# Murray County Energy Dialogue

## How Renewable Energy Development Happens

**February 2020**


# 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.

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# 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

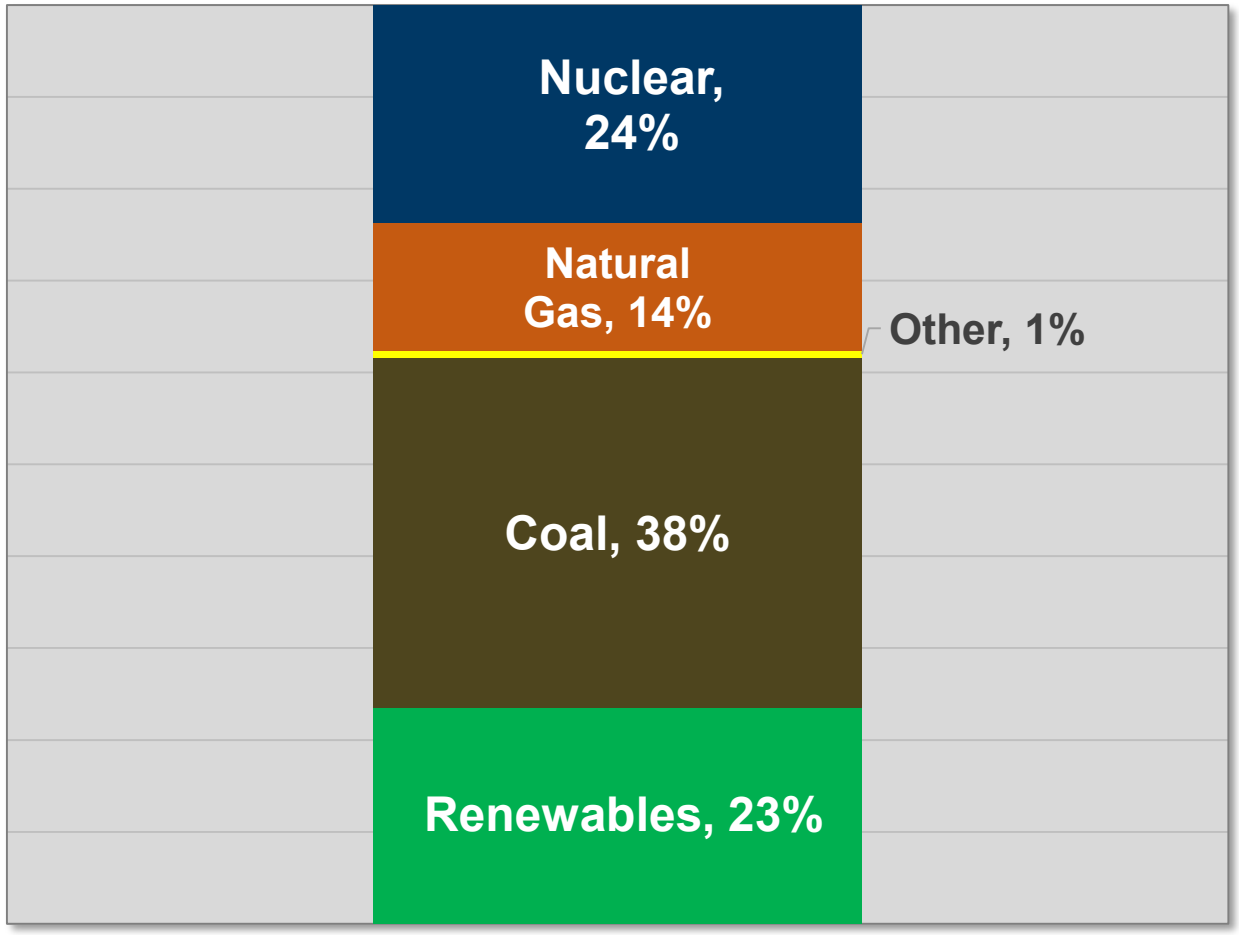
**What it is:**

- 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)

## Minnesota Net Electricity Generation *(annual 2018)*




The Minnesota Legislature passed renewable energy objectives, requiring 25% of total retail electricity sales to be generated by renewable energy sources by 2025.

As of 2019, we have met the 25% standard goal, but the fuel generation breakdown is yet to be released.



*Other includes non-biogenic municipal solid waste, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels, and miscellaneous technologies, including petroleum.

*Source: EIA data on state electricity generation, updated October 2019; available at https://www.eia.gov/electricity/data/state/*

# 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

**Xcel Energy Carbon Reduction Plan**



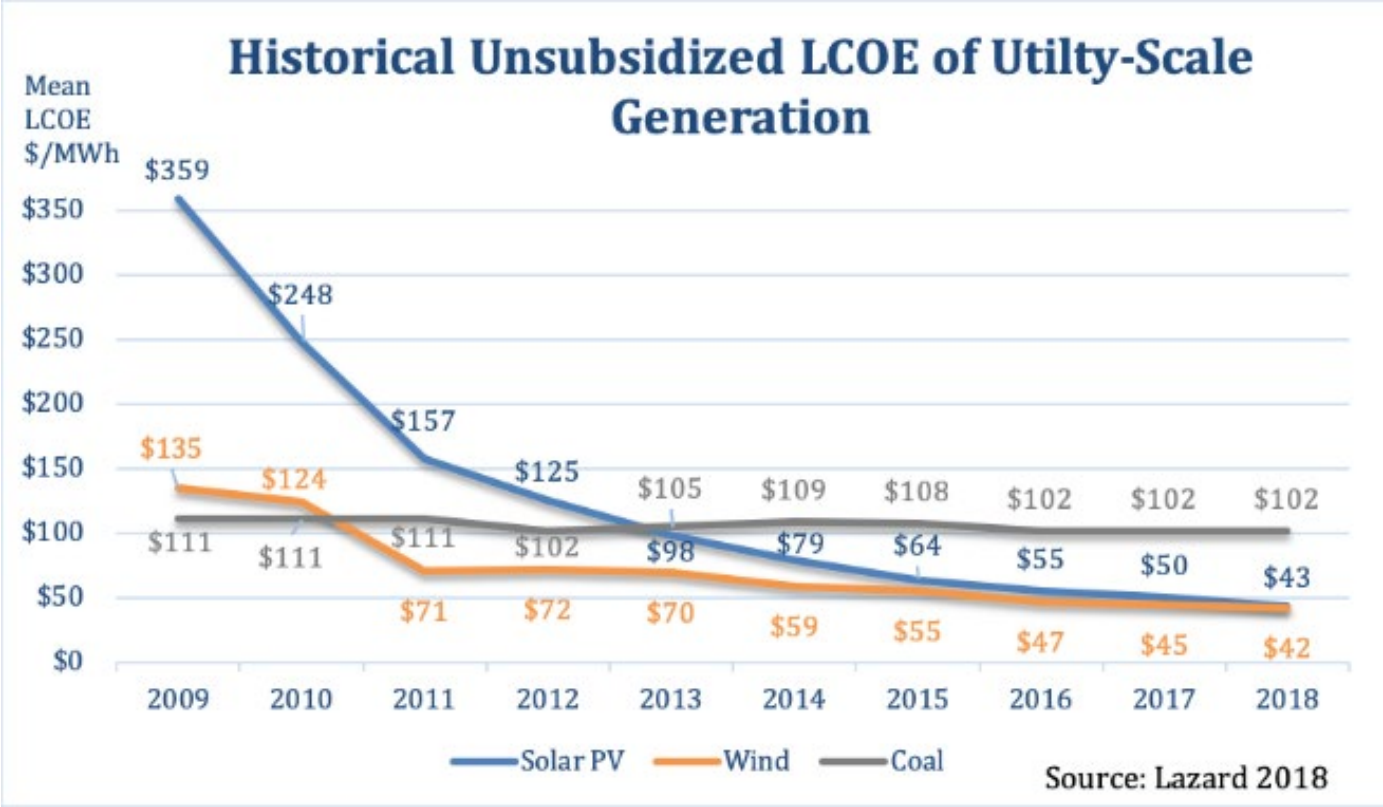

*Source: Union of Concerned Scientists, https://blog.ucsusa.org/jeff-deyette/states-march-toward-100-clean-energy-whos-next*

# 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

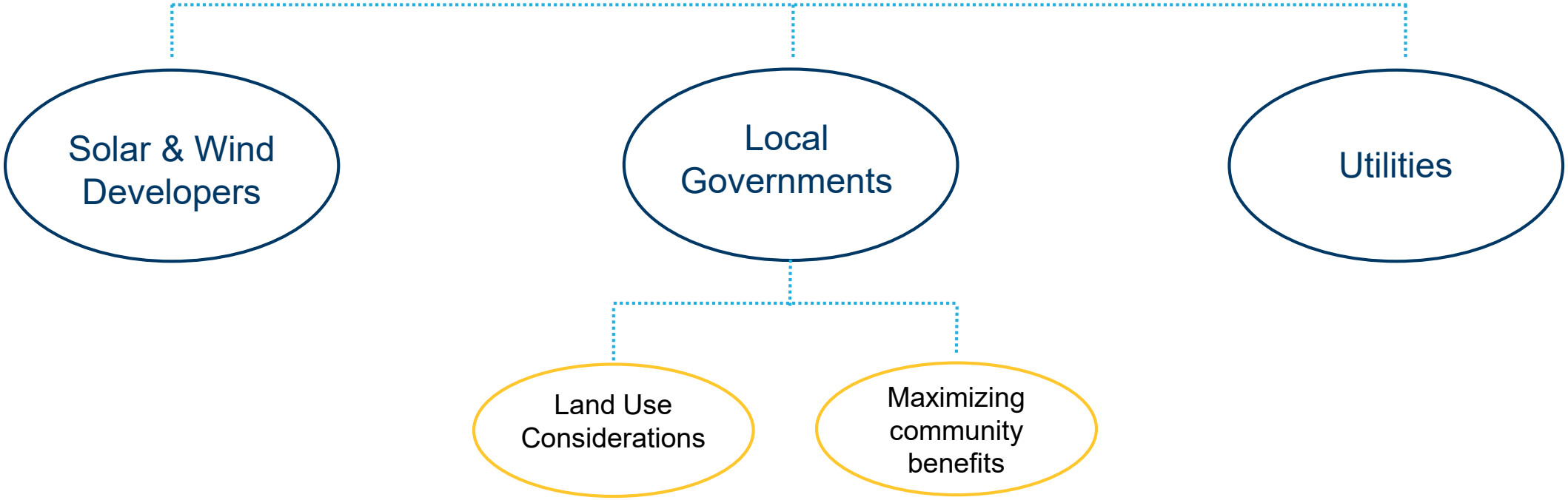





Source: Advanced Energy Economy, “The numbers are in and Renewable are Winning On Price Alone” https://blog.aee.net/the-numbers-are-in-and-renewables-are-winning-on-price-alone

