEMP
Project Validation
Evaluating Project Financing Options

Chandra Shah, FEMP / NREL
Renewable Energy Procurement Pathways

- On-Site Renewable Energy Projects with Government Ownership
- On-Site Renewable Energy Projects with Private Ownership
- Purchasing Renewable Energy From Off-Site Projects
- Purchasing Renewable Energy Certificates (RECs)
On-Site Renewable Projects with Government Ownership

Appropriations
• Agencies with appropriations can pay directly for on-site renewable energy projects

Project Financing
• No up-front capital costs required for the equipment
• Include renewable energy conservation measures (ECMs) within:
  – Energy Savings Performance Contracts (ESPCs)
  – ESPC ENABLE
  – Utility Energy Service Contracts (UESCs)
On-Site Renewable Projects with Private Ownership

**Power Purchase Agreements**
- Agency hosts privately owned and operated on-site renewable project
- Agency purchases the electricity

**Real Property Arrangement**
- Agency hosts privately owned and operated on-site renewable project
- Some or all of the electricity is sold elsewhere
- Enhanced-use lease (EUL), lease, easement or license
Power Purchase Agreement

**Renewable Developer**
- Purchases, installs, owns, operates, and maintains renewable equipment on federal land and/or buildings
- May be able to take advantage of tax incentives
- May sell the project renewable energy certificates if they are valuable

**Agency**
- Hosts an on-site renewable energy project
- Purchases energy from the renewable project for the life of the contract

- Best for large renewable projects (generally >500 kW)
- Long term contract (20 years) is ideal, but civilian agencies have limited long term contract options
Power Purchase Agreement

Interconnection Agreement (may be between utility & RE developer or tri-party agreement)

Contracting Agent (DLA Energy, GSA, WAPA, other)

Federal Site

Renewable Developer

Site Access Agreement

PPA

Utility
### Advantages and Benefits

- No agency up-front capital required for equipment
- Renewable developer may be eligible for tax incentives; can sell the project RECs
- Renewable developer provides operations and maintenance, repair, and replacement
- Known long-term electricity price for portion of site load
- Minimal risk to government
- Eligible for on-site bonus toward Energy Policy Act of 2005 RE goals
- Provides energy resilience if renewable project configured to operate during a grid outage

### Challenges and Considerations

- Some states/utilities do not allow PPAs
- Contract term limitations
- Other contractual issues
- Transaction costs
- Less federal sector experience than ESPC and UESC
- Net metering and/or other policy changes
- REC market volatility
- Some funding will be required for activities such as National Environmental Policy Act (NEPA), utility interconnection studies and/or required upgrades
Procurement Options*

- 10 USC 2922a (Dept. of Defense only)
- 40 USC 501/FAR Part 41
- FAR Part 12 Commercial Items
- Western Area Power Administration
- ESPC Energy Sales Agreement (ESPC ESA)
- Real Property Arrangement

*Disclaimer: Not all options are available to all agencies; check with your contracting and legal staff regarding available options.
PPA: 10 USC 2922a (Department of Defense only)

• Contract term: 30 years
• Department of Defense authority
  – Not available to civilian agencies
• Requires Secretary of Defense approval (delegated)
• Streamlined approval process
• Contract term:
  – 10 years
  – Two GSA regions have awarded 10 years with 10 year option contracts under FAR Part 12 and FAR Part 41 to the extent applicable

• FAR Part 41 is a GSA authority, other agencies must request a delegation of this authority from the GSA Energy Division
  – FEMP can help with the request

• Certain agencies (DOE, DOD) have permanent FAR Part 41 delegation
PPA: FAR Part 12 Commercial Items

- The Commercial Item is the electricity being purchased
- Contract length limitation is typically 5 years; options may be allowed (depends upon agency policy)
- Discuss applicability with agency contracting and legal staff
PPA: Western Area Power Administration (WAPA)

- WAPA has a unique power marketing authority that can be used for long term agreements
- Only available for federal agencies in WAPA’s service territory
- Agency selects renewable developer
- WAPA negotiates and signs PPA contract
- WAPA has a Renewable Resources for Federal Agencies (RRFA) program
  - https://www.wapa.gov/Renewables/ForFederalAgencies/Pages/federal-agencies.aspx
- Fee for WAPA’s services

Randy Manion
Western Area Power Administration
(720) 201-3285
manion@wapa.gov
Real Property Arrangement

- Agency hosts privately- or utility-owned renewable energy project on underutilized government land

- Real property arrangement
  - Enhanced Use Lease (EUL)
  - Lease
  - Easement
  - License

- Some or all of the electricity is sold elsewhere
  - Agency may or may not purchase any electricity

- Payment (typically in-kind consideration) for use of the land
Energy Savings Performance Contract Energy Sales Agreement is a project structure using ESPC authority for renewable energy conservation measures (ECMs) on federal buildings or land where the ECM is initially privately owned and the agency purchases the electricity.

