

Figure 4. The development of a new wind power plant is a multistep process that can take years to complete.  
 Source: American Clean Power (2020)

# WHAT IS A WIND ORDINANCE?

Laws passed by sub-national governments, such as counties, that define the parameters wind turbines and farms must meet to be approved and built.

↓ PURPOSE ↓

To enable cost-effective wind development while protecting the interests and safety of participating landowners, non-participating landowners, and members of the community.<sup>9</sup>

↓ COMMON COMPONENTS ↓

Application and approval requirements

Constructions and decommissioning guidelines

Safety

Setbacks and other technology-specific requirements



# SETBACKS AND TECHNOLOGY REQUIREMENTS EXPLAINED

## SETBACKS

- ▶ Establish the minimum distance between turbines and roads, property lines, or structures.
- ▶ For structures, setbacks are typically a **standard distance** (ex. 1,250 ft).
- ▶ For roads, setbacks are typically a **multiplier of total turbine height** (ex. 110%), defined as the sum of hub height and rotor radius.

## TECHNOLOGY STANDARDS

- ▶ Can include limitations on
  - ▶ **Turbine height**
  - ▶ **Shadow flicker:** the number of hours per year that the shadow cast from the turbine and its rotating blades falls on buildings
  - ▶ **Noise level:** as measured in decibels A (dBA), recorded at a particular distance from a wind farm



# HAWKEYE STATE HEADWINDS

*A Case Study of Local Opposition and  
Siting Challenges for Large Scale Wind  
Development in Iowa*



CLEARPATH



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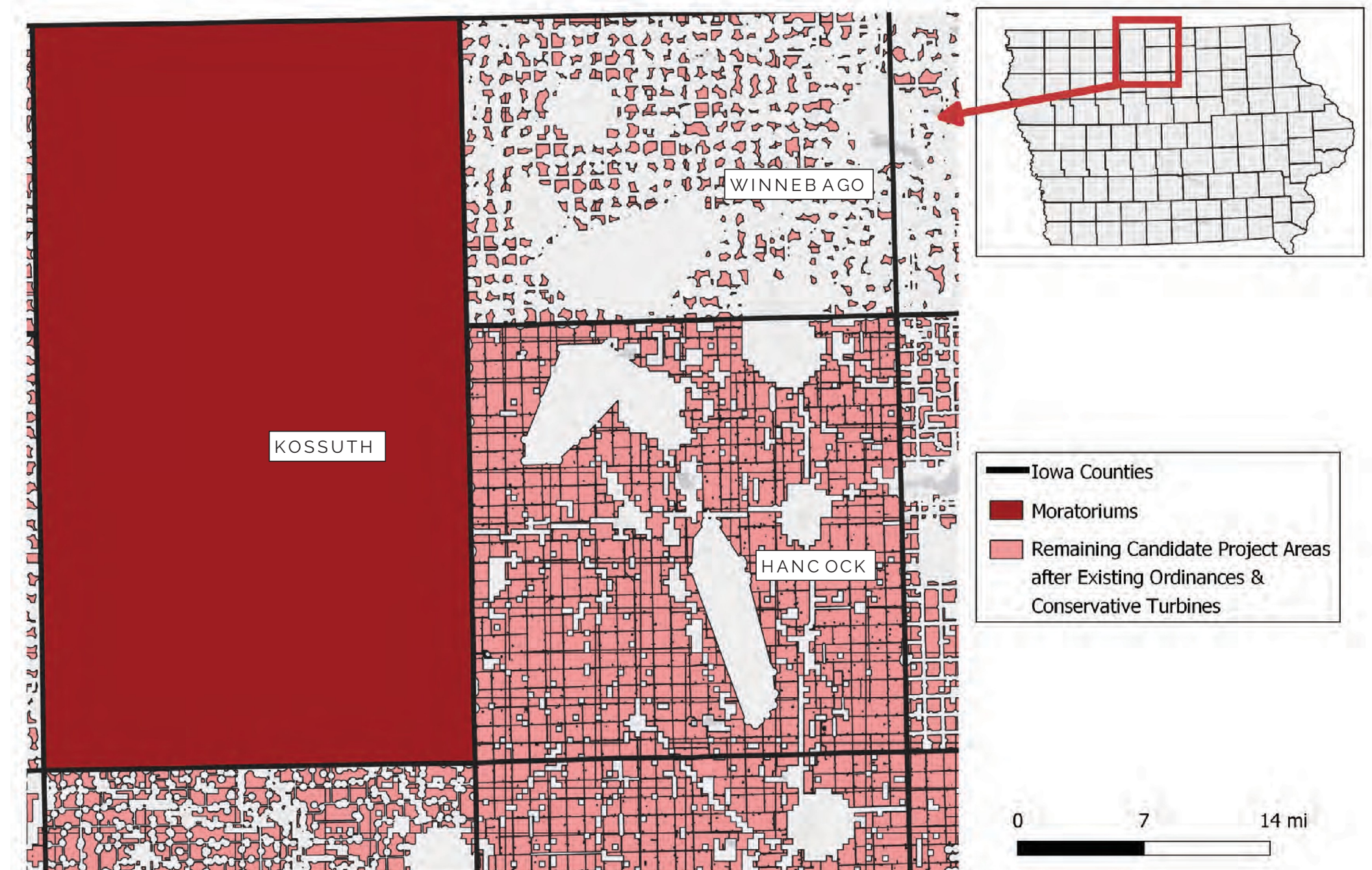
# PROCESS IN BRIEF: SPATIAL DOWNSCALING ANALYSIS OF WIND SITING LIMITS

Princeton University's Net-Zero America Project (NZAP), an optimization modelling study, projected five technological pathways to achieve a net-zero economy by 2050.