# Lowering cost of solar and wind energy

*effects long-term planning for*




**More proposed projects are going to be coming to your community.**

# If you remember one thing…

**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.**

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Photo credit: Brian Ross


Photo credit: NREL InSPIRE, Flickr

# 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

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# Siting Authority - Wind

| FEDERAL, STATE & LOCAL ROLES | | STATE | LOCAL |
|---|---|---|---|
| Wind | Permitting for facilities between 5 MW and 25 MW | X | X |
| | Permitting authority for large wind facilities over 25 MW | X | |
| | Expansion of wind system greater than 5 MW | X | |
| | Siting authority for small wind energy systems | | X |

**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 Murray 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?

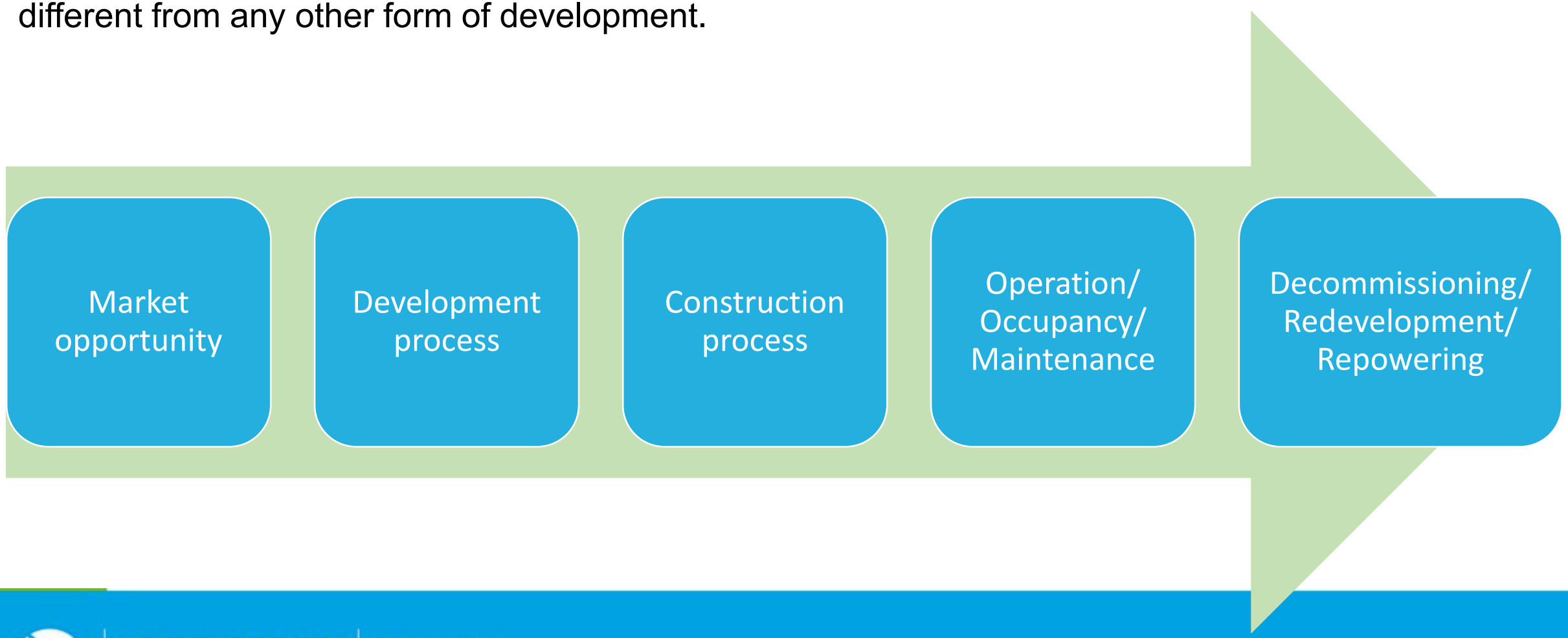
4 County or State considers land use considerations – prime farmland, community character, etc.

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 . . .

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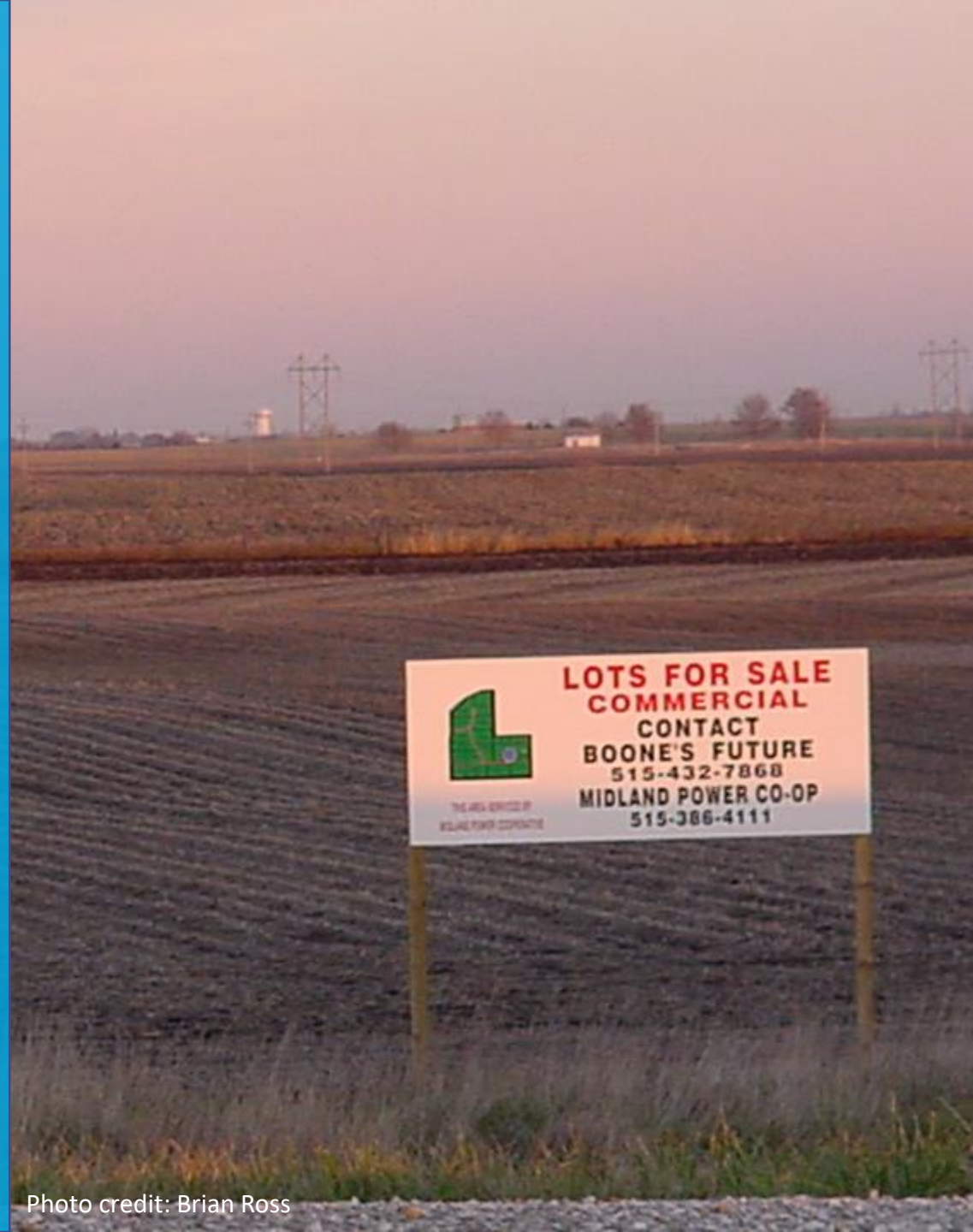
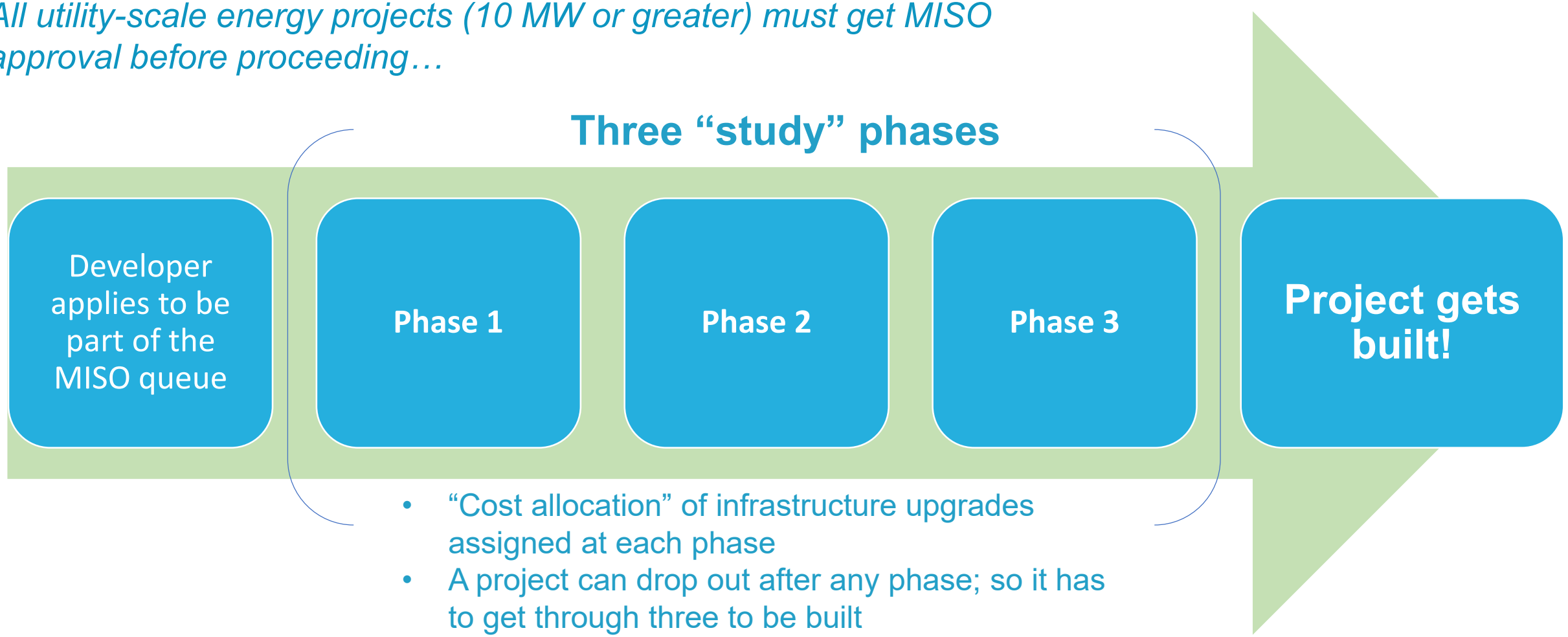