- **Long-term ESPC authority**
  - One of limited options civilian agencies have for implementing on-site renewables

- **Differences from typical ESPC:**
  - Payment is based on kWh generation; price is in ¢/kWh
  - Private ownership initially
    - Energy service company (ESCO) may take advantage of tax incentives, sell renewable energy certificates (RECs) if valuable, to reduce the ESPC ESA price

- **FAR Part 41 authorizes use of ESPC for the acquisition of utility services (48 CFR § 41.102(b)(7))**
ESPC ESA Benefits

- Statutory cost savings requirement
- Long-term contract
- ESCO eligible for tax incentives (government is not)
- ESCO can sell the project RECs (difficult for government)
- ESCO provides O&M
- Known price for portion of load
- Possible resilience, with additional equipment requirements for operation during grid outage
ESPC ESA Requirements

The ESPC ESA must meet all ESPC authority requirements.*

• Payments from energy savings generated each year of contract (ESPC ESA price must be less than utility price)

• On federal land or building

•ESCO must be on DOE qualified list by time of award

• Meet all other ECM requirements under 42 USC 8259

*See e.g., 42 U.S.C. § 8287 et seq.
ESPC ESA: Unique Requirements/Considerations

• Must retain title by end of contract for annual scoring
  – 2012 Office of Management and Budget (OMB) Memo M-12-21

• Safe harbor provided by IRS
  – IRS will not challenge treatment of an ESPC ESA as a service contract under §7701(e)(3) of Internal Revenue Code
  – Section 4 contains ESPC ESA contract requirements
ESPC ESA Implementation Mechanisms

- Site-specific/stand-alone
- DOE IDIQ
- Army Corps IDIQ
- ENABLE

All requirements apply regardless of ESPC ESA implementation mechanism
## On-Site Renewable Energy Procurement Pathways

<table>
<thead>
<tr>
<th>Project Ownership</th>
<th>Financing Method</th>
<th>Authority or Pathway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Owned</td>
<td>Appropriations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ESPC</td>
<td>42 U.S.C. § 8287</td>
</tr>
<tr>
<td></td>
<td>ESPC ENABLE</td>
<td>42 U.S.C. § 8287</td>
</tr>
<tr>
<td>Privately Owned</td>
<td>PPA</td>
<td>40 U.S.C. § 501; FAR Part 41&lt;br&gt;FAR Part 12&lt;br&gt;10 U.S.C. § 2922a (DOD)&lt;br&gt;WAPA</td>
</tr>
<tr>
<td></td>
<td>ESPC ESA</td>
<td>42 U.S.C. § 8287</td>
</tr>
<tr>
<td></td>
<td>Real Property Arrangement</td>
<td>EUL, lease, easement, license, or other</td>
</tr>
</tbody>
</table>
A resource that is focused on ESPC ESA projects*

- Assumes site-specific (stand-alone) ESPC
- Process diagram, checklist, and team responsibility chart
- Project consideration description
- Authorizing legislation and other applicable information
- Editable templates
- Available at https://energy.gov/eere/femp/energy-savings-performance-contract-energy-sales-agreements

* This information may be useful for other types of projects.
Affordable Power Infrastructure Partnership Overview

APIP is a partnership between DOE FEMP and a federal agency that uses a programmatic approach to implement cost effective on-site energy generation projects through public-private partnerships.
APIP’s Programmatic Approach

APIP’s programmatic approach achieves the best possible outcome for an agency pursuing on-site energy generation projects with the least staff-time investment by applying the following:

1. An established process using tools and resources
2. Project assistance from subject matter experts
3. Lessons learned and government best practices
# Benefits of APIP

<table>
<thead>
<tr>
<th>Direct Cost Savings</th>
<th>Other Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private ownership for greater savings (e.g. tax incentives, SREC sales)</td>
<td>System performance risk is on third party, including operation and maintenance</td>
</tr>
<tr>
<td>No up-front capital investment</td>
<td>Complexity of project development is handled by third party</td>
</tr>
<tr>
<td>Long term utility cost stabilization</td>
<td>Increased industry interest from replicable solutions</td>
</tr>
<tr>
<td>Economies of scale from site aggregation, where applicable</td>
<td>Energy supply diversification</td>
</tr>
<tr>
<td>Avoided premium cost of unbundled RECs to meet federal mandates</td>
<td>Support of domestic energy independence</td>
</tr>
</tbody>
</table>
Web Resources


• FEMP PPA website: http://energy.gov/eere/femp/federal-site-renewable-power-purchase-agreements

• FEMP ESPC ESA website (includes link to Toolkit): https://www.energy.gov/eere/femp/energy-savings-performance-contracts-energy-sales-agreements

On-Site Project Implementation Process

Phase 1
Initial Screening

Phase 2
Form a Strong Project Team

Phase 3
Project Validation

Phase 4
Procurement

Phase 5
Construction and Performance Period

Courtesy of FEMP
On-Site Project Implementation Process

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Phase 5
Construction and Performance Period