We conduct a spatially explicit downscaling analysis of NZAP projected onshore wind deployment in Iowa to quantify the impact that local siting regulations, not included in NZAP or other leading energy system modelling studies, could have on the feasibility of achieving the pace and scale of deployments.

We catalogued all county-level wind ordinances and used GIS to calculate the reduction in land availability for overall wind potential and specific technological pathways.

We considered four scenarios, including current ordinances, a future with ordinances in all counties, and both current and future wind turbine technology.



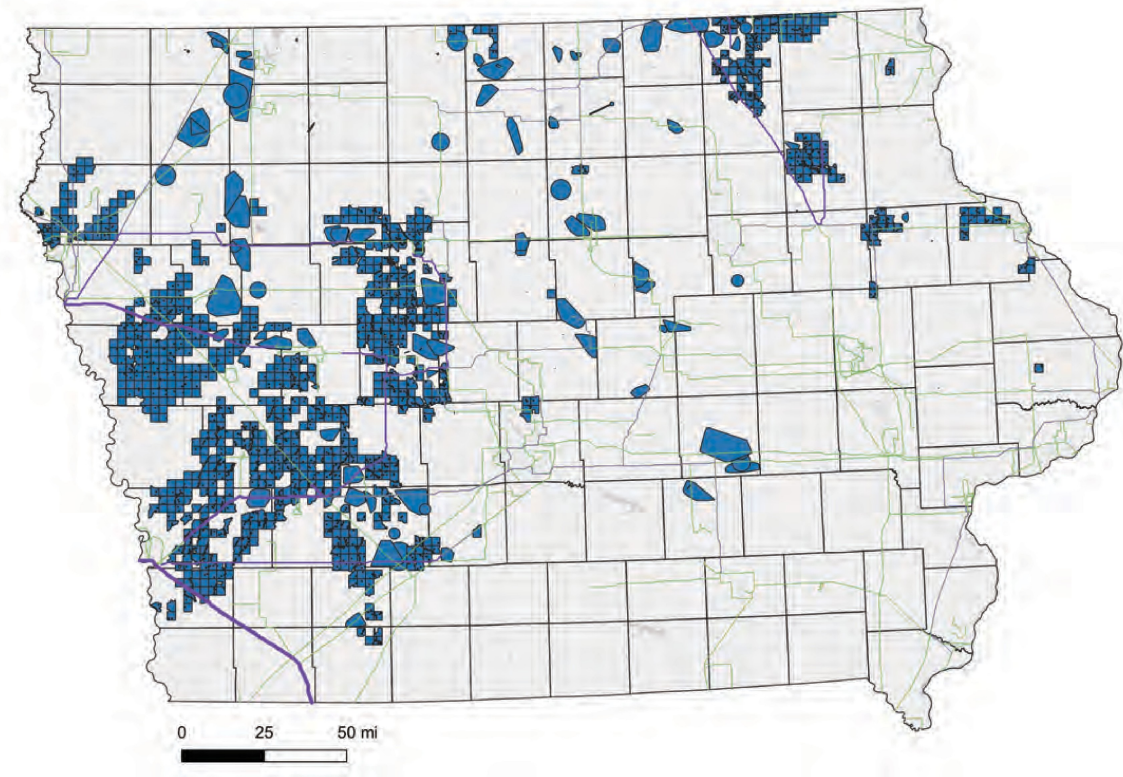
SOURCE: NZAP (2021); IOWA DNR (2020); CLEARPATH IOWA WIND ORDINANCE DATABASE

**EXAMPLE OF REMAINING CANDIDATE PROJECT AREAS (CPAs) BASED ON CURRENT ORDINANCES IN THREE COUNTIES**

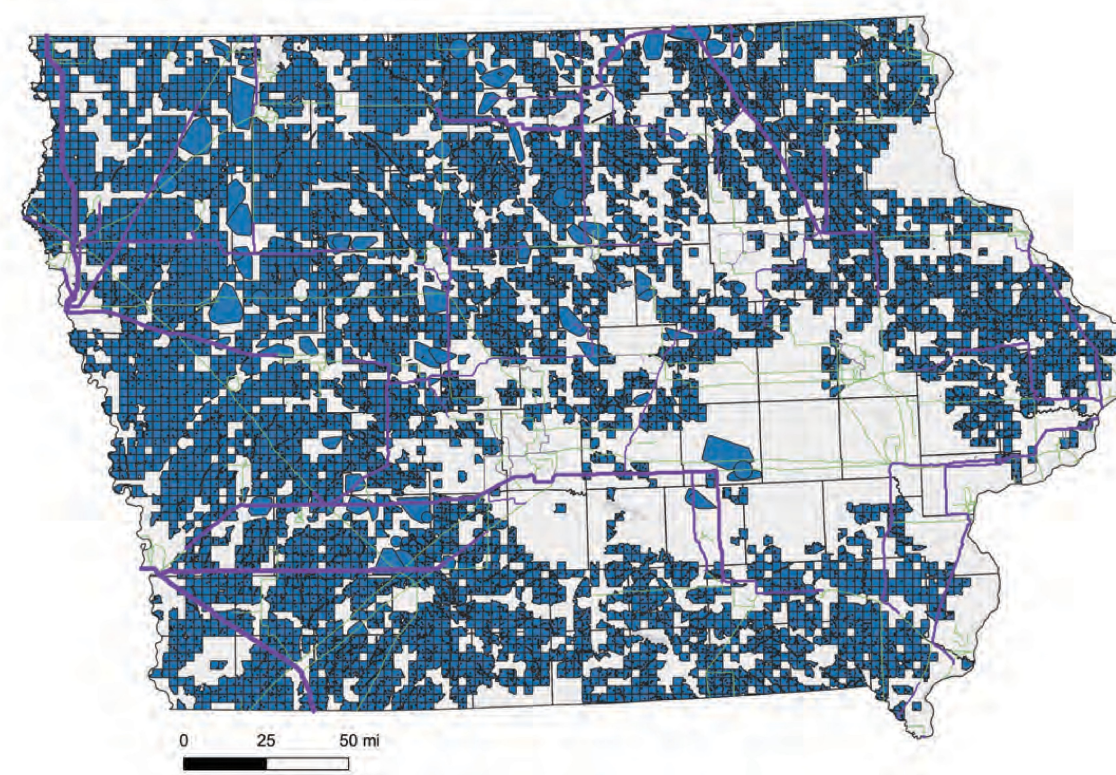