Photo credit: Brian Ross

# Midcontinent Independent System Operator (MISO) General Interconnection Process

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




- "Cost allocation" of infrastructure upgrades assigned at each phase
- A project can drop out after any phase; so it has to get through three to be built

Source: https://www.misoenergy.org/api/documents/getbyname/GI%20Process%20Flow%20Diagram.pdf

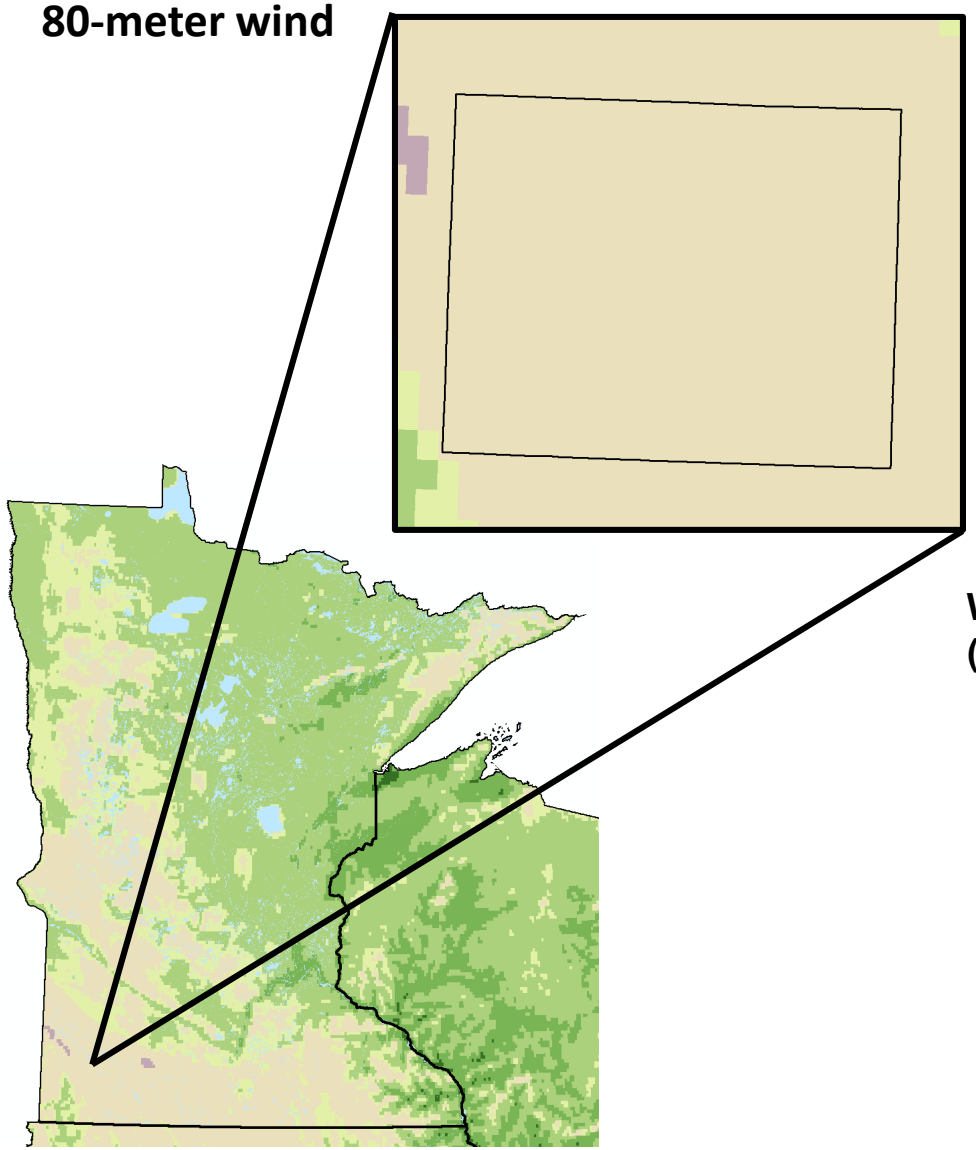

# Understanding The Resource Market

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

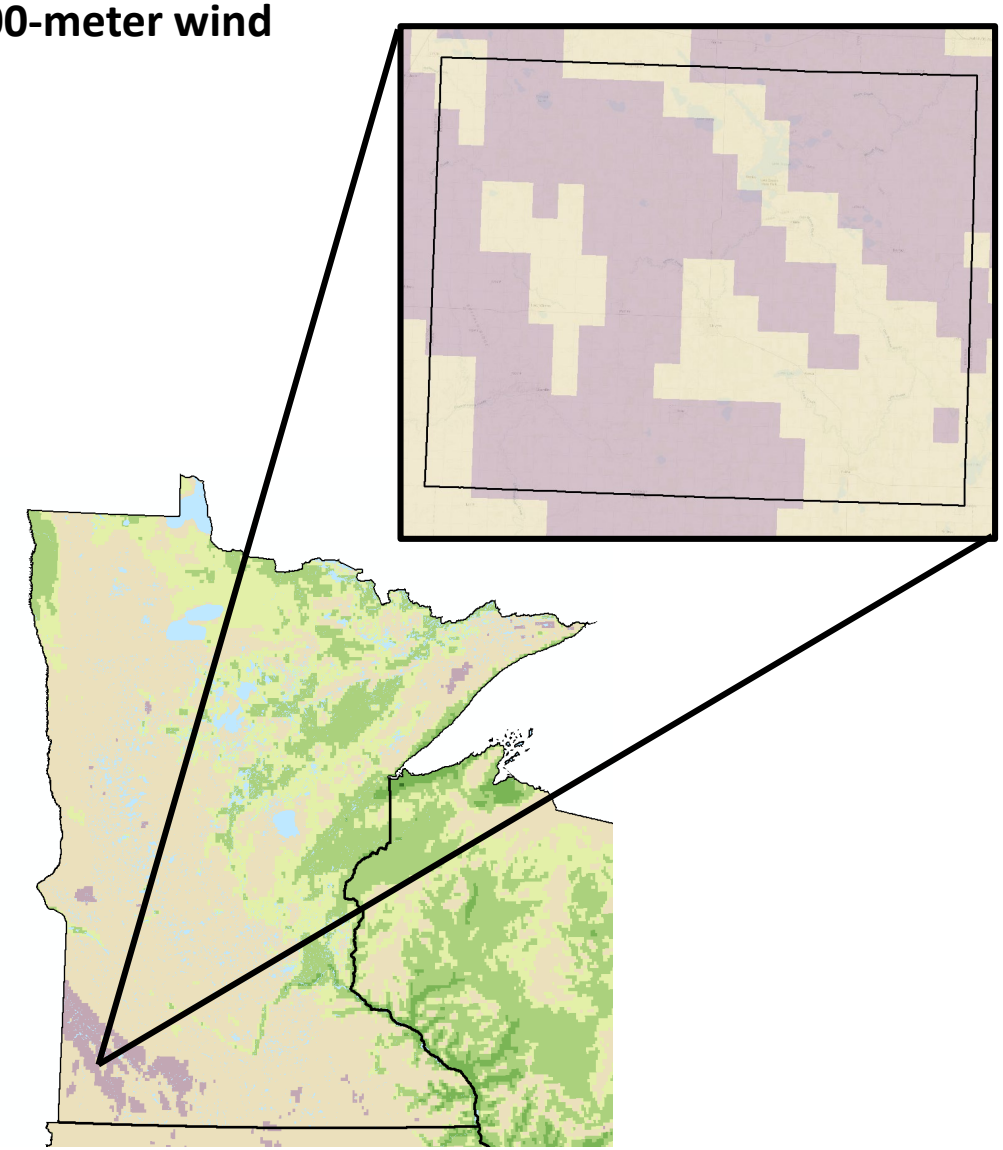

# Existing Resource: How good are your wind and solar resources?

# Wind Resource

## 80-meter wind



## 100-meter wind



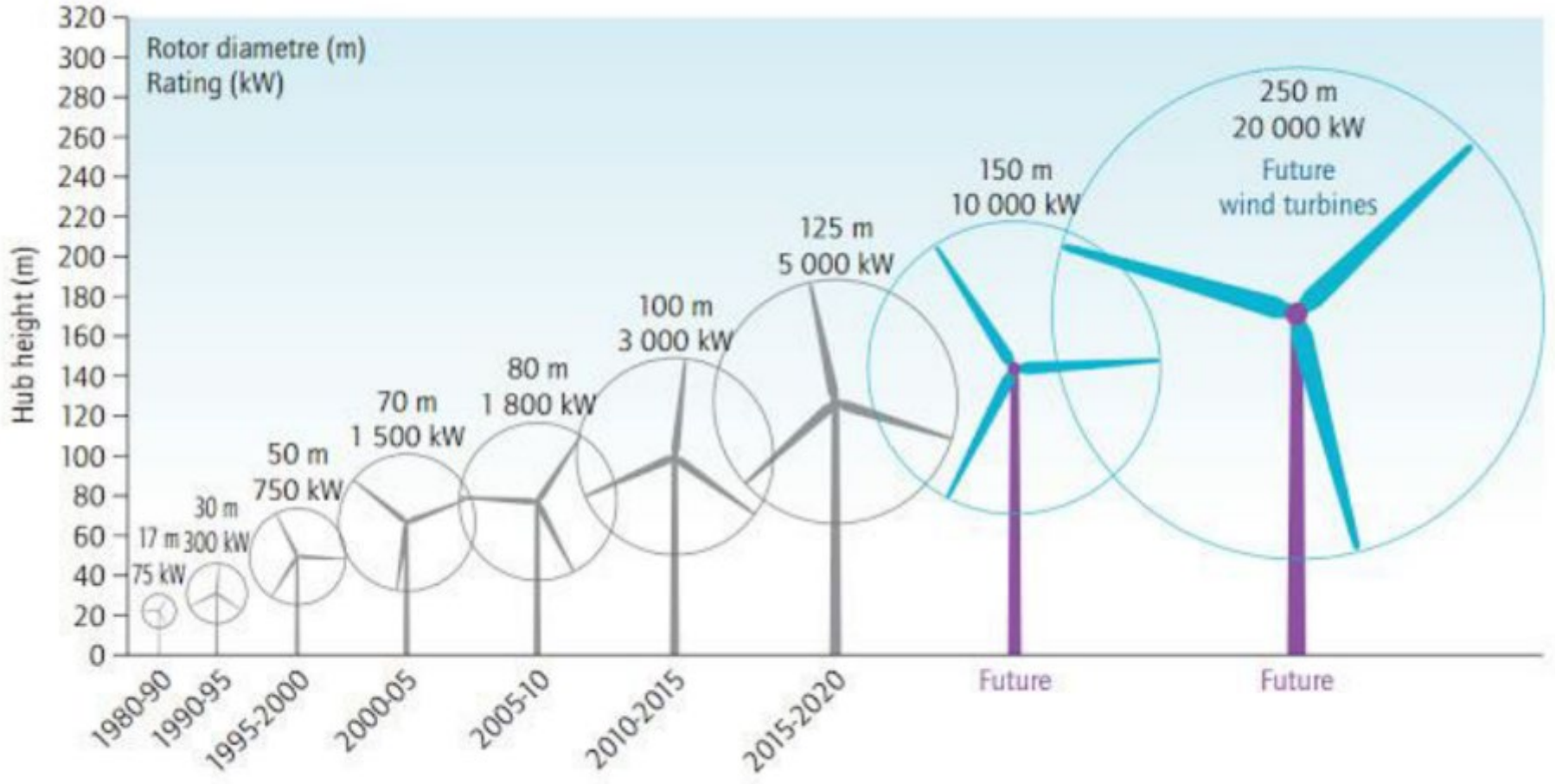