Courtesy of FEMP
Construction and Performance Period

Overview

Complete Design

Begin Construction

Commission

Project Acceptance

Maintenance

Operations

Courtesy of FEMP
Construction and Performance Period

Maintenance

- Preventative (Scheduled) Maintenance
  - Manufacturer’s recommended service schedule
  - Increase efficiency and energy delivery (kWh/kW)
  - Extend system lifetime
  - Decrease downtime (hours/year)
  - Often required by warranty
  - Ensure safety and reduce risk

- Corrective (Unscheduled Repair) Maintenance
Federal Energy Management Program (FEMP) Resources

Distributed Wind Workshop 2018

Tuesday, February 27
Federal Government’s Progress Towards RE Goals

Federal Government's Progress Towards RE Goals

Renewable Electricity (MWh)

<table>
<thead>
<tr>
<th>Year</th>
<th>Renewable Electricity (% of Facility Electricity)</th>
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<tbody>
<tr>
<td>2010</td>
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<td>2016</td>
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- Wind: 47%
- Wood and Wood Residuals: 18%
- Solar Photovoltaic: 12%
- Biogas (Captured Methane): 6%
- Incremental Hydropower: 5%
- GHP: 5%
- Other: 5%
- Purchases And Remote Agency Owned (Off Site): 7%
- Renewable Energy Certificate Purchases (Off-Site): 6%
- REC Replacement Bonus for Federal/Indian Land: 5%
- Direct Bonus for Federal/Indian Land: 5%
- Agency-Owned (On-Site): 5%
Federal Government’s Progress (Wind Only)

Federal Government's Progress Towards RE Goals (Wind Only)

Federal Government's Progress Toward RE Goals, FY 2016 (Wind Only)
FEMP Roadmap for the future
FEMP’s RE Program helps federal agencies accomplish their mission through investment in lasting and reliable energy generation projects and purchases. The program is comprised of two teams; Technical and Procurement.

- Facilitate Cost Effective On-Site Energy Generation Projects
- Integrate Resilience Measures into On-Site Generation Projects
- Facilitate Cost Effective Off-Site Power Purchases
- Advance the Federal Workforce
- Coordinate Interagency Efforts

Tools & Resources • Training • Project & Purchasing Assistance
FEMP’s Renewable Energy Program

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Kevin DeGroat
Antares Group, Project Director
kdegroat@antaresgroupinc.com
301-789-7768
On-site Renewable Energy Project Assistance

- Technical and procurement assistance is provided at key instances throughout the on-site renewable energy project implementation process.
- Request project and purchasing assistance through FEMP’s Assistance Portal.

https://www4.eere.energy.gov/femp/assistance
Web Resources


- **FEMP Training**: [https://www4.eere.energy.gov/femp/training/](https://www4.eere.energy.gov/femp/training/)

- **FEMP Assistance Portal**: [https://www4.eere.energy.gov/femp/assistance/](https://www4.eere.energy.gov/femp/assistance/)


- **REopt**: [https://reopt.nrel.gov/](https://reopt.nrel.gov/)

Please visit the FEMP Training Website: https://www4.eere.energy.gov/femp/training/
Trainings are certified for Continuing Education Credits by: IACET

- Combined Heat and Power: An Integrated Approach to Energy Resources
- Distributed-Scale Renewable Energy Projects: From Planning to Project Closeout
- Federal On-Site Renewable Power Purchase Agreements
- FEMP Large-Scale Renewable Energy Guide
- Introduction to Alternative Financing for Energy Efficiency and Renewable Technologies
- O&M Best Practices for Small-Scale PV Systems
- Procuring Solar Energy for Federal Facilities: Practical Guidance
- Renewable Energy (First Thursday Seminar)
- Renewable Energy Technology Applications: Biomass Technologies
- Renewable Energy Technology Applications: Geothermal Energy Technologies
- Renewable Energy Technology Applications: Hydropower and Ocean Technologies
- Renewable Energy Technology Applications: Integration of Renewable Energy Systems
- Renewable Energy Technology Applications: Photovoltaics and Daylighting Technology
- Renewable Energy Technology Applications: Solar Thermal and Concentrating Solar Power Technology
- Renewable Energy Technology Applications: Wind Energy Technology
- Renewable Power Purchases and Renewable Energy Certificates
- Selecting, Implementing, and Funding Photovoltaic Systems in Federal Facilities
- Strategic Planning for Renewable Energy Deployment: REopt (First Thursday Update)
- Utility Green Tariff Programs (First Thursday Update)
- Operations and Maintenance for Optimal Photovoltaic System Performance
FEMP Federal Project Executives (FPEs)

**Scott Wolf**
Western Region including N. Marianas, Palau, Guam, American Samoa; plus East, South, and Central Asia; the Pacific; and Near East
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wolfsc@ornl.gov

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**Tom Hattery**
Northeast Region plus State Dept.
202-256-5986
thomas.hattery@ee.doe.gov

ESPC Three-Day Training Workshop

- March 6th–8th from 8:00 am – 4:30 pm at the National Academy of Sciences (2101 Constitution Ave NW)
- Workshop will cover how to implement energy and water projects through an ESPC, including resilience and updates on the latest DOE indefinite-delivery, indefinite-quantity (IDIQ) contract

https://www4.eere.energy.gov/femp/training/training/energy-savings-performance-contracting-espc-three-day-training-workshop-includes-new-module
https://energy.gov/eere/femp/energy-exchange
Case Studies
Air Force Civil Engineer Center