# RANGE OF NZAP NET-ZERO PATHWAYS

LOWEST DEPLOYMENT: RE- BLUA



HIGHEST DEPLOYMENT RE+ BLUA



## TECHNOLOGICAL PATHWAYS TO NET-ZERO

E+  
BLUA

High end-use electrification and minimal supply-side constraints. No land use change for biomass supply is allowed.

Base Land Use Assumptions (BLUA)

E+  
CLUA

High end-use electrification and minimal supply-side constraints. No land use change for biomass supply is allowed.

Constrained Land Use Assumptions (CLUA)

RE-  
BLUA

High end-use electrification but limits annual capacity additions for wind and solar to historical maximum. No land use change for biomass supply is allowed.

Base Land Use Assumptions (BLUA)

RE+  
BLUA

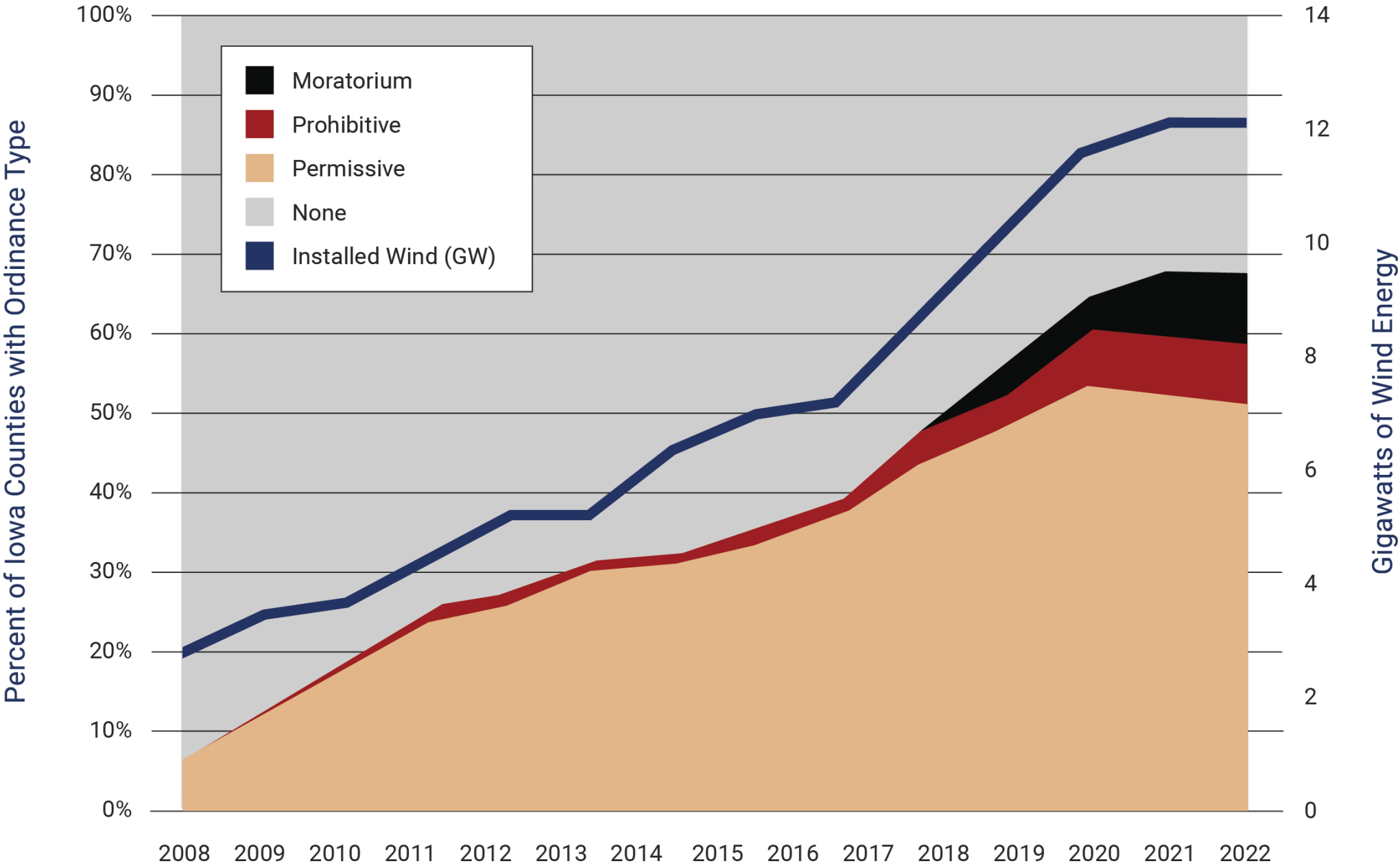
High end-use electrification and supply-side constraints of 100% renewable energy supplies with no new nuclear or geological CO<sub>2</sub> sequestration allowed, no land use change for biomass supply, and no fossil fuel use by 2050.

