Distributed Wind Soft Costs: A Beginning

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Acknowledgments

We thank the installers and developers who shared project cost information with us and are patiently answering our follow-up questions.
• (Briefly) describe the distributed wind (DW) soft costs project
• Present summary data from our alpha data set of DW project costs survey
• Seek feedback on initial results and future direction of the project.

Photo from Pika Energy, NREL 33942
Presentation Overview

• Soft Costs Project Overview
• DW Project Taxonomy
  o Soft costs are a subset of the taxonomy
• Alpha Data Set Project Demographics
• Data Summary
• Future Work
• Discussion.

Photo from Robin and Duncan Ross, Arrowhead Spring Vineyards, NREL 26772
Project Overview

**Key challenge:** The U.S. DW industry has identified high, non-hardware, balance-of-system (soft) costs as a barrier to DW system deployment. Information about the cost details of installed DW turbine systems is limited.

**Key opportunity:** Follow efforts undertaken by the solar industry, largely under the U.S. DOE SunShot Initiative, to understand and then reduce soft costs associated with DW technologies.

**Project scope (FY16-FY18):**

- Develop DW taxonomy based on industry input
- Gather initial data sets to alpha test and pre-populate a DW project soft cost spreadsheet; long-term, add to PNNL’s master DW database
- Seek additional project cost information to inform a baseline
- Develop a technical report documenting the larger DW taxonomy
  - The taxonomy will be used to establish programmatic goals for DW soft costs.
  - The labs will develop an internal soft cost reduction roadmap providing an initial plan to reduce soft costs and address barriers.
Project Overview

Work to Date
• Developed draft DW project cost taxonomy
• Vetted draft taxonomy with stakeholders at DWEA Conference (September 2015)
• Vetting with industry via phone and in-person interviews (ongoing)
• Collecting an initial project cost data to populate the alpha data set and proof test the taxonomy (in progress)
• Discuss the project cost taxonomy and results from the alpha data set with DOE/team/industry at the Small Wind Conference (in progress).

Future Work (funding Dependent)
• Gather additional project cost information
• Identify soft cost reduction opportunities and develop strategies to pursue
• Identify deployment barriers and develop strategies to address
• Publish DW soft costs technical paper, including soft cost metrics and industry benchmarks.
Q: What is a “soft cost”?
A: Any non-hardware costs

Examples of soft costs:

- Permitting fees
- Installer/developer profit
- Taxes
- Transaction costs
- Permitting, installation, interconnecting labor
- Indirect corporate costs
- Customer acquisition
- Installation labor
- Supply chain costs

Note:
This initial cost-gathering effort is from the installer/developer point of view.
# Distributed Wind Project Taxonomy

## Turbine System Equipment
- Turbine, tower, other equipment

## Installation
- Site prep and cleanup, foundation, electrical, turbine installation, commissioning
  - Materials, labor, equipment

## Supply Chain, Transportation, and Turbine Equipment Logistics

## Taxes
- Material, labor, local, state, etc.

## ZPIII/Regulatory Requirements
- Zoning, Permitting, Inspection, Interconnection, Incentives

## Site Engineering and Design

## Financing

## Customer Acquisition

## Installer/Developer Overhead and Profit

## Other Costs
- Project management
- Other development costs.

## Operations & Maintenance (O&M)
Alpha Data Set: Project Demographics

Regional Distribution

<table>
<thead>
<tr>
<th># of installers</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td># of projects</td>
<td>30</td>
</tr>
<tr>
<td># of turbine models</td>
<td>13</td>
</tr>
<tr>
<td># of states</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Turbine Rated Power</th>
<th># Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 20 kW</td>
<td>13</td>
</tr>
<tr>
<td>&gt; 20 – 100 kW</td>
<td>11</td>
</tr>
<tr>
<td>&gt; 100 – 1,000 kW</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 1,000 kW</td>
<td>3</td>
</tr>
</tbody>
</table>
## Alpha Data Set: Project Demographics – Utility Type

<table>
<thead>
<tr>
<th>Utility Type</th>
<th># Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-op</td>
<td>9</td>
</tr>
<tr>
<td>IOU</td>
<td>17</td>
</tr>
<tr>
<td>Muni</td>
<td>3</td>
</tr>
<tr>
<td>PUD</td>
<td>1</td>
</tr>
</tbody>
</table>

