Energy and Agriculture Successful Farmer Series
January 2020

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Extension Educator Energy

- On Farm Energy Use
- Wind Development and Community Impacts
- Solar Development
• Top 3 ways you use energy to grow corn
• Make a list of top 3
  – Irrigated corn
  – Dryland corn
Energy Use in Irrigated Corn Production

- Seed Energy: 0.3%
- Drying Energy: 7.2%
- Irrigation Energy: 16.1%
- Fertilizer and Lime Product Energy: 17.7%
- Amortized Lime Product Energy: 6.1%
- Crop Protection/Crop Chemical Product Energy: 55.3%
- Tillage and Field Operation Energy: 4.3%
- Crop Transport Energy: 0.2%
- Planting and Harvest: 0.1%
- Manure Energy: 0.1%

Which Yardsticks Might You Use?

N
- Top 10%
- Top 25%
- Mean
- 75th%
- 90th%

0.4 lbs. N/bu of corn
0.7 lbs. N/bu of corn
0.8 lbs. N/bu of corn
1.0 lbs. N/bu of corn
1.1 lbs. N/bu of corn

Water
- Top 10%
- Top 25%
- Mean
- 75th%
- 90th%

27 bu. corn/ inch of water
19 bu. corn/ inch of water
17 bu. corn/ inch of water
8 bu. corn/ inch of water
5 bu. corn/ inch of water

Soil Loss
- Top 10%
- Top 25%
- Mean
- 75th%
- 90th%

0 lbs. Soil/bu of corn
0 lbs. Soil/bu of corn
5 lbs. Soil/bu of corn
12 lbs. Soil/bu of corn

Energy Use
- Top 10%
- Top 25%
- Mean
- 75th%
- 90th%

7 lbs. CO2 equivalent/ bu
8 lbs. CO2 equivalent/ bu
10 lbs. CO2 equivalent/ bu
12 lbs. CO2 equivalent/ bu
13 lbs. CO2 equivalent/ bu

GHG
- Top 10%
- Top 25%
- Mean
- 75th%
- 90th%

1.0 SOC Score
1.0 SOC Score
8.6 SOC Score
8.6 SOC Score

Soil Health
- Top 10%
- Top 25%
- Mean
- 75th%
- 90th%

Land Use Efficiency
- Top 10%
- Top 25%
- Mean
- 75th%
- 90th%

Irrigated
- Top 10%
- Top 25%
- Mean
- 75th%
- 90th%

263.16 Bu./Ac
243.90 Bu./Ac
198.17 Bu./Ac
182.95 Bu./Ac
69.93 Bu./Ac

Rainfed
- Top 10%
- Top 25%
- Mean
- 75th%
- 90th%

212.77 Bu./Ac
188.68 Bu./Ac
128.08 Bu./Ac
62.50 Bu./Ac
45.05 Bu./Ac
Wind Power

Major Drivers

• Tax Credit
  – Federal Subsidy
• Renewable Energy Standards
  – States
  – Utilities
• State Subsidies
  – Property tax incentives
  – Sales tax incentives
• Private citizens
Individual-level Impacts

- Noise
- Visual
- Health
- Property value
- Farm income
- Farm succession

Turbines create noise pollution

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Paid</th>
<th>Unpaid</th>
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<tr>
<td>Strongly agree</td>
<td>19</td>
<td>21</td>
<td>12</td>
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<tr>
<td>Agree</td>
<td>29</td>
<td>12</td>
<td>40</td>
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<tr>
<td>Disagree</td>
<td>47</td>
<td>31</td>
<td>22</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>18</td>
<td>38</td>
<td>10</td>
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Individual-level Impacts

- Noise
- Visual
- Health
- Property value
- Farm income
- Farm succession

Turbines create visual/aesthetic problems

<table>
<thead>
<tr>
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<th>All</th>
<th>Paid</th>
<th>Unpaid</th>
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<tr>
<td>Strongly agree</td>
<td>24</td>
<td>27</td>
<td>12</td>
</tr>
<tr>
<td>Agree</td>
<td>25</td>
<td>14</td>
<td>39</td>
</tr>
<tr>
<td>Disagree</td>
<td>39</td>
<td>46</td>
<td>22</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>12</td>
<td>27</td>
<td>10</td>
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</tbody>
</table>
Individual-level Impacts