Base Land Use Assumptions (BLUA)



# ORDINANCE STRINGENCY HAS INCREASED WITH DEVELOPMENT

### Iowa Wind Energy and County Ordinance Type Over Time



Permissive ordinances can provide useful development guidelines that innately limit development in areas with many roads and buildings.

Ordinances that prohibit or severely limit the cost-effective development of wind farms have **become increasingly prevalent** as deployment has boomed across the state.

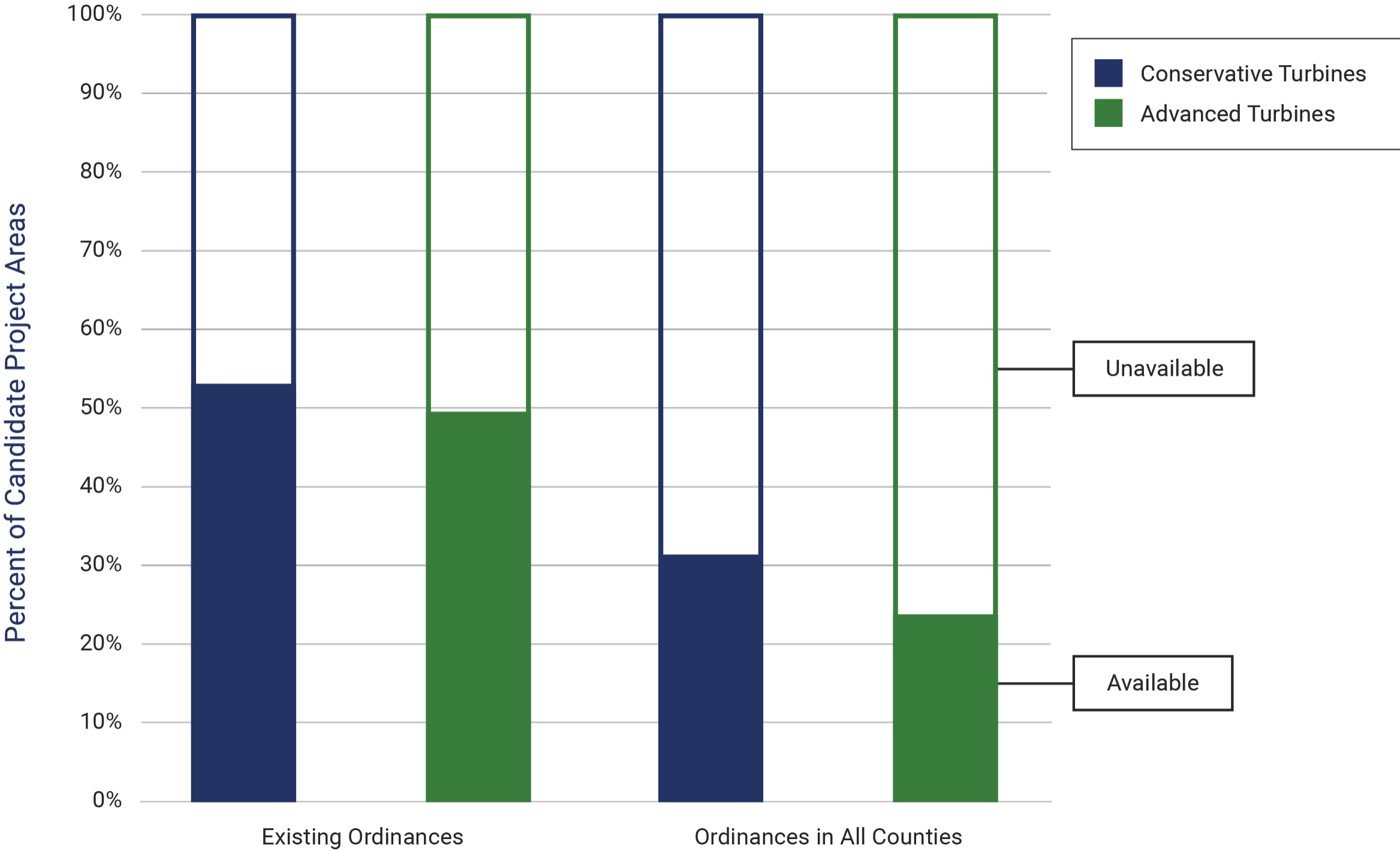
Counties can change ordinances at any time, creating uncertainty for developers.