Wind Energy Projects for
Groundwater Treatment Systems at Joint Base
Cape Cod

Distributed Wind Workshop
27 Feb 2018

Rose Forbes, P.E.
Air Force Civil Engineer Center
The Installation Restoration Program at Joint Base Cape Cod (JBCC)
MULTI-USE FACILITY

- Veterans Administration National Cemetery
- Barnstable County Sheriff’s Office / Correctional Facility
- 6th Space Warning Squadron PAVE PAWS
- U.S. Department of Agriculture
- Massachusetts Environmental & Readiness Center
- U.S. Army Environmental Center Impact Area
- Groundwater Study Program
- Air Force Center for Engineering and the Environment /
  Installation Restoration Program
- 253rd Combat Communications Group
- 267th Combat Communications Squadron
- U.S. Coast Guard Air Station Cape Cod
  - Exchange/Commissary
  - Golf Course
  - MWR
  - Family Housing
  - Storage for ships in Boston
- Massachusetts Army National Guard Army Aviation Support
  Facility #1
- Massachusetts Army National Guard Regional Training
  Institute
- Environmental Management Commission
- Senior Environmental Corps
- Massachusetts Disaster Preparedness Safe Haven Facility
- US. Air Force Auxiliary (Civil Air Patrol)
- Massachusetts Maritime Academy
- Federal Aviation Administration, North Atlantic Region
- Bourne School System
- Coast Guard Communications Station, Boston
- Coast Guard Electronic Systems Support Detachment
- Coast Guard Marine Safety Field Office
- Coast Guard Northeast Regional Fisheries Training Center
- Coast Guard LANT Area Armory
- Coast Guard Port Security Unit
- Police Motorcycle & Canine Training Areas
- Upper Cape Trash Transfer Station / Bay Colony Railroad
- U.S. Geological Survey
- Volpe Test Center
- Buzzards Bay Project
- FAA Cape Approach
- Crane Wildlife Management Area
Where did the contamination come from?
JBCC Installation Restoration Program

- AFCEC manages Installation Restoration Program (IRP) at JBCC
  - IRP began in 1984; added to National Priorities List (NPL) in 1989
  - Jointly funded by AF and Army
  - 97 source areas; 17 groundwater plumes; 11 emerging contaminant sites
  - 9 pump and treat systems (18 MGD in 2006; 10 MGD today)
  - Electricity usage 100% offset by renewable energy (three 1.5MW wind turbines)
Air Force Groundwater Cleanup Progress
Currently Treating 11.9 Million Gallons a Day
Sustainability Evaluation

Impacts of Electricity Generation

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

Wind I and II
## Details

<table>
<thead>
<tr>
<th></th>
<th>Wind I</th>
<th>Wind II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Machines</strong></td>
<td>One Fuhrlander 1.5 MW</td>
<td>Two GE 1.5 MW</td>
</tr>
<tr>
<td><strong>Hub height/rotor diameter</strong></td>
<td>80 m/77 m</td>
<td>80 m/77 m</td>
</tr>
<tr>
<td><strong>Total height</strong></td>
<td>~390 ft</td>
<td>~390 ft</td>
</tr>
<tr>
<td><strong>Startup Date (witness test)</strong></td>
<td>2 Dec 2009</td>
<td>8 Nov 2011</td>
</tr>
<tr>
<td><strong>Project Timeframe</strong></td>
<td>~5 years</td>
<td>~2 years</td>
</tr>
<tr>
<td><strong>Distance from homes</strong></td>
<td>1140 ft (on base residents)</td>
<td>3000 ft (off base residents)</td>
</tr>
<tr>
<td><strong>Foundation</strong></td>
<td>Spread form – 57' diameter, 600 yds 5000 psi concrete</td>
<td>Spread form – 47' diameter, 470 yds 5000 psi concrete</td>
</tr>
<tr>
<td><strong>Blades</strong></td>
<td>ND: 122 ft, 13,600 lbs each</td>
<td>TX: 121.4 ft, 13,900 lbs each</td>
</tr>
<tr>
<td><strong>Tower Sections</strong></td>
<td>MN: 4; 41'-79'; 65,000-106,000 lbs</td>
<td>IA: 3; 72'-97' long; 62,700-114,000 lbs</td>
</tr>
<tr>
<td><strong>Machine Head</strong></td>
<td>GE: 12.8' high, 26.6' long, 143,200 lbs</td>
<td>FL: 12.5' high, 29' long, 126,000 lbs</td>
</tr>
<tr>
<td><strong>Crane</strong></td>
<td>Manitowoc 16000; 440 ton; 315' mast</td>
<td>Manitowoc 16000; 440 ton; 315' mast</td>
</tr>
<tr>
<td><strong>Funding Type</strong></td>
<td>Environmental Restoration Account</td>
<td>Environmental Restoration Account</td>
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<tr>
<td><strong>Constructability Assessment</strong></td>
<td>$400,000</td>
<td>$462,284</td>
</tr>
<tr>
<td><strong>Construction</strong></td>
<td>$4.87M (plus two years O&amp;M)</td>
<td>$9.43M (plus substation and one year O&amp;M)</td>
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<tr>
<td><strong>Utility Interconnection</strong></td>
<td>$53,858 (to existing 23 kV distribution)</td>
<td>$272,000 (to new 23 kV distribution line through new substation and then to existing 115 kV transmission line)</td>
</tr>
<tr>
<td><strong>Title II Oversight</strong></td>
<td>$150,000</td>
<td>$341,000 (and environmental surveys)</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td>$5,473,858 ($3,649/kW)</td>
<td>$10,505,284 ($3.502/kW)</td>
</tr>
<tr>
<td><strong>Energy Production (startup to date)</strong></td>
<td>18,832 MWhr (02 Dec 09 – 31 Jan 18)</td>
<td>45,853 MWhrs (8 Nov 11 – 31 Jan 18)</td>
</tr>
<tr>
<td><strong>ROI</strong></td>
<td>23 years</td>
<td>11.4 years (based on costs to date)</td>
</tr>
</tbody>
</table>
Fuhrlander FL-1500