Water

**Wind speed (miles per hour)**

- > 26 mph
- 24 - 26 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



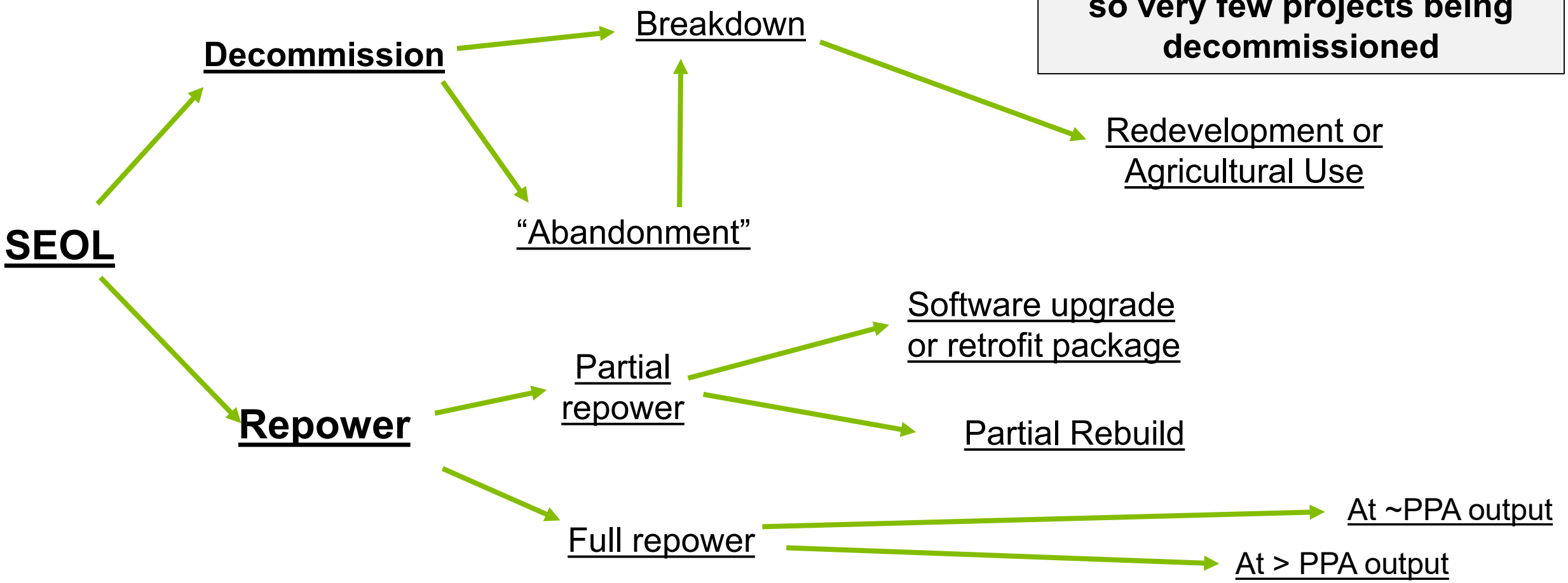

Source: adapted from EWEA, 2009.



Source: "Figure 14: Growth in size of wind turbines since 1980 and prospects" in *Technology Roadmap: Wind Energy, 2013 edition*, International Energy Agency (IEA), 2013 copyright OECD/IEA, page 27, adapted from European Wind Energy Association, 2009. Accessible at: https://webstore.iea.org/technology-roadmap-wind-energy-2013

# Options for a wind systems at "Simple End of Life" (i.e. 25 – 35 years depending on initial construction)

**What are we seeing?**
**Value of interconnection queue is > cost of repowering, so very few projects being decommissioned**