SOURCES: EIA FORM-860 DATA (FEBRUARY 2022); NZAP (2021); CLEARPATH IOWA WIND ORDINANCE DATABASE



# ORDINANCES GREATLY REDUCE TOTAL DEVELOPABLE AREA

## Percent of Remaining Candidate Project Areas after Setbacks are Applied



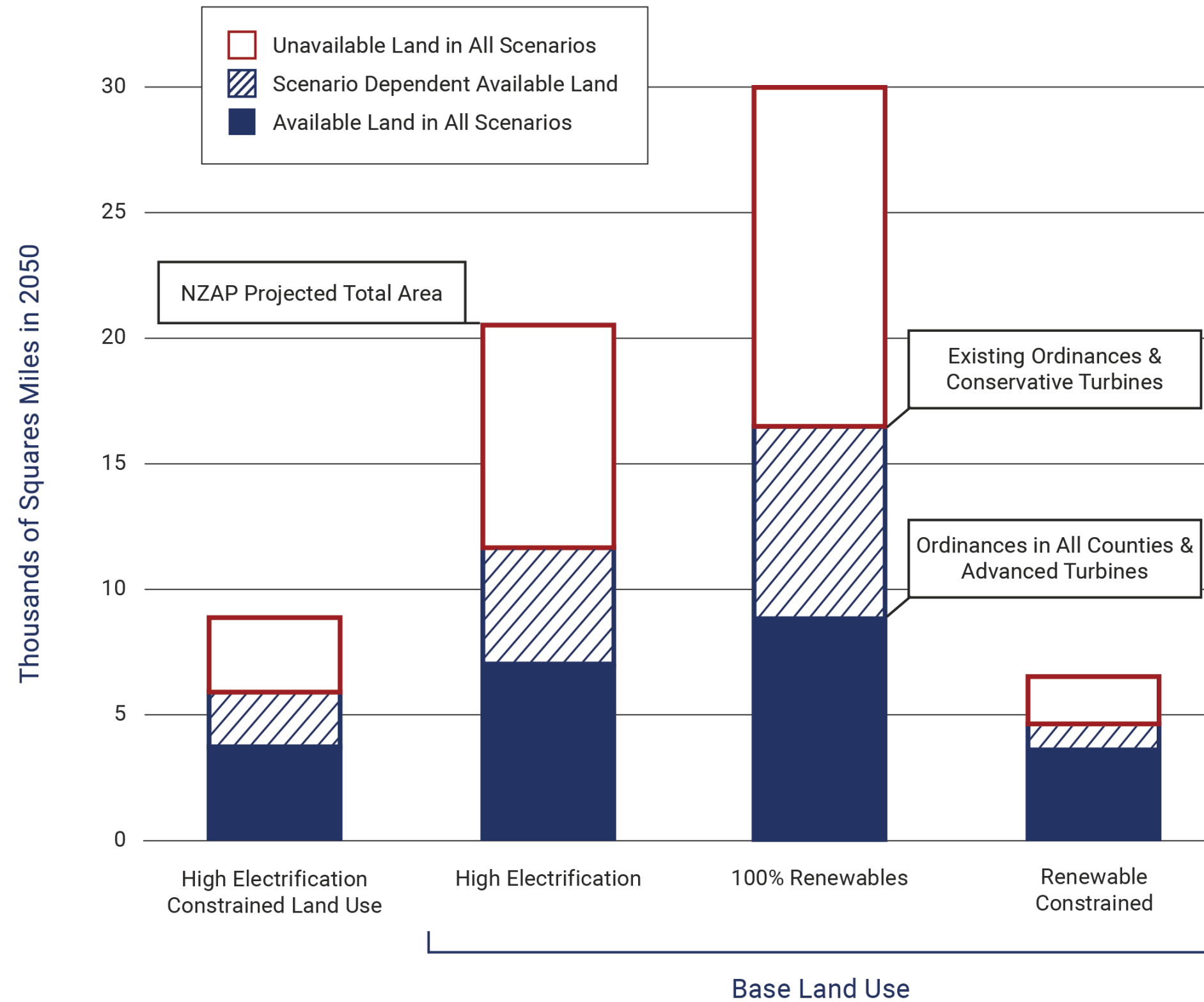
49-52% of total CPAs are unavailable under Existing Ordinances.