*Photo by Warren Gretz, NREL 00002*
### Alpha Data Set: Project Demographics – Jurisdiction Type

<table>
<thead>
<tr>
<th>Jurisdiction Type</th>
<th># Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town/City</td>
<td>5</td>
</tr>
<tr>
<td>Township</td>
<td>4</td>
</tr>
<tr>
<td>County</td>
<td>19</td>
</tr>
<tr>
<td>State</td>
<td>1</td>
</tr>
<tr>
<td>Federal Government</td>
<td>1</td>
</tr>
</tbody>
</table>

*Photo by Dennis Schroeder, NREL 21764*
<table>
<thead>
<tr>
<th>Customer Category</th>
<th># of Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>7</td>
</tr>
<tr>
<td>Farm</td>
<td>6</td>
</tr>
<tr>
<td>Government</td>
<td>1</td>
</tr>
<tr>
<td>Industrial</td>
<td>4</td>
</tr>
<tr>
<td>Residential</td>
<td>9</td>
</tr>
<tr>
<td>School</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
</tr>
</tbody>
</table>
Alpha Data Set Summary: Caveats

- Alpha data set as presented is **preliminary**
- Data QC is ongoing
- Current data set is small
  - Much scatter in the data
  - Not enough data points to look at effects of location, jurisdiction type, interconnecting utility type, etc.
- Need a larger data set to establish a baseline.

*Photo from Roger Dixon, NREL 35679*
### Alpha Data Summary: Installed Capital Cost ($/kW)

<table>
<thead>
<tr>
<th>Turbine Rated Power</th>
<th>Installed Capital Cost ($/kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Residential (0 - 20 kW)</td>
<td>$7,793</td>
</tr>
<tr>
<td>Commercial (&gt; 20 - 100 kW)</td>
<td>$6,730</td>
</tr>
<tr>
<td>Mid-Size (&gt; 100 - 1,000 kW)</td>
<td>*$2,569</td>
</tr>
<tr>
<td>Large (&gt; 1,000)</td>
<td>$2,802</td>
</tr>
</tbody>
</table>

* This bin includes remanufactured turbines.
## Alpha Data Set Summary: Regulatory (ZPIII)

Number of projects with entries in the following categories:

<table>
<thead>
<tr>
<th>Taxonomy Category</th>
<th>All</th>
<th>Small Residential</th>
<th>Small Commercial</th>
<th>Mid-Size</th>
<th>Large</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZPIII (Overall)</td>
<td>30</td>
<td>13</td>
<td>11</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Zoning</td>
<td>21</td>
<td>7</td>
<td>9</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Permit (Building/Structural)</td>
<td>28</td>
<td>12</td>
<td>10</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Permit (Electrical)</td>
<td>21</td>
<td>10</td>
<td>9</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Permit (FAA)</td>
<td>17</td>
<td>3</td>
<td>8</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Permit (Environmental)</td>
<td>7</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Permit (Erosion/Sediment Control)</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Other Permit</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Utility Interconnection</td>
<td>22</td>
<td>6</td>
<td>10</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Incentives Paperwork Processing</td>
<td>15</td>
<td>9</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
Next Steps, Future Work

Short Term
• Finalize alpha data set
• Incorporate feedback
• Refine taxonomy.

Long Term (Funding Dependent)
• Gather additional project cost information
• Examine cost-reduction opportunities and develop strategies to pursue
• Examine deployment barriers and develop strategies to address
• Publish DW soft costs technical paper, including soft cost metrics and industry benchmarks.

Photo from Roy Rakobitsch, NREL 26792
We want your feedback!!!!

• What is your business model?
• What do you see as the most promising cost-reduction opportunities?
• What do you see as the most significant barrier(s) to DW deployment?

Please see the handout with a full list of questions.
Thank you!

tony.jimenez@nrel.gov

303-585-1424
All Questions
These will be on a hardcopy handout

• What is your business model?
• Are there jurisdictions you avoid? Why?
• What is the best way to highlight ZPIII challenges? (Cost? Labor hours? Calendar time? Other?)
• Are there particular questions we should try to answer with the data at hand?
• Any suggested improvements to the taxonomy?
• What do you see as the most promising cost-reduction opportunities?
• Are there significant cost reduction opportunities in installation labor?
• What do you see as the most significant barrier(s) to DW deployment? (We’re tracking zoning as a big one.)
• Do you have project cost data to share?
• Any other thoughts/ideas?