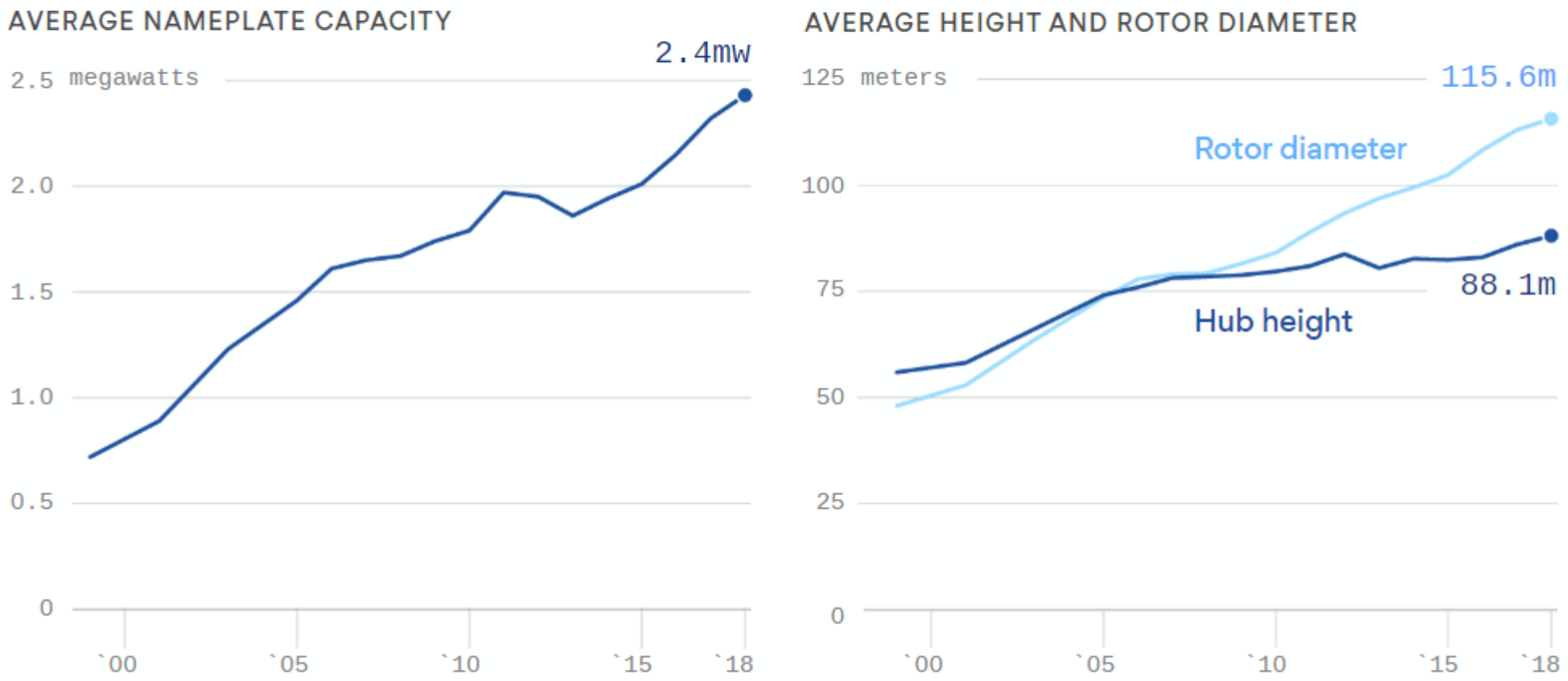





Source: MN PUC, LWEC Guidance 2019
https://mn.gov/eera/web/doc/13655/

# Wind Resource is three dimensional

## Average turbine capacity, hub height, and rotor size for land-based wind projects, 1998-99 to 2018




Data: U.S. Department of Energy; Chart: Axios Visuals

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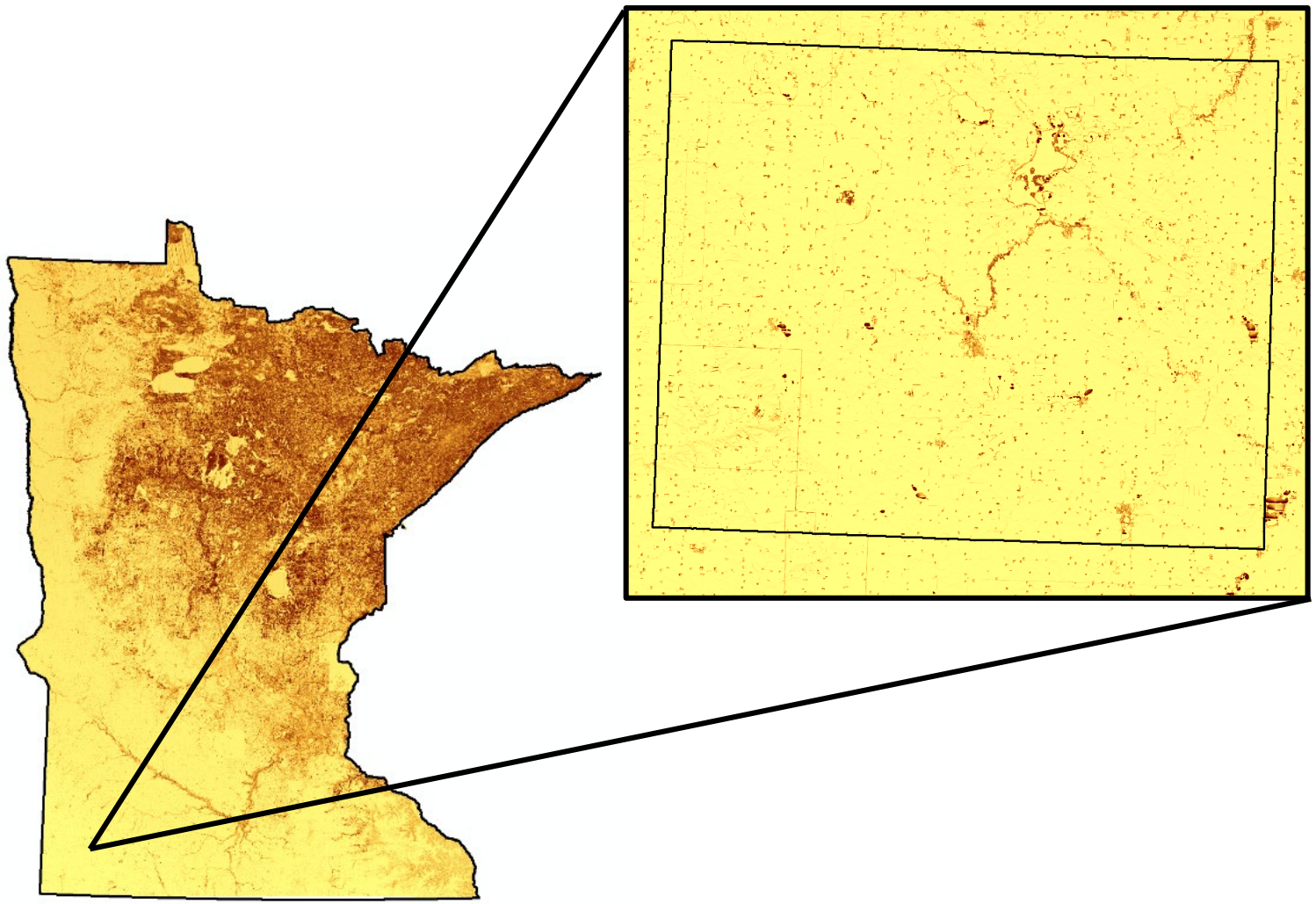
Source: "Average turbine capacity, hub height, and rotor size for land-based wind projects, 1998-99 to 2018", U.S. Department of Energy and Axios. Accessible at: https://www.axios.com/wind-power-renewable-energy-donald-trump-888ec2bc-4f99-4fb1-b2f4-b31160a938e6.html

# Solar Resource



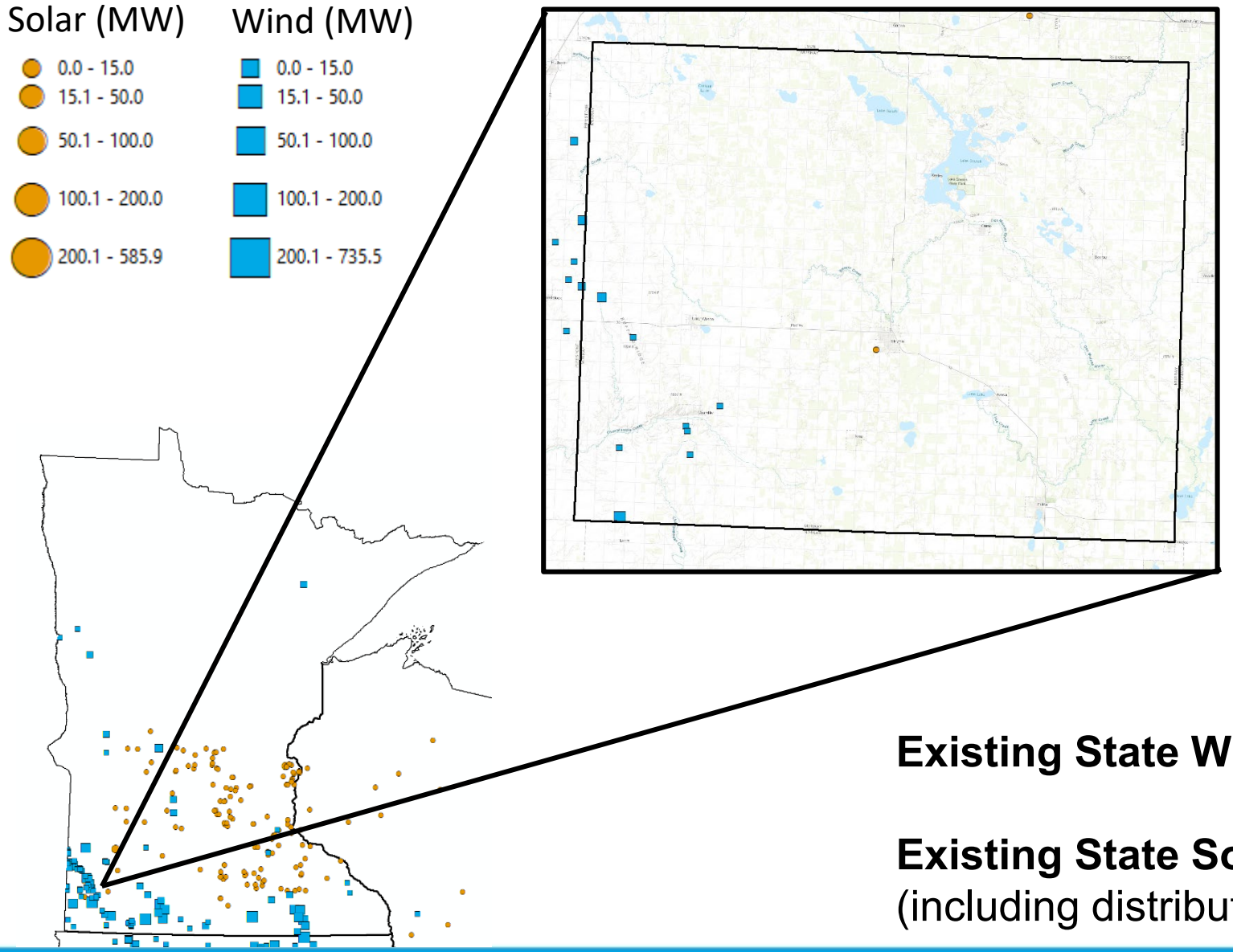
Climate-related factors (clouds, humidity) affect solar resources only about 15%. The solar resource shown here is primarily defined by shading, which is in turn defined by local land uses (buildings, trees).