Turbines cause human health problems

- Noise
- Visual
- Health
- Property value
- Farm income
- Farm succession

Turbines decrease nearby property values

- Noise
- Visual
- Health
- Property value
- Farm income
- Farm succession
Individual-level Impacts

Investments over 5 years: 2009-2013

- Noise
- Visual
- Health
- Property value
- Farm income
- Farm succession

<table>
<thead>
<tr>
<th></th>
<th>Non-windfarm</th>
<th>Unpaid neighbors</th>
<th>Neighbors in pool</th>
<th>Turbines</th>
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</thead>
<tbody>
<tr>
<td>$</td>
<td>$187k</td>
<td>$180k</td>
<td>$193k</td>
<td>$449k</td>
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Legend:
- Home
- Outbuildings
- Drainage/Irrigation
- Equipment

Individual-level Impacts

% that have farm succession plan

- Non-windfarm 57%
- Unpaid neighbors 64%
- Neighbors in pool 62%
- Turbines 80%

Legend:
- Home
- Outbuildings
- Drainage/Irrigation
- Equipment
West of Salina, KS

Western Iowa
Sherman Co Oregon

This map shows the annual average wind power estimates at a height of 50 meters. It is a combination of high resolution and low resolution datasets produced by NREL and other organizations. The data was screened to eliminate areas prone to be developed onshore due to land use or environmental issues. In many states, the wind resource on this map is visually enhanced to better show the distribution on ridge crests and other features.

<table>
<thead>
<tr>
<th>Wind Power Class</th>
<th>Resource Potential</th>
<th>Wind Power Density at 50 m</th>
<th>Wind Power Density at 80 m</th>
<th>Wind Speed at 50 m</th>
<th>Wind Speed at 80 m</th>
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<tbody>
<tr>
<td>3</td>
<td>Fair</td>
<td>300 – 400</td>
<td>6.4 – 7.0</td>
<td>14.3 – 15.7</td>
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<tr>
<td>4</td>
<td>Good</td>
<td>400 – 500</td>
<td>7.0 – 7.5</td>
<td>16.7 – 16.8</td>
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<tr>
<td>5</td>
<td>Excellent</td>
<td>500 – 600</td>
<td>7.5 – 8.0</td>
<td>16.8 – 17.9</td>
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</tr>
<tr>
<td>6</td>
<td>Outstanding</td>
<td>600 – 800</td>
<td>8.0 – 9.0</td>
<td>17.8 – 18.1</td>
<td></td>
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<tr>
<td>7</td>
<td>Outstanding</td>
<td>800 – 1000</td>
<td>9.0 – 10.0</td>
<td>17.8 – 18.1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Outstanding</td>
<td>1000 – 1200</td>
<td>10.0 – 11.0</td>
<td>17.8 – 18.1</td>
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</table>

*Wind speeds are based on a Weibull k value of 2.0
Important Government Incentives *

• Federal Package:
  – Production Tax Credit (PTC): 2.3¢/kWh, indexed for inflation OR
  – Investment Tax Credit (ITC): 30% of qualifying property value OR
  – Treasury Grant of 30% of qualifying property value

* Begin to ratchet down beginning in 2017
**Wind In A Public Power State**

- 1. Public utility builds it, LES, OPPD, MEAN, NPPD
- 2. Native tribe or nation
  - no examples
- 3. Community Based Energy Development (CBED)
  - Bloomfield, Crofton
- 4. Private Developer with Public Power PPA
  - LB 629, 2007
  - LB 561, 2009
  - LB 1048, 2010
- 5. Private Developer for Export
  - Saline County (spot market)

$Incentive Legislation$

- LB 104 2013 – sales tax for over $20 Mil
- LB 402 2014 – sales tax help for CBEDs