70-77% of total CPAs are unavailable under Ordinances in All Counties (scenario assumes that counties without ordinances adopt permissive setback requirements).

The ability to offset capacity losses through larger turbines with higher production is unclear. Larger turbines have greater setbacks, and many counties have adopted height limits that would prevent the adoption of these advanced technologies.

# AVAILABLE LAND FALLS SHORT OF NZAP TARGETS

Iowa Land Availability for Wind Energy Across Net-Zero Pathways



The least-cost siting projections for each net-zero pathway are not feasible under any ordinance or turbine-size scenario we assessed.

The sensitivity of land use constraints to evolutions in regulations and technology demonstrates their importance to net-zero planning.

Land with existing and planned wind development is included in these figures.

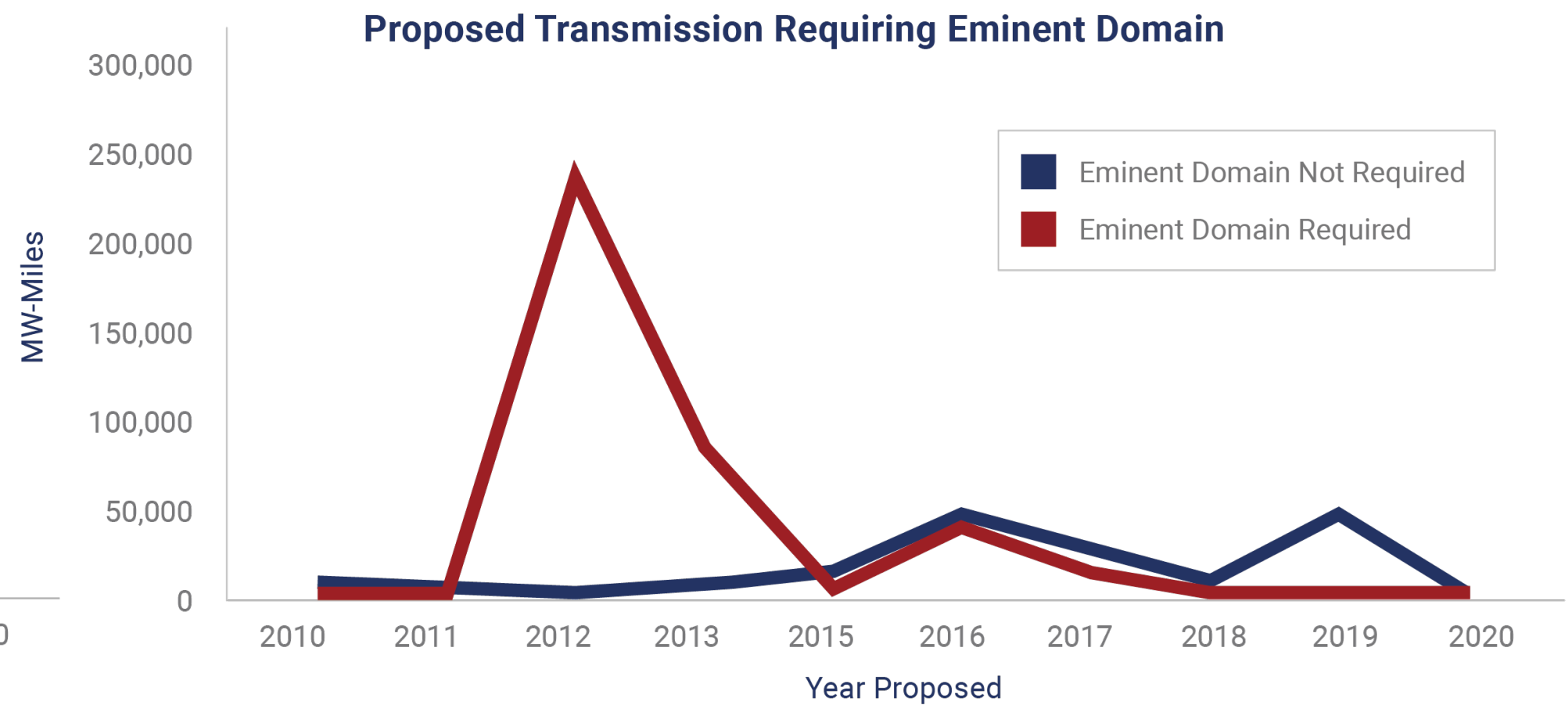
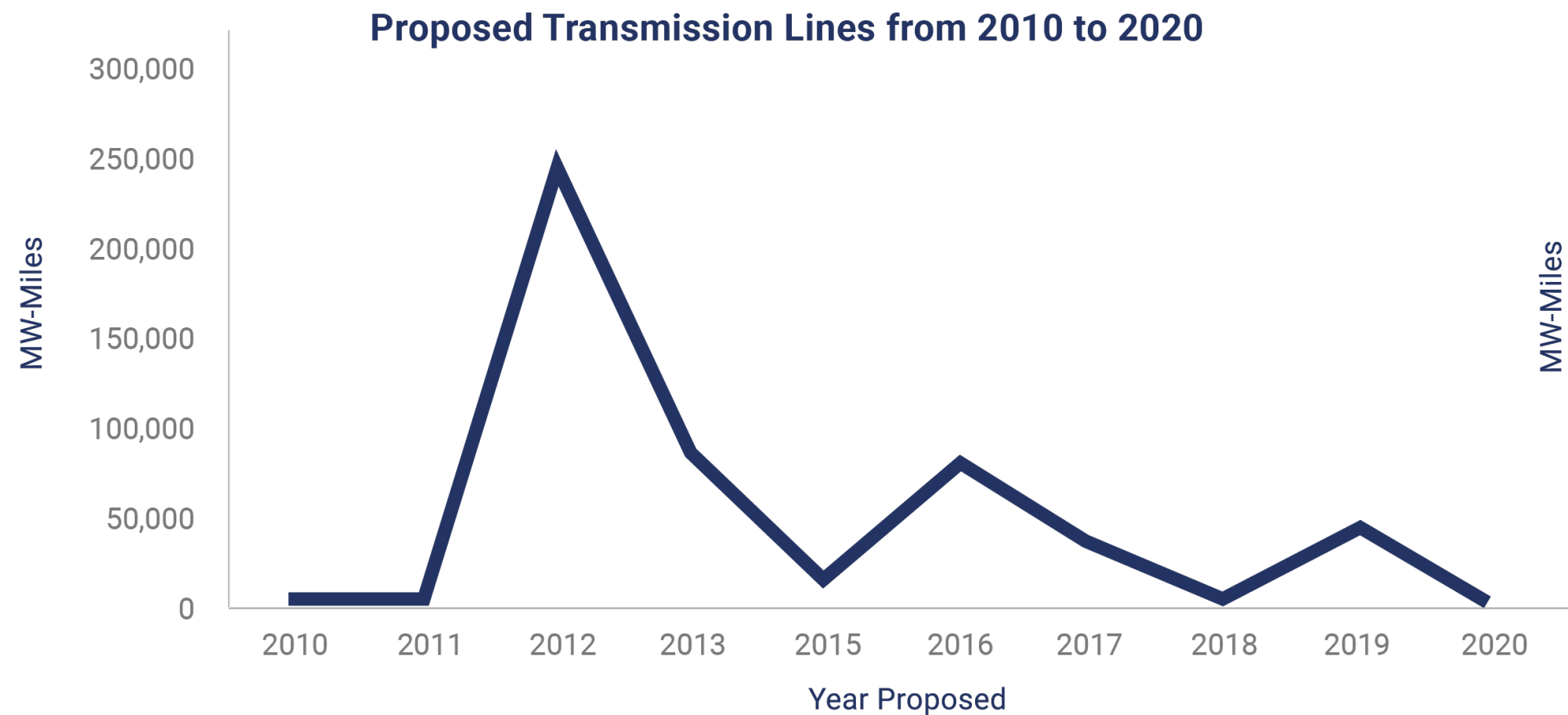