High solar resource

Low solar resource

*Data source: University of Minnesota, Uspatial Solar Insolation Raster Data, 2007 - 2013*

# Existing Wind and Solar




As of 2018, Murray had:

- **329.4 MW** of wind installed
- **3.7 MW** of solar installed

**Existing State Wind Capacity – 3,751 MW**

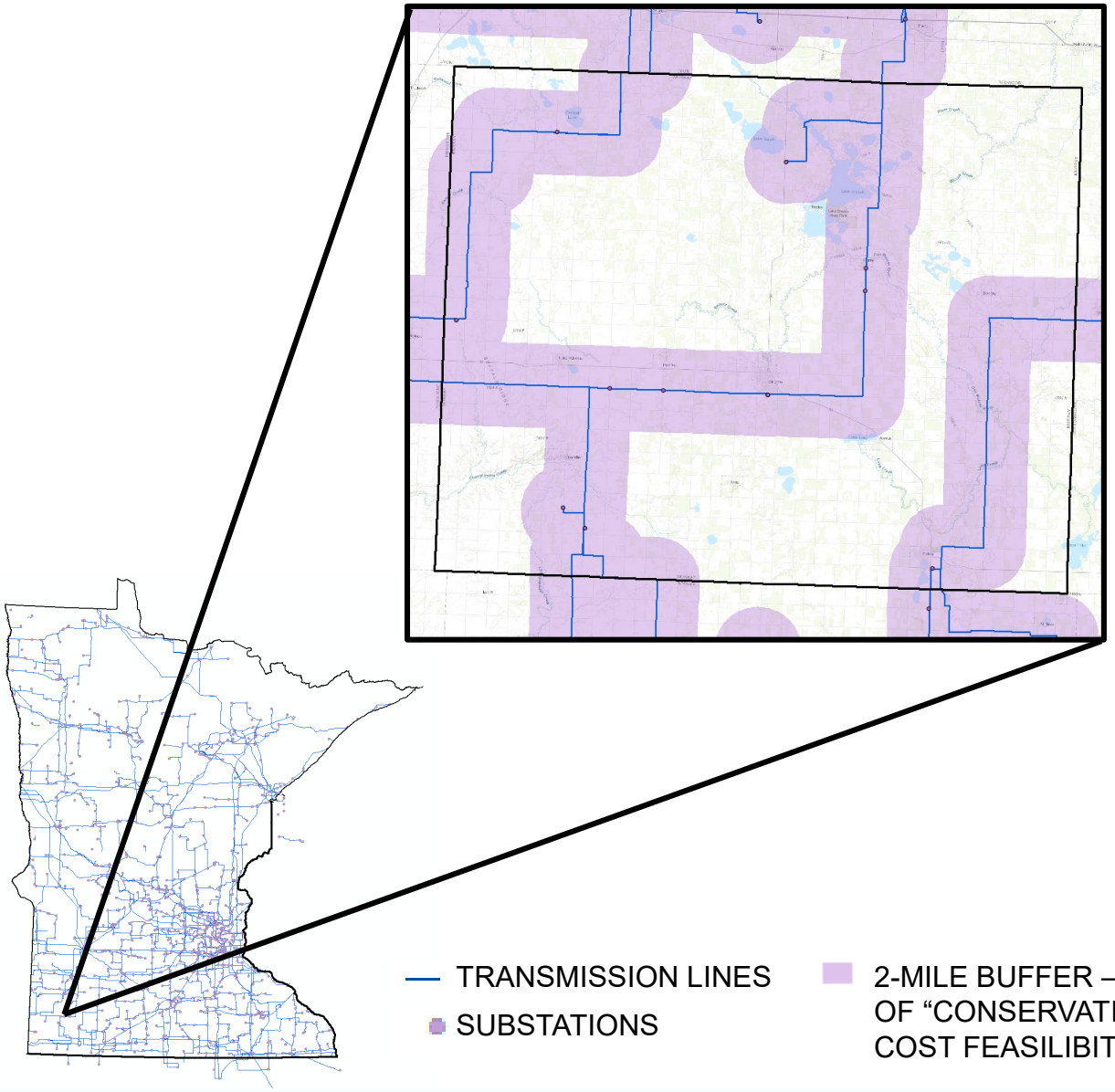
**Existing State Solar Capacity – 1,407 MW**
(including distributed solar)