- Rating: 1.5 MW
- 80 m hub height
- 77 m rotor diameter

**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 (134 mph)
• Fuhrlaender date of operation 2 Dec 09

• Expectations:
  • produce ~ 3,810 MWh annually based on 29% capacity factor (P50); ~ 3,377 MWh annually based on 25.7% (P90)
  • generate 25-30% of AFCEC’s total electrical requirement
  • reduce ~25-30% air emissions

• Actual production: 18,832 MWhr from startup (Dec 2009) through 31 Jan 2018; 17.6% capacity factor

• Credit of $2.66M through Dec 2017
Transportation Obstacles

- Bridges
- Rotaries
- Curfews/holidays
- Frost restrictions
- Weather
- Drivers/traffic
- State DOT permits
- Special permits
- Scheduling police escorts
- Special events
- Tight turns
- Medians
- Power poles
- Overhead utilities/bucket trucks
Bridge Vs Tower – Part I

• Bridge (NY)
  – Cracked I beam
  – Bent I beam
  – I-81 southbound lane closed

• Tower Section
  – Dents/Scrapes

• Why?
  – Height pole too low

• Tower inspected and repaired on site
Wind I Start Up Issues

• Startup at 50% power production
  • maximum output 750 kW for 50 hours (break in)
  • did not increase to 100% after 50 hours
  • reprogramming fixed problem – now at 100%
  • Lesson learned – pay attention to production

• Autorestart not working properly
  • would not restart after shutting down for high wind, low wind or power outage
  • reprogramming fixed problem
  • Lesson learned – pay attention to operation

• Turbine not responding well to gusts
  • shutdown on gusts less than cutout speed
  • reprogramming required along with replacement of encoder model
  • Lesson learned – specified parts might not always be the right ones
Start Up Issues (cont)

- Nacelle lighting not adequate
  - reports of red flashing light at night too dim
  - airfield ops concerns with visual identification during daytime
  - light replaced - white flash during the day and red flash at night
  - Lesson learned – communicate with local airfields on startup

- Remote monitoring not ready
  - software not available at startup
  - license agreement not finalized
  - Lesson learned – try to have agreements in place and work with a reputable company
Operational Issues

- Encoder – improper make/model
- Backup batteries – short life; possibly older when installed
- Generator brushes – short life; wore earlier than anticipated; possibly installed improperly
- Lightning strike damaged bearings and isolation disc in the generator
Operational Issues (cont)

• **Blade edge guard**
  – Factory installed on edge of blades
  – Lighting strike caused material to bubble and make noise (inefficiency)
  – Removed during blade inspection

• **Bridge rectifier**
  – monitors grid power
  – caused a grid loss error
  – Took several months to identify; thousands $ in lost production for a $150 part
Operational Issues (cont)

• Chopping resistor
  – Bleeds off excess electricity produced and helps to stabilize power output
  – Faulty part resulted in a yaw converter error that lasted about 1.5 years
  – Turbine would run for 10 mins and shut down for 2 mins; likely contributed to early gearbox failure
Operational Issues (cont)

Gearbox failed after 4.5 years of operation – started seeing metal flakes in oil filter which was chrome plating from bearings
Operational Issues (cont)

Lightning damage to main bearing
Service Issues

• Slow response to problems (delayed service), no written service agreement or warranty; foreign country – issues were eventually (and painfully) resolved
• Issues with subcontracts; language barriers; travel delays from Germany
• No end of warranty inspection conducted (did not know this was available)
• Fuhrlander closed North American office in Sep 2012 and subsequently filed for bankruptcy
• Subsequent contractors also inexperienced and not prepared (arrive without tools, break stuff, not finish the job in a timely manner)
Wind II
Wind II