## Wind Power

<table>
<thead>
<tr>
<th>2017</th>
<th># of turbines</th>
<th>Capacity (MW)</th>
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<tbody>
<tr>
<td>Ainsworth</td>
<td>36</td>
<td>59.4</td>
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<tr>
<td>Broken Bow I</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>Broken Bow II</td>
<td>43</td>
<td>75</td>
</tr>
<tr>
<td>Creston Ridge</td>
<td>4</td>
<td>6.8</td>
</tr>
<tr>
<td>Crofton Bluffs</td>
<td>22</td>
<td>42</td>
</tr>
<tr>
<td>Elkhorn Ridge</td>
<td>27</td>
<td>80</td>
</tr>
<tr>
<td>Flat Water</td>
<td>40</td>
<td>60</td>
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<tr>
<td>Grande Prairie</td>
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<td>400</td>
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<td>Kimball</td>
<td>7</td>
<td>10.5</td>
</tr>
<tr>
<td>Laredo Ridge</td>
<td>54</td>
<td>80</td>
</tr>
<tr>
<td>Petersburg</td>
<td>27</td>
<td>40.5</td>
</tr>
<tr>
<td>Prairie Breeze</td>
<td>118</td>
<td>200</td>
</tr>
<tr>
<td>Prairie Breeze II</td>
<td>41</td>
<td>73.4</td>
</tr>
<tr>
<td>Prairie Breeze III</td>
<td>20</td>
<td>35.8</td>
</tr>
</tbody>
</table>

### Salt Valley
- 2 | 1.32 |

### Springview II
- 2 | 3 |

### Steele Flats
- 44 | 74.8 |

### Valentine
- 1 | 1.85 |

### Valley Station
- 1 | 0.660 |

### Perennial
- 3 | 2.3 |

### Seward
- 1 | 1.7 |

### Creston Ridge II
- 3 | 6.9 |

### Cottonwood I
- 52 | 90 |

### Prairie Wind
- 1 | 2.5 |

### Rattlesnake
- 101 | 318 |

### Upstream
- 81 | 200 |

### Perennial
- 3 | 2.3 |

### Seward
- 1 | 1.7 |

### Pavilion
- 225 MW (changing to NG/H)

## Standard Generation

- **Coal**
  - Sutherland
    - ~1300 MW
  - Nebraska City
    - ~1300 MW
  - Grand Island
    - 100 MW
  - Hallam
    - 225 MW (changing to NG/H)

- **Nuclear**
  - Brownville
    - 800 MW
  - Fort Calhoun
    - 500 MW

- **Hydro**
  - Kingsley – 50 MW
  - Gavin’s Point – 130 MW

- **Natural Gas**
  - Many locations and various sizes

http://www.neo.ne.gov/statshtml/89.html#graph
http://www.eia.gov/state/?sid=NE

Access Easement: An easement allowing the developer to travel across the property to reach the turbine areas.

Construction Easement: Often tied to access easement. Gives access for construction of turbines and support systems. May also allow for a “lay-down” area(s).
Transmission easement: gives access for transmission lines (underground and overhead) between turbines, substation, and transmission lines

Source: Google Earth
Overhang/encroachment easement: You agree to allow turbine blades to overhang your property, even if turbines are on adjoining property.

Noise easement: Allows for noise from operations up to a certain level (usually measured in decibels [dB]), often within a specific radius.

Sources:
- Google Earth
Decommissioning

Don’t Forget the Transmission
Don’t Forget the Underground Cable

• Landowners should be aware of the economic benefits and the potential legal risks associated with negotiating a contract for the generation of electricity from wind.
• Above all, landowners should be
  – Aware that signing a wind contract should be a matter of negotiation. The landowner should be aware of the terms of the contract and should seek greater compensation for terms of the contract that are less favorable to the landowner.
  – The contract provisions listed above, along with many other aspects of the contract, should be considered carefully given the long term of commitment required by many contracts.
  – Negotiation of an equitable contract requires the assistance of effective legal counsel.
  – If satisfactory terms or compensation are not provided in the contract, new or additional terms should be negotiated or the contract should not be signed.
Solar

- Behind the meter
  - Residential <25 kW
  - Business Usually under 100 kW
- Community
  - 100 kW to X MW
- Utility Scale multi Megawatt

Wyandot County Solar (12 MW / 83 Acres / 159,200 panels)
Proposed Lancaster County Solar (230 MW / 1,000 Acres / 900,000 + panels)

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