*Data source: EIA-860 Form national power dataset, 2018*


# Considerations that Impact Resource Use

# Electricity Transmission




## 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 must 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

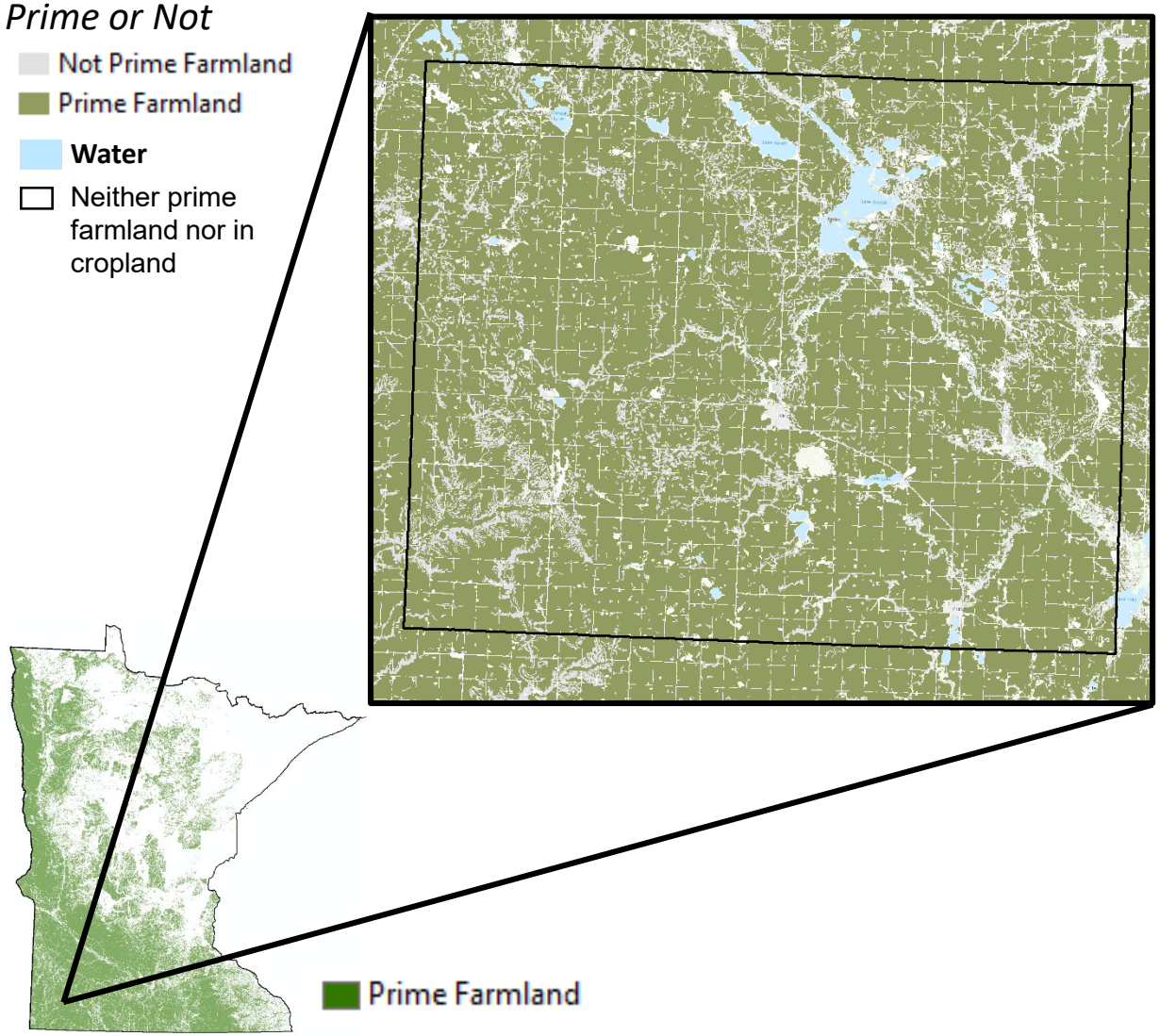
Agricultural Preservation Goals

# Prime Farmland Exclusion (Minnesota Administrative Rules, 7850.4400)

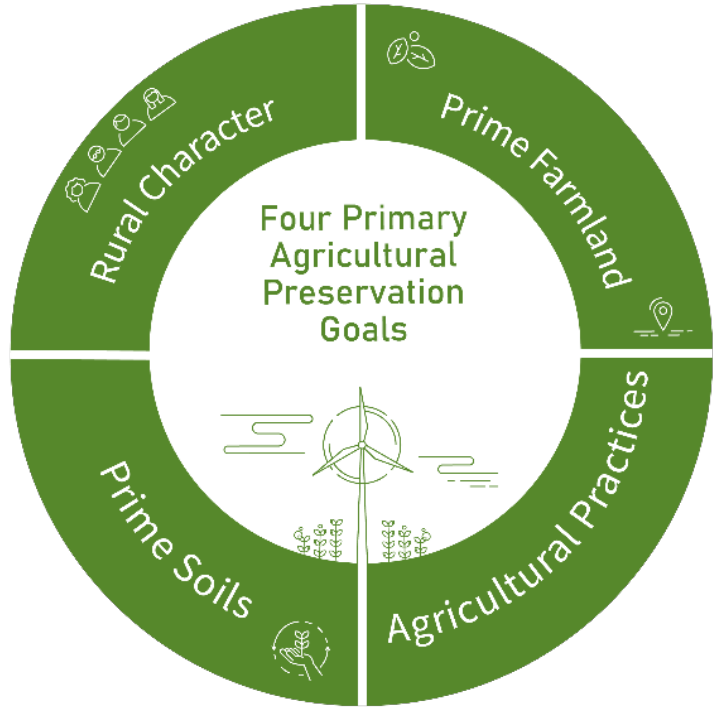
**Subp. 4.**
**Prime farmland exclusion.**
**No large electric power generating plant site may be permitted** where the developed portion of the plant site, excluding water storage reservoirs and cooling ponds, includes more than 0.5 acres of prime farmland per megawatt of net generating capacity, or 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

All Cropland (2016) *as Prime or Not*




## Prime Farmland as a **Natural Resource**

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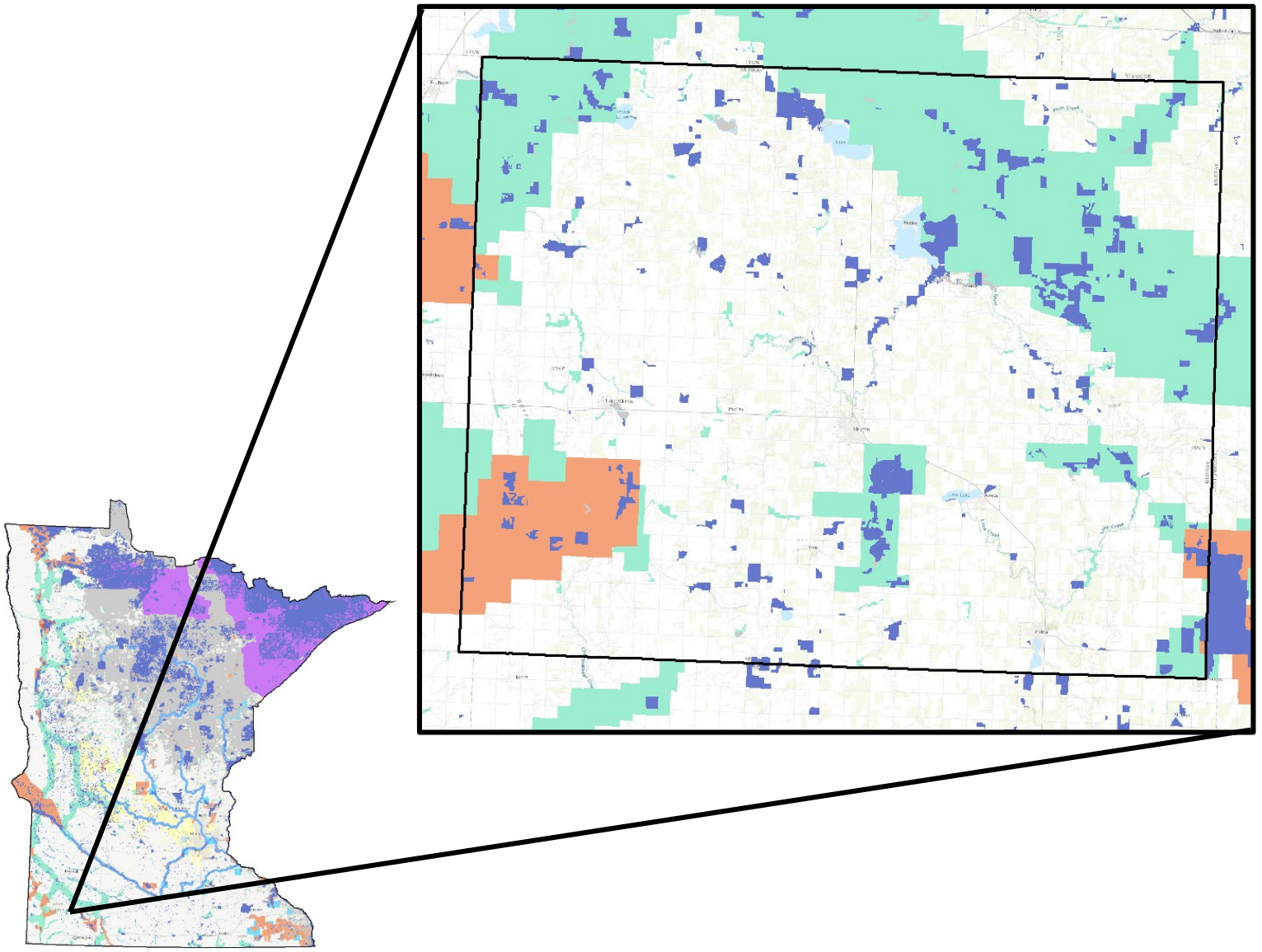
*Data source: NRCS / USDA prime farmland, ArcGIS Living Atlas Online Layer, 2018*

# Habitat Consideration

## The Nature Conservancy
"Site Wind Right" Project

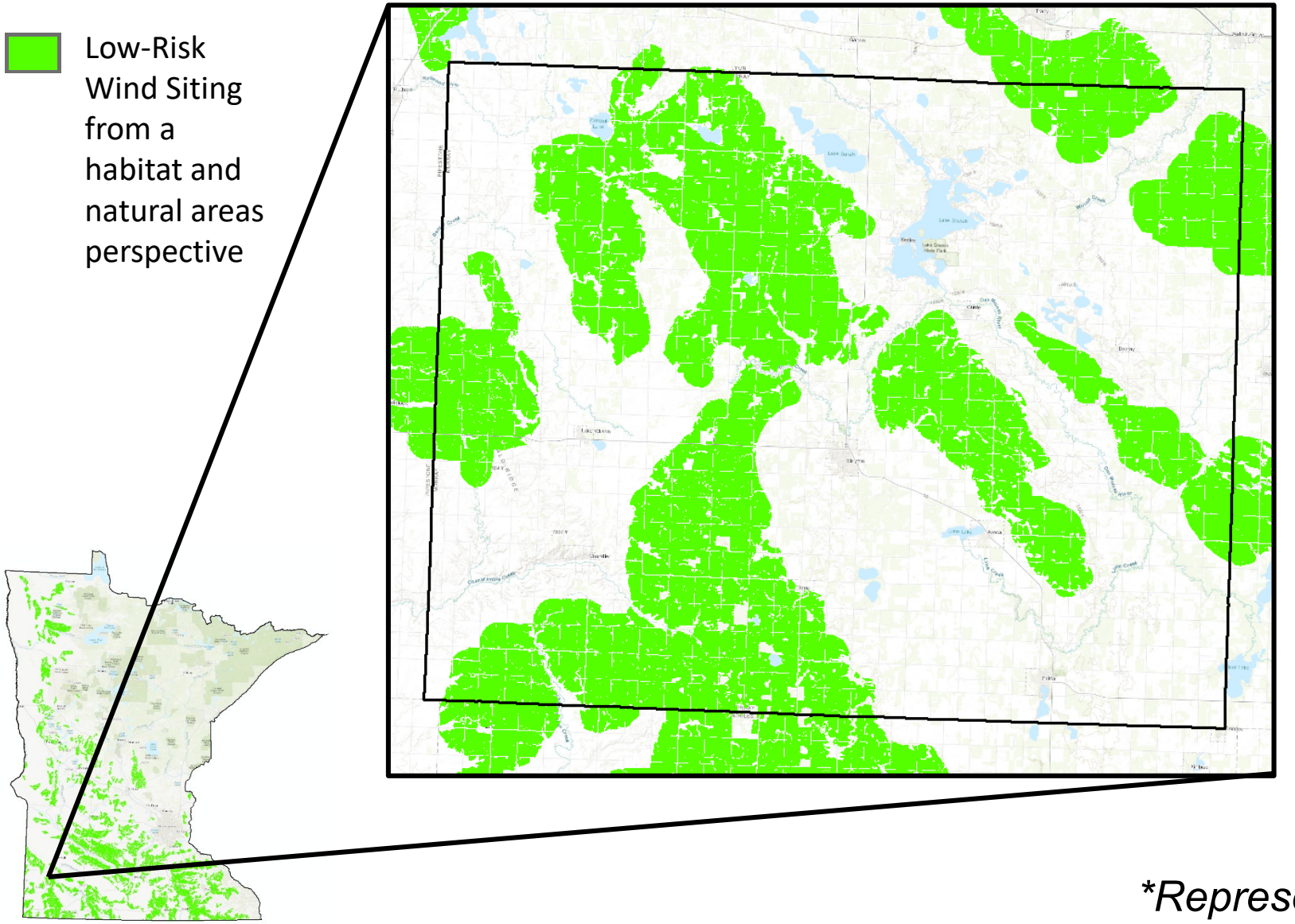


- Whooping crane stopover sites
- Eagles / other raptors
- Prairie grouse
- High waterfowl breeding density
- Important bird areas
- Bat roosts
- Threatened / endangered species
- Big game
- Important wetlands / rivers
- Protected / managed lands
- Intact natural habitats
- Other biodiversity significance