- Two GE 1.5 MW, 80 m hub, 77 m rotor

- Two year project; date of operation 8 Nov 11

- Expectations:
  - produce ~ 7,620 MWh annually based on 29% capacity factor (P50)
  - generate 50-60% of AFCEE’s total electrical requirement (>2M in 2009; $1.7M in 2011)
  - reduce ~25-30% air emissions

- Actual production: 45,853 MWh from 08 Nov 2011 to 31 Jan 2018; credit of $6.58M through Dec 2017

- ROI showing ~11 years
Tower of power

Travellers heading onto the Cape over the Sagamore Bridge will see a new landmark towering over the trees with the addition of a 390-foot wind turbine on the Massachusetts Military Reservation, the first of two 1.5-megawatt turbines planned for the location. Combined with a turbine already in operation near Route 101 in Falmouth, the three turbines are expected to someday generate all the electricity needed for the Air Force Center for Engineering and the Environment to operate the groundwater treatment plants needed for the ongoing pollution cleanup at the base.
New Transportation Obstacles

- Bad directions
- State police
- No signage
Bridge Vs Tower – Part II

• Bridge (KY)
  – Minor damage
• Tower Section
  – Dents/Scrapes
• Why?
  – Driver went off route to get gas
• Inspected/repaired on site
Construction Issue

• Metric/English conversion for bolts and poor quality milling resulted in bolts being too large for tower flange opening
• GE milled flange openings on site to accommodate bolts
Start Up Issues

• Generator cooling fans failed
  – One fan failed within first week of operation – the day of the ribbon cutting ceremony
  – Second fan failed a few weeks later
  – Known problem with the installed turbine model
  – Why wait until after turbine is up to replace?

• Nacelle lighting did not switch from white strobe to red strobe at night
  – Received complaint from concerned resident living 5 miles away
Operational Issues (cont)

Oil leak at filter housing – gaskets not seated properly
Operational Issues (cont)

Lightning/Surges
Operational Issues (cont)

- Wye ring crack in GE-1 generator – had to replace generator.
- GE knew of condition with this generator model and had developed a proprietary repair but did not let customers know.
- If repair had been done sooner, would not have had to change the generator.
Figure J-1: Combined GE1 & GE2
Wind Turbine Energy Analysis
- Lifetime

GE1 down due to generator issues from 12/2/15 to 4/20/2016.

GE2 down due to transformer down from 2/9/2017 to 3/18/2017.

GE2 down due to leaking oil cooler from 6/7/2017 to 7/21/2017.

Note:
1. Data from 01 July - 24 August 2014 produced from Mark V meter data due to SCADA server malfunction.
In March 2014, the capacity factor used for the estimated cumulative energy production curve was changed from 29% to 25.4% to reflect the actual capacity factor as measured in calendar year 2013.
Figure 11
JBCC Wind Turbine Production vs. Remediation Project Usage
Since Wind I Startup

Startup of Wind II turbines

Monthly Production/Usage [kWh]

kWh = kilowatt-hours
Figure 10
JBCC Wind Turbine Production vs. Remediation Project Usage
Historical and Future

Notes:
1. 2017-2021 data figures are estimated.
2. Future wind turbine performance estimates are based on net capacity factors (NCF) of 25.4% for the Wind I and 28.3% for the Wind II turbines.
3. Future electricity usage figures are based on estimates of electricity consumption as plumes are remediated and flow rates are reduced.

MWh = megawatt-hours
NUSCO DBA EVERSOURCE ENERGY SERVICE COMPANY

Pay EIGHTY SEVEN THOUSAND ONE HUNDRED SIXTY FOUR & 04/100 ***** US DOLLARS

To The DSSN3801LI
Order ATTN ROSE FORBES
Of HQ AFCEE/MMR
322 EAST INNER RD
Palmouth MA 02540

Date 05/11/15
USD $87,164.04

Philp &
VICE PRESIDENT & TREASURER
EVERSOURCE
PO Box 660369
Dallas, TX 75266-0369

Account Number
12 0 0000791740 17 70 2847 222 0012

HQ AFCEC/MMR
322 E INNER RD #41
OTIS ANGAR MA 02542-1320

NO PAYMENT NECESSARY

Please allow 7-10 business days for your payment to post. RETURN THIS PORTION WITH YOUR PAYMENT MOVING? PLEASE LET US KNOW, OTHERWISE YOU MAY BE RESPONSIBLE FOR ENERGY USE AFTER YOU MOVE.

THIS BILL REFLECTS RATE CHANGES APPROVED BY THE MASS. DEPARTMENT OF PUBLIC UTILITIES EFFECTIVE JANUARY 1. FOR MORE INFORMATION, INCLUDING BASIC SERVICE PRICING, PLEASE VISIT THE "ABOUT MY BILL" SECTION OF EVERSOURC.COM.

