Agenda

• Introduction to Wind and Solar Technologies and Markets
• Policy, Regulatory, and Economic Context
• Actor Map and Scenario Example
• Resource Data
TRANSFORMING THE ENERGY SYSTEM TO BENEFIT THE ECONOMY AND ENVIRONMENT.
Scope of “Utility-Scale”

**Utility-Scale Solar**

**What it is:**
- Solar PV, typically 1MW or greater (10MW for transmission asset)
- Owned and operated by utility
- Can be a community solar garden

**What it is not:**
- Less than ~1MW
- Rooftop solar
- Alternative solar energy systems (water heating, etc.)
- Small-scale ground-mounted solar

**Utility-Scale Wind**

**What it is:**
- Turbine generation capacity typically equivalent to 1MW or greater (25MW for jurisdictional authority designation)
- Multiple turbines

**What it is not:**
- A single turbine
- Alternative wind technologies (wind mill)
Market Forces

- Renewable energy technologies have an increasingly prominent role in energy systems

- Utility-scale **wind** energy is the cheapest form of electric generation in the world, and the cost continues to go down

- Utility-scale solar energy is expected to achieve parity with wind in the next couple of years, among the cheapest forms of electricity in the world

Source: Advanced Energy Economy, “The numbers are in and Renewable are Winning On Price Alone” https://blog.aee.net/the-numbers-are-in-and-renewables-are-winning-on-price-alone
Utility Resource Plans

- **2018 - Xcel Energy** announces a plan to reduce carbon emission by 80% carbon-free by 2030, and to be 100% carbon free by 2050
- **2019 – other utilities** make similar announcements for 80 -100% carbon free electric generation by 2050
- **Eight States** have passed laws committing to 100% carbon-free electric generation by 2050. Minnesota
More proposed projects are going to be coming to your community.
Renewable energy development is a significant growth industry that will play an increasing role in your county’s land use and economic development decision making.
If you remember two things…

Renewable energy development is a land use and economic choice, like any other type of development

- Investment in the community with economic returns; taxes, rents, jobs
- Development option that is part of the bundle of property rights
- Creates synergies or conflicts with other land uses and local resource opportunities
- It’s not a yes or no decision: The community can shape siting and site design decisions to maximize benefits and minimize risks
How Projects Happen: Siting Authority and Minnesota Context
The Minnesota Legislature passed renewable energy objectives, requiring 25% of total retail electricity sales to be generated by renewable energy sources by 2025.

In 2018, wind energy provided 18% of electric generation, all renewables produced 24%.
# Siting Authority - Solar

<table>
<thead>
<tr>
<th>Solar</th>
<th>FEDERAL, STATE &amp; LOCAL ROLES</th>
<th>STATE</th>
<th>LOCAL</th>
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<tbody>
<tr>
<td></td>
<td>Regulating authority for access to direct sunlight for solar energy systems</td>
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<td>Environmental review for solar systems equal to or greater than 50 MW*</td>
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<tr>
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<td>Permitting for solar systems less than 50 MW</td>
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1. Minnesota State Statute 462.357 and 394.25
2. MN Department of Commerce [https://mn.gov/commerce/industries/energy/solar/](https://mn.gov/commerce/industries/energy/solar/)
4. [https://mn.gov/puc/permitting/](https://mn.gov/puc/permitting/)
Counties in Minnesota have land use authority and approval control for all wind energy projects with a total energy capacity of five (5) MW (between 2 and 4 utility-scale turbines).

Counties can choose to expand their land use authority for wind projects up to 25 MW in capacity (projects with 10-15 turbines).
Case Study Example

Developer “WindPerson” approaches Ms. Landowner about developing a **utility-scale** wind farm on her property. What happens next?

1. Ms. Landowner needs to decide whether to move forward with the development on her land

2. Developer applies for land use permit – *if over 25 MW, at state level. If under 25 MW, at Redwood Co. level*

3. County or State deliberates land use permit – including public meetings and comments
Case Study Example

Developer “WindPerson” approaches Ms. Farmer about developing a **utility-scale** wind farm on her property. What happens next?

4. County or State considers land use considerations – prime farmland, community character, etc.

5. Environmental Review and other permits considered – including public comments

6. Decision to grant land use permit
Lifecycle of Development

Renewable energy development is not conceptually different from any other form of development. . .
Lifecycle of Development

Renewable energy development stakeholders are not conceptually different from any other form of development. . .

1. Financier
2. Developer
3. Regulators (state and/or local)
4. Contractor (EPC)
5. Owner/Manager 1
6. Market participants (products/services)
   7. Owner/Manager 2
   8. Market participants (products/services)
   9. Owner/Manager 3 . . .
Midcontinent Independent System Operator (MISO) General Interconnection Process

All utility-scale energy projects (10 MW or greater) must get MISO approval before proceeding...

Understanding The Resource Market

- Wind Resource
- Solar Resource
- Existing Solar and Wind Development
- Prime Farmland
- Transmission Lines
- Habitat and Environmental Considerations
- Population Density
- Project Development (MISO) Queue
Existing Resource
Wind Resource

80-meter wind

100-meter wind

Wind speed (miles per hour)
- > 26 mph
- 24 - 25 mph
- 22 - 24 mph
- 20 - 22 mph
- 18 - 20 mph
- 16 - 18 mph
- 14 - 16 mph
- 12 - 14 mph
- 10 - 12 mph
- < 10 mph

Data source: National Renewable Energy Lab (NREL)
national wind speed data, 2006 - 2013
Wind Resource is three dimensional
Average turbine capacity, hub height, and rotor size for land-based wind projects, 1998-99 to 2018

Climate-related factors (clouds, humidity) affect solar resources only about 15%. The solar resource shown here is primarily defined by shading, which is in turn defined by local land uses (buildings, trees).

