MidAmerican Energy Company
Wind Energy
Brady Evans - Project Developer, Renewable Energy
Presentation Topics

• Wind Power in the U.S.
• Wind Power in Iowa
• Wind Power at MidAmerican Energy
• Wind Project Development
• Wind Project Construction
• Wind Operations & Maintenance
• Questions
Wind Power in the U.S.

• No. 1 source of new electric generating capacity
  – More than 74,000 MW of wind power generation capacity in the U.S., enough to power the equivalent of 20 million average homes

• 4.7% of all electrical energy generated in the U.S. in 2015 was from wind

• More than 48,500 operating utility-scale wind turbines in the U.S.

• Department of Energy estimates: wind could supply 20% of U.S. energy and support 500,000 jobs by 2030
More than 500 wind-related manufacturing facilities in the U.S. across 43 states

Source: American Wind Energy Association
Wind Power in the U.S.

- 39 states host operating utility scale wind projects
Iowa is Leading the Way

- No. 1 state in U.S. for percentage of power generated by wind energy – 31.3%
- No. 2 state in total wind generation (in MWh)
- No. 2 state in U.S. installed wind capacity
  - 6,364 MW installed
  - 3,718 wind turbines
  - Enough to power the equivalent of approximately 1.9 million average Iowa homes
  - 8.6% of all U.S. wind generation
- No. 7 state in terms of wind resources

Source: American Wind Energy Association
Iowa is No. 2 in the nation for installed wind capacity.

- Oklahoma led the country during the first quarter with 270 MW of wind capacity installed, followed by Iowa (154 MW), Utah (62 MW), and New Mexico (32 MW).
- The 154 MW wind farm commissioned in Iowa during the first quarter includes one prototype concrete tower turbine that is now the tallest operating wind turbine in the U.S. at 168 meters, or 554 feet, in height. The turbine has a 115 meter hub height and a 108 meter rotor diameter.
- Guam installed the territory’s first utility scale wind turbine during the first quarter.
- Texas continues to lead the nation with over 17,700 MW of installed capacity.

Source: American Wind Energy Association
Iowa is Leading the Way

- Nearly 100 wind projects online
- 14 wind related manufacturing facilities

Source: American Wind Energy Association
Began building wind projects in 2004
No. 1 rate-regulated utility owner of wind generation in the U.S.

Wind project benefits:

- Stabilize rates in the long term for customers
  - No fuel costs
  - 9th lowest electric rates out of 157 utilities in the nation; 38% lower than the national average
- Foster economic development in Iowa communities
  - Property taxes
    - 300 MW-150 turbine project – approximately $16m paid in property taxes to the county over the first 10 years
  - Landowner easement payments
    - Millions paid to landowners each year for all projects
- Demonstrate MidAmerican Energy’s commitment to the environment
MidAmerican Energy –
Investing in Wind and Iowa

• Jobs
  – Approximately 400 temporary jobs in an average construction year
  – More than 200 permanent jobs

• Increased business revenue during construction

• Support local jobs
  – Wind industry in Iowa supports more than 6,000 jobs in Iowa

• Renewable energy and low electric rates attract energy-intensive businesses to Iowa
MidAmerican Energy Wind – By Year-End 2016:

• Own and Operate 2,020 turbines
• 4,048 megawatts of wind generation capacity
  – One megawatt of capacity powers the equivalent of roughly 300-400 average homes depending on the turbine technology
  – Approximately 5.2% of the total installed capacity in the U.S.
• 21 distinct parks
  – Located in 23 counties
• Wind comprising nearly 47 percent of generation capacity
• Approximately 58% of MidAmerican's retail sales from wind generation planned for 2017
• Through 2045, landowners and counties are expected to have benefited through an $1.5b of lease and property tax payments
MidAmerican Energy - Wind Project Locations
The Cornerstone of Iowa’s Leadership in Wind

MidAmerican Wind Stats in Iowa

<table>
<thead>
<tr>
<th></th>
<th>Iowa</th>
<th>MEC</th>
<th>MEC Share</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2016 Capacity (MW)</strong></td>
<td>6,941</td>
<td>4,048</td>
<td>58%</td>
</tr>
<tr>
<td><strong>2016 Turbines</strong></td>
<td>3,970</td>
<td>2,020</td>
<td>51%</td>
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<tr>
<td><strong>2016 Production (GWh)</strong></td>
<td>16,300</td>
<td>8,176</td>
<td>50%</td>
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<tr>
<td><strong>2016 Investment</strong></td>
<td>$12.6b</td>
<td>$6.7b</td>
<td>53%</td>
</tr>
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Values are approximate. The renewable qualities of much of MidAmerican’s owned wind generation is currently sold in the form of Renewable Energy Credits, or RECs, for the financial benefit of our customers.
Renewable Energy Generation Leadership

MEC Nameplate Generation Capacity
owned and contracted

EOY 2004
Coal 57%
Natural Gas 28%
Nuclear 9%
Wind 5%
Other 1%

EOY 2016
Coal 31%
Natural Gas 16%
Nuclear 5%
Wind 47%
Other 1%

MidAmerican ENERGY
Wind XI

- 2,000 MW project announced on April 14, 2016
- Iowa Utilities Board approved the project on August 26, 2016
- By the end of 2019, our wind generation production would be equal to approximately 85% of our Iowa electric retail load (end of 2016 at 58%)
- Largest economic development in Iowa’s history - $3.6b
- Approximately $30.5 million in annual landowner payments and county tax revenue
- At the peak of construction more than 600 temporary jobs will be created
- More than 70 permanent positions will support the project
Wind Project Development

- **Siting Considerations**
  - Wind Resource (wind resource maps)
    - Central US has the best wind resource
    - Western Iowa has the best wind resource
  - Transmission Access
    - Available transmission line
    - Transmission system not congested
  - Welcoming landowners to host wind facilities
  - Welcoming Regulators
    - Tax abatement adopted by the county
    - Wind ordinance and permitting is not overly restrictive
  - Environmental Considerations
    - Pre-construction environmental surveys
    - Low concentration of threatened, endangered and protected species

- **Approximately two - three years from start of development to end of construction**
United States Wind Resource

Iowa’s Wind Resource

MidAmerican Wind Turbine Construction
Wind Turbine Operation & Maintenance

• Staffing
  – Education and training required

• Remote control access

• Safety

• Service & Maintenance

• Production and availability measures

• Local support
  – Snow removal, weed spraying, road repairs, etc.

• Why do I see turbines not spinning?
Interesting Wind Facts – Vestas V110-2.0MW Turbines

- The distance from ground the tip of a blade when fully extended is 493 feet
  - The Statue of Liberty is 305 feet tall

- It takes approximately 53 concrete trucks to pour one turbine foundation
  - That’s equivalent to 640 feet of a two-lane highway per turbine

![Wind Turbine and Statue of Liberty silhouette]