ACCOUNT NUMBER
2847 222 0012

BILLING DATE
JAN 26, 2018

NEXT READ DATE
FEB 23, 2018

SERVICE PROVIDED TO
HQ AFCEC/MMR
GOOD NEWS RD BLDG#8502
FORESTDALE MA 02644

ACCOUNT SUMMARY
PREVIOUS BILL - 9,398.49
TOTAL COST ELECTRICITY 5,271.96
OTHER CREDITS -1,790.87
CREDIT BALANCE - 7,917.40

ELECTRICITY USED
RATE 55-GENERAL TOU
METER 5114042
JAN 25, 2018 ACTUAL READ 6898.4
DEC 22, 2017 PREVIOUS READ 88450.1
34 DAY BILLED USE 18,448

CURRENT ELECTRIC CHARGES
(SEE DETAIL PAGE) 3,271.96

OTHER CREDITS
NET METERING CREDIT -1,790.87
TOTAL OTHER CREDITS -1,790.87

CHARGES ARE SUBJECT TO 0.86% INTEREST AFTER 55 DAYS.

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<tr>
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<td>2,250</td>
<td>15,199</td>
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</table>
Notable Issues/Lessons Learned

- Communicate early and often with stakeholders
- Understand net-metering, RECs, and state rules
- Utility Interconnection – build in time and plan for costs and changes
- Logistics - room to haul and build (bridges, road width, corners, permits, bad drivers, Military Cargo Preference Act of 1904, etc)
- Explore additional grants – can AF/DoD accept them?
- Inspect the manufacturing facilities if possible
- Make sure the turbine components suppliers and transportation companies are insured.
- Evaluate modes of transportation (roadway, rail, barge)
- Contracting: Firm Fixed Price or Cost (Best Value or Lowest Price); own/operate or lease with power purchase agreement
Notable Issues/Lessons Learned

- Do spare parts come with the wind turbine purchase? Plan a budget for spares but don’t buy them outright.
- Just because spare parts are new doesn’t necessarily mean they will work
- Plan for technical and safety training – involve local emergency response personnel
- An FAA ruling of presumed hazard is not the end of a project, it’s the beginning of negotiations
- Ensure manufacturers are reputable and there are working wind turbine models in the US for several years
- Select contractors who have experience with wind turbine planning and construction projects – note some may overstate their abilities
- Provide site signage/directions to transportation companies and police details
Notable Issues/Lessons Learned

• Long lead time on turbines - explore interest from manufacturers (important on Wind I, not so much on Wind II)
• Evaluate use of direct drive turbines – no gearboxes
• Some manufacturers have specific setback requirements for noise, ice shed, etc
• Plan on a schedule and hold contractors to it – include liquidated damages in contracts
• Evaluate warranties and O&M/service contracts in advance; build in availability guarantee if possible
• Conduct end of warranty inspections
• Contracting officers may not want to mix construction and O&M; use warranty as justification for O&M; specify manufacturer’s standard warranty in contract package (typically 2 years)
Notable Issues/Lessons Learned

• Construct foundation in cool weather and allow time to achieve strength
• Use existing wind resource data and other studies if available and applicable
• Consult experts (i.e. DOE, AFCESA) on funding mechanisms (DERA, ECIP, EULs, ESPCs, tax credits)
• Don’t plan a ribbon cutting ceremony until the turbine is up and operational
• Long Haul Project – need a dedicated champion
Other Energy Projects at JBCC

• PAVE PAWS installed two GE 1.68 MW wind turbines; operational in Jan 2014
• The Air National Guard is planning the installation of multi MW solar panel arrays on the landfill – developer PPA
• The Air National Guard is also integrating Wind I into a microgrid project
• The VA cemetery installed a smaller wind turbine (50 kW) on their property
• USCG uses a geothermal heating/cooling system at two of its hangars and is exploring the possibility of a solar array
• JBCC agencies are actively making improvements in energy efficiency including programs offered by Cape Light Compact
Solar PV Array on Landfill

- EPA-funded Feasibility Study (FS) to evaluate potential for solar photovoltaic (PV) on landfill
- FS conducted by NREL
- Otis ANG (102 IW) is the proponent
- Defense Logistics Agency is the contracting office
- Notice of Intent signed but contract can’t be awarded until interconnection agreement is done
QUESTIONS/COMMENTS?

rose.forbes@us.af.mil
Lessons Learned in Federal Wind Projects

Robi Robichaud

February 27, 2018
Wind Projects in the Federal Sector – Lessons Learned

Topic Outline

Federal installations of wind turbines
Tools to enhance early opportunity identification
Steps or activities to avoid in developing federal wind project
Recommendations from those who have done federal wind projects

Challenges:
• FAA and height restrictions
• Ensuring long-term savings stream

There are two 1.5MW wind turbines at a state prison facility in Gardner, MA.

ESPC Contract:
• 750 kW Wind Turbine
• 75 kW PV Parking Structure
• HVAC & Controls System Upgrade

Sources: Scott Debenham, NORESCO Presentation
Wind Power – A new 120-foot (37m) wind turbine at the BLM Field Office in Rawlins, Wyoming has blades 70 feet (21m) in diameter and is rated at 100 kW with an estimated output of 300,000 kW hours per year.