Data source: University of Minnesota, Uspatial Solar Insolation Raster Data, 2007 - 2013
Existing Wind Capacity – 3,694 MW

Existing Solar Capacity – 1,100 MW (includes distributed solar)

Data source: EIA-860 Form national power dataset, 2018
Considerations that Impact Resource Use
Importance of Interconnection

Solar and wind development is greatly dependent on opportunities to interconnect to the transmission or distribution grid:

- **Utility scale** wind and solar are connected to the transmission grid *(shown here)*
- **Community scale solar** is typically connected to the distribution grid. The distribution grid is much more granular and disperse.

Data source: Homeland Infrastructure Foundation-Level Data (HIFLD) from the Federal Geographic Data Committee, Last updated 10/19/18

Weblink: [https://hifld-geoplatform.opendata.arcgis.com/datasets/electric-power-transmission-lines?geometry=-77.689%2C44.31%2C-75.105%2C44.994](https://hifld-geoplatform.opendata.arcgis.com/datasets/electric-power-transmission-lines?geometry=-77.689%2C44.31%2C-75.105%2C44.994)
Subp. 4.
Prime farmland exclusion.
No large electric power generating plant site may be permitted where the developed portion of the plant site, excluding water storage reservoirs and cooling ponds, includes more than 0.5 acres of prime farmland per megawatt of net generating capacity, or where makeup water storage reservoir or cooling pond facilities include more than 0.5 acres of prime farmland per megawatt of net generating capacity, unless there is no feasible and prudent alternative. Economic considerations alone do not justify the use of more prime farmland. "Prime farmland" means those soils that meet the specifications of Code of Federal Regulations 1980, title 7, section 657.5, paragraph (a). These provisions do not apply to areas located within home rule charter or statutory cities; areas located within two miles of home rule charter or statutory cities of the first, second, and third class; or areas designated for orderly annexation under Minnesota Statutes, section 414.0325.
Prime Farmland as a Natural Resource

Data source: NRCS / USDA prime farmland, ArcGIS
Living Atlas Online Layer, 2018
Prime Farmland currently in Cropland

Data source: MDA Prime Farmland dataset (aggregated with NRCS Soils dataset), and USDA 2017 Cropland Data
Habitat Consideration

The Nature Conservancy
“Site Wind Right” Project

Data source: The Nature Conservancy, Site Wind Right Analysis, July 2019
Low-Risk Wind Analysis

The Nature Conservancy
“Site Wind Right” Project

Low-Risk Wind Siting from a habitat and natural areas perspective

*Representation, **NOT** go, no-go

Data source: The Nature Conservancy, Site Wind Right Analysis, July 2019
Population Density


Household density by census tract

Individual density by census tract

Prospective Considerations
Total Solar Capacity in the Queue (MN, Sept 2019): 4,500 MW

Total Wind Capacity in the Queue (MN, Sept, 2019): 3,550 MW

Data source: MISO Interconnection Queue, January 2019 (for map), Sept 2019 (for MW capacity)
Redwood County Solar and Wind Resources
Redwood County: Existing Resource
Wind Resource

80-meter wind

Data source: National Renewable Energy Lab (NREL)
national wind speed data, 2006 - 2013
Wind Resource

100-meter wind

Wind speed (miles per hour)

- > 26 mph
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Data source: National Renewable Energy Lab (NREL)
national wind speed data, 2006 - 2013
Redwood currently has 3.4 MW of wind installed and 2.7 MW of solar installed.
Redwood County: Considerations that Impact Resource Use
Electricity Transmission

- Transmission Lines
- Substations
- 2-Mile Buffer – Zone of Conservative Cost Feasibility
Redwood County
Example of Agricultural Goals

Objective No. 1: Protect the rural, agricultural character of Redwood County.

Objective No. 2: Encourage ag-related commercial and non-traditional agricultural development.

Objective No. 5: Establish land use patterns that preserve and protect the natural qualities and existing rural character of the landscape.

Objective No. 6. Preserve open space and wildlife habitat and protect natural resources.
Habitat Consideration

Low-Risk Wind Siting from a habitat and natural areas perspective

Data source: The Nature Conservancy, Site Wind Right Analysis, July 2019
*As of September 2019, two wind projects are seeking interconnection (616 MW), no solar projects in the queue*

*Shown on the map, In adjacent counties, there is 230 combined MW of wind, and 32.5 MW of solar*
Optimal Locations and Site Design Criteria

This depends on the goals and priorities that Redwood County sets through this comprehensive planning process.

These maps are inputs into your decision-making process, they are not the decisions.

We can’t show you a map – you are creating it through your planning process.
Wind Site Design
Land Use Co-Benefits

Wind has fairly limited conflicts with agricultural land uses

- Compatible land use with many forms of agriculture
- Clear benefit of adding to agriculture economic diversity
- Least costly form of energy generation
- Significant local tax benefits
- Primary land use conflicts are with habitat and rural residences
- Visual impacts cannot be mitigated
THANK YOU

Brian Ross, AICP, LEED GA
Great Plains Institute
bross@gpisd.net
612-767-7296