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

# Low-Risk Wind Analysis

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



**The Nature Conservancy**
"Site Wind Right" Project

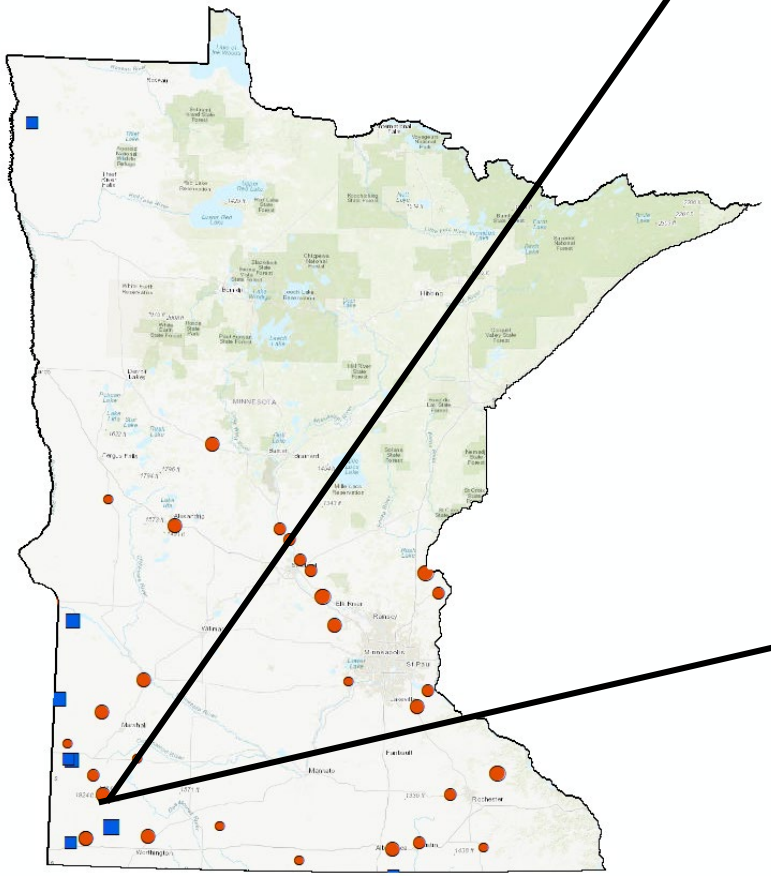
**Representation, NOT go, no-go*

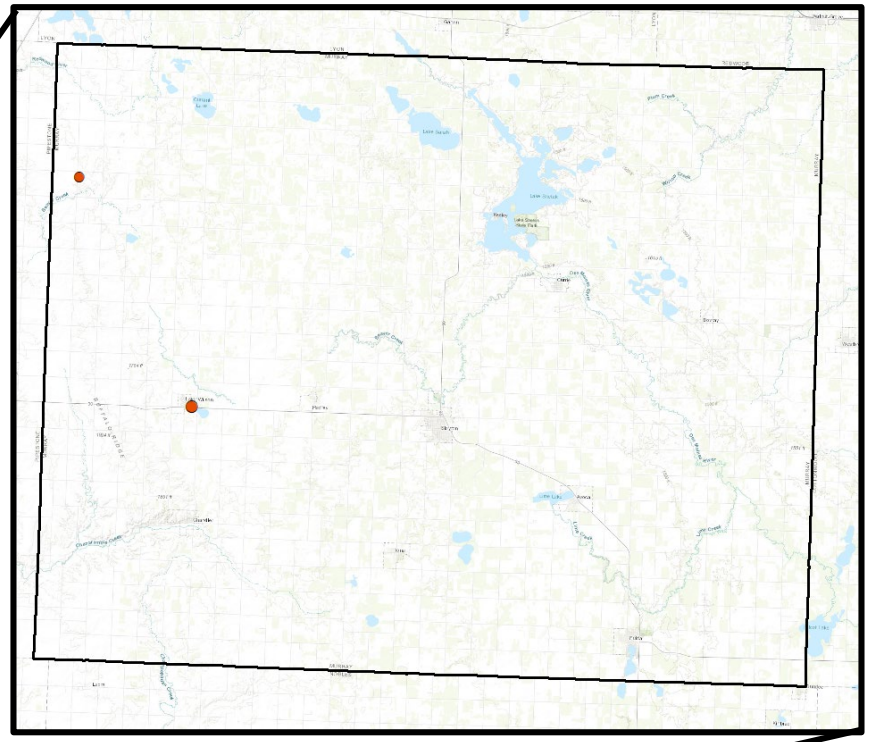
*Data source: The Nature Conservancy, Site Wind Right Analysis, July 2019*


# Prospective Considerations

# MISO Queue

**As of February 2020, two solar projects are seeking interconnection (210 MW), and one wind project in Murray County (or adjacent counties filed under both counties) (600 MW)*





Queue WIND Projects (MW)

- 0.0 - 15.0
- 15.1 - 50.0
- 50.1 - 100.0
- 100.1 - 200.0
- 200.1 - 735.5

Queue SOLAR Projects (MW)

- 0.0 - 15.0
- 15.1 - 50.0
- 50.1 - 100.0
- 100.1 - 200.0
- 200.1 - 585.9

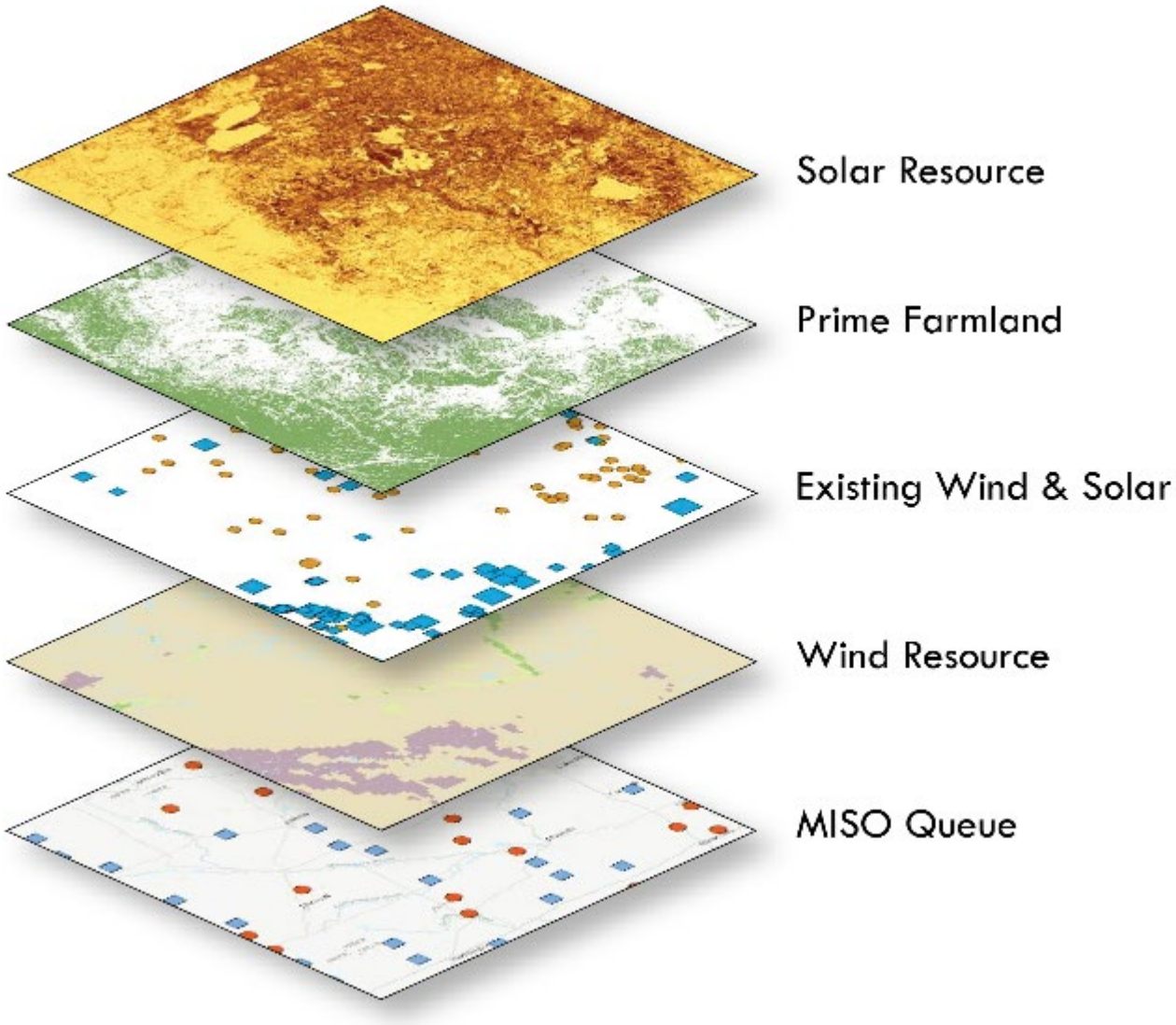
***Total Solar Capacity in the Queue (MN, Feb, 2020): 4,510 MW***

***Total Wind Capacity in the Queue (MN, Feb, 2020): 2,979 MW***



*Data source: MISO Interconnection Queue, January 2020 (for map), February 2020 (for MW)*

# Decision Making




# Optimal Locations and Site Design Criteria

**This depends on the goals and priorities that Murray 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**

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# THANK YOU

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