There was a 20 kW turbine that was in place for 12-15 years and taken down after the NPS100 turbine was installed.

BLM Goals: To meet 25% RE goal by 2025 per President Obama’s goal was the impetus for BLM to engage in a 6-year, $18.5 million ESPC. Numerous ECM’s and ~1MW of renewable energy.

Overall was one of the largest renewable projects under a federal ESPC, the project used ARRA dollars to augment the energy savings.

Pembina Wind Project Goal: The GSA would like to generate most or all the electrical power required to operate the Pembina Land Port of Entry Facility utilizing one wind turbine with a capacity of ~ 1MW.

Source: Jason Hessling, GSA – Rocky Mountain Region – Presentation at FEDWEATS 2011
Pembina Challenges:

- NEPA
- Migratory birds
- Building in a wetland
- Access road
- Buy American Act
- FAA
- Utility Provider
- Transmission/System Impact Study
- Interconnection Agreement

Recommendations:

- Choose contractor team best equipped to solve your unique challenges (you will have them)
- Identify and team with stakeholders/technical advisors
- Discuss with utility provider – early & often – and in writing
- Have a realistic schedule
- O&M monitoring
- Manage expectations
Federal Wind Actions Best Not to Repeat

- Site PQR:
  - Used 3 months of on-site wind data as basis for large-scale turbine purchase
  - Purchased turbine relatively new to US market with short, but lousy track record

- Site DEF:
  - Used ~3-5 months of wind data from location with dissimilar wind (airport/sea level/coastal data for mountainous land-locked site) as basis for large-scale turbine project

- Site M&M:
  - Purchased turbine from manufacturer trying to break into US market, but with no presence here – O&M efforts were not successful

- Site XYZ:
  - Purchased turbine from Chinese company (low bid) with no presence in US; O&M nightmares, manufacturing defect (QC issue)

- Site ABC:
  - Purchased turbine from Canadian manufacturer ‘new to wind’ – went out of business after selling small number of turbines, no O&M
How to do a Successful Federal Wind Project

Keys to success:

**Energetic Champion** - vision, resourcefulness, persistence & diligence

**Contracts Champion** – when creativity is needed to solve a problem, contracts needs to be on your side – they can create multiple options that kept things moving.

Key meetings & activities included:

- Meet with stakeholders individually & multi-agency group to foster cross-agency communication
- Meet with FAA, DOD, NEXRAD, Site Operations to explain project – work towards negotiated solution to resolve “issues”
- Meet with media and conducted open meetings with public to explain project parameters & intent
- Meet with Airport/FAA and to find effective solution to height restriction
- Resolved budgeting issues when project installation moved more slowly than anticipated – reserved budget allocation for initial **cost buy-down**

No one gets “everything they wanted” but compromise solutions are necessary to keep projects moving forward through to successful completion.
How to do a Successful Federal Wind Project

Keys to success – send several members of project team to AWEA workshops – siting, financing, etc. to learn about:

- PR and successful public information campaigns (ABC did not move forward on very good potential project due to negative press; XYZ not move forward on very good potential project for fear of negative press)
- Dealing with FAA, DOD, and radar issues and mitigation strategies
- Working through NEPA studies, issues, and developing effective paths forward
- Hire an experienced consultant to help guide the agency through the process

Learn from industry, they have been through it many times in many different circumstances. Send members of your project team to workshops & conferences with industry pros.

AWEA Wind Project O&M and Safety Conference
AWEA Wind Project Siting & Environmental Compliance Conference March 20-21, 2018
AWEA Regional Wind Energy Conference – Northeast June 26-27, 2018
https://www.awea.org/UpcomingAweaEvents
PNNL Distributed Wind Data and Reports

http://wind.pnnl.gov/distributedwind.asp
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Resources

PNNL Distributed Wind:
http://wind.pnnl.gov/distributedwind.asp
Wind Resource Maps:
http://apps2.eere.energy.gov/wind/windexchange/
DOE Distributed Wind:
https://energy.gov/eere/wind/distributed-wind
Certified Turbine List:
http://www.irecusa.org/credentialing/certified-small-wind-turbines/
ITAC List:
http://cesa.org/projects/ITAC/itac-unified-list-of-wind-turbines/
REopt Lite:
https://reopt.nrel.gov/tool.html
SAM:
https://sam.nrel.gov/
CREST:
https://financere.nrel.gov/finance/content/crest-cost-energy-models
Distributed Wind Policy Comparison Tool:
https://wind.pnnl.gov/pdf/PTP_PolicyTool.swf
U.S. Utility Rate Database:
https://openei.org/apps/USURDB/
Wind Prospector:
https://maps.nrel.gov/wind-prospector

Work with an Installer:
https://openei.org/wiki/Distributed_Wind_Installers
AWS Truepower:
https://www.awstruepower.com/software/wind-data-reports
US EIA Electricity Data:
https://www.eia.gov/electricity/data.php
FAA Obstruction Evaluation / Airport Airspace Analysis (OE/AAA)
https://oeaaa.faa.gov/oeaaa/external/portal.jsp
THANK YOU