# IOWA'S TRANSMISSION BUILD RATE IS TRENDING DOWN

LucidCatalyst reviewed all 71 dockets for transmission line proposals overseen by the Iowa Utilities Board for 161 kV and 345 kV lines proposed between 2010 and 2020.

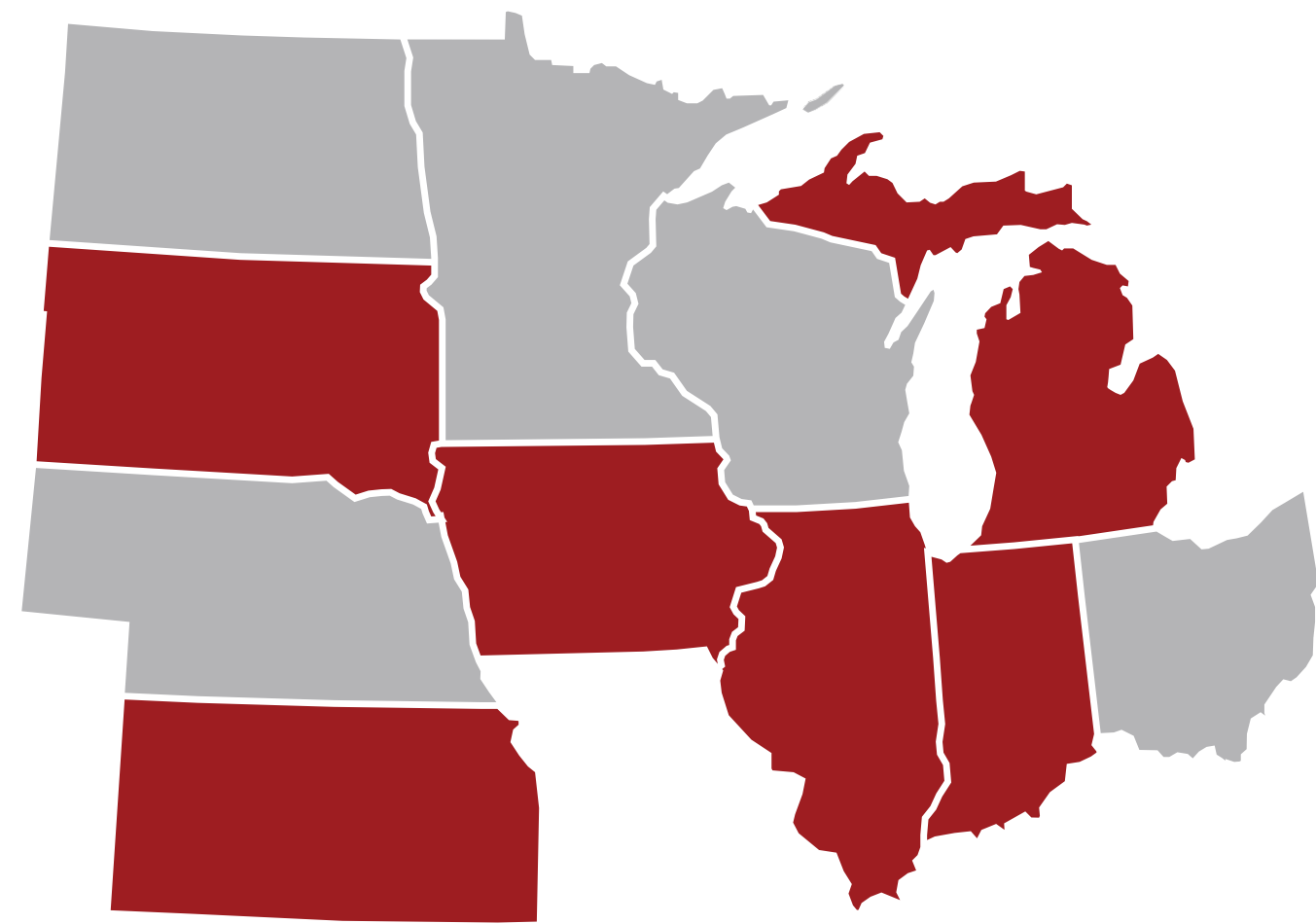
Proposals for new high-voltage transmission capacity (measured as MW-miles) trended down over the past decade, and more than 50% of transmission projects required eminent domain to complete.

Public opposition noted in Iowa Utilities Board dockets is increasing in absolute terms and as a proportion of proposed projects: 47% of 161 kV line segments have faced opposition, and 61% of 345 kV lines have faced opposition.



# WIND ENERGY SITING REGULATIONS ACROSS STATES

## PRIMARY SITING AUTHORITY FOR WIND ENERGY



■ LOCAL AUTHORITY

■ SOME KIND OF MIXED OR JOINT AUTHORITY  
AMONG STATE AND LOCAL GOVERNMENTS

Wind potential is consistently high across most states in the midwest, where there is some degree of local siting control.

Prohibitive ordinances or state-level regulations are increasingly common in Iowa, Illinois, Indiana, and Ohio.

Wind energy siting and permitting regulations will play a growing role in achieving state-level renewable energy targets and national decarbonization.

ADAPTED FROM CSG MIDWEST



## CONCLUSIONS

### SITING LIMITATIONS WILL GREATLY REDUCE ONSHORE WIND CAPACITY

- ▶ Local ordinances have a meaningful impact on wind energy siting potential. When these factors are not considered in modelling, potential is likely to be overestimated.
- ▶ **Net-zero is still possible, but there are real land limitations to highly wind-dependent futures.**

### IMPROVING WIND ACCEPTANCE IS VITAL—BUT NOT A CURE-ALL

- ▶ **All nine of Iowa's moratoriums were enacted in the past three years**, highlighting the increasing **prevalence** and **stringency** of wind ordinances.
- ▶ The increasing size of turbines and scale of projected deployment underscore the importance of addressing community concerns, providing resources and tools, and implementing best practices throughout the development process.

### TRANSMISSION CONSTRAINTS PRESENT ADDITIONAL CHALLENGES

- ▶ Long infrastructure development timelines and interconnection queue wait times imperil the ability to build cleaner and faster. Currently, **there is little to no room to add wind energy in Iowa without additional transmission.**
- ▶ Opposition to transmission projects has been increasing, further compounding the issue.

### TECH-INCLUSIVE, PUBLIC-ORIENTED PROCESSES ARE ESSENTIAL

- ▶ These results demonstrate the importance of considering land use constraints when evaluating a technology's potential role in deep decarbonization.
- ▶ Research suggests that early, open engagement results in more public support for wind energy.
- ▶ Several policies can be implemented to improve permitting, encourage appropriate development, and minimize land use impacts.