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February 12, 2025

Comments regarding:

January 13, 2025 Proposed Regulatory changes under the Endangered Species Act to extend application of conditional exemptions to newly listed species and update the conditional exemption for the operation of wind facilities (ERO number 019-9411)

Submitted by:

Pattern Energy Group LP

Submitted electronically to:

Ministry of Environment, Conservation and Parks of the Province of Ontario
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RE: ERO No. 019-9411 - Regulatory changes under the *Endangered Species Act* (the "ESA") to extend application of conditional exemptions to newly listed species and update the conditional exemption for the operation of wind facilities dated January 12, 2025 (the "Proposal")

To Whom It May Concern:

Pattern Energy Group LP ("Pattern") submits these comments in response to the Ontario Ministry of Environment, Conservation and Parks ("MECP") proposed amendments to the Ontario Regulation, 242/08 General Regulation ("O Reg 242/08") under the *Endangered Species Act* ("ESA"), *2007* posted to the Environmental Registry of Ontario regarding wind facilities and proposed approaches to reduce impacts to endangered bat species (the "O Reg 242/08 Revisions").

Pattern considers the potential impacts of wind facilities to bat species to be of leading importance among the environmental impacts of wind energy and supports MECP's efforts to protect species at risk pursuant to the ESA as well as MECP's interest in providing flexibility for wind developers and operators. However, Pattern has significant concerns about the proposed changes detailed in the O Reg 242/08 Revisions and seeks to provide technical information to inform MECP's decision-making. We respectfully submit these comments to MECP's January 13, 2025 request for feedback and input from the public, First Nations, and interested parties.

1. <u>We commend MECP for adding three recently protected migratory bats to the regulatory framework of O Reg 242/08, as this allows wind facilities to manage risk and potential impacts to all protected species under a single regulatory framework.</u>

2. <u>We believe that the existing conditional exemption for the operation of wind facilities framework for protecting sensitive species has and can continue to effectively provide for the protection of bat species at wind facilities in Ontario and, at a minimum, MECP should allow for additional time to develop a workable policy update regarding bat species and wind facilities.</u>

3. <u>We are concerned by the approach that MECP has taken with respect to proposed revisions relating to how wind facilities are proposed to minimize impacts to protected bat species under either:</u>

a. a common approach
    i. The common approach requires a 5-month aggressive wind turbine curtailment requirement of 7 meters per second (“m/s”) that would cause significant adverse impact to existing wind facilities and compromise the ability of wind developers to develop economic projects and hinder the province’s ability to meet both its clean energy and grid management objectives; or

b. a custom approach
    i. The custom approach should not be prescriptive and, like the existing regulatory framework, should allow for adaptive management and innovation (e.g., allowing for smart and informed curtailment reflective of local conditions, deterrents, and emerging research and technology).

4. Additionally, existing wind facilities managing impacts to bats should be able to incorporate the newly listed migratory bats using existing data and mitigation strategies rather than begin from - the beginning.

5. As proposed, the revisions to O Reg 242/08 have the potential to have significant adverse unintended consequences that outstrip the proposed bat conservation benefits.

INTRODUCTION

In Ontario, there are currently two regulatory frameworks that oversee the management of bat fatality impacts at wind facilities: the Renewable Energy Act (“REA”) approval and the Conditional Exemption for Wind Facilities under O. Reg. 242/08, Section 23.20.

Projects that operate under a REA approval have permit conditions that require projects to implement mortality monitoring and to manage bat mortality in accordance with provincially identified performance objectives. This includes all species of bats, including the three newly listed bat species (Hoary Bat, Eastern Red Bat and Silver-haired Bat), which comprise the majority of bat fatalities at wind facilities. In Ontario, bat mortality is considered significant when a threshold of annual bat mortality (averaged across a project) exceeds 10 bats/turbine/year (MNRF, 2011) and wind facilities must operate in accordance with this performance objective. At facilities where site specific fatality monitoring documents the annual bat mortality threshold of 10 bats/turbine/year has been exceeded, mandated operational curtailment will be implemented across the wind facility (i.e. at all turbines) from sunset to sunrise, from July 15 to September 30 and continue for the duration of the project.

The potential incidental impacts of operating wind facilities to Species at Risk in Ontario (“SARO”) listed species (*see* O Reg 230/08) that are protected under the ESA (including listed bat species) are also managed through the implementation of conditional exemptions under the ESA pursuant to

Section 23.20 of O Reg 242/08 ("Wind Facility Regulations" or "Section 23.20"). Section 23.20 requires wind facility operations obtaining coverage for impacts to protected species to develop mitigation plans ("Mitigation Plans") to evaluate, monitor, reduce, and report on impacts to protected species. Operators must comply with the requirements of the Mitigation Plan and ensure that reasonable steps are taken to minimize the adverse effects on Species at Risk. If the mitigation steps are ineffective, the operator must take further actions (e.g. habitat compensation, contributions to research projects, operational curtailment adjustments etc.) to increase the effectiveness of those steps and take other steps to minimize the adverse effects.

The O Reg 242/08 Revisions would amend Section 23.20 to (1) extend the amended conditional exemptions to include recently ESA-listed eastern red bat (*Lasiurus borealis*), hoary bat (*L. cinereus*), and the silver-haired bat (*Lasionycteris noctivagans*) (the "23.20 Species Additions") (2) revise existing conditional exemptions relating to bat species and wind facility operations (the "23.20 Bat Revisions").

The O Reg 242/08 Revisions have the stated objective of protecting ESA-listed bat species while providing for a streamlined approach to coverage under the conditional exemptions of O Reg 242/08. To this end, MECP proposes a two-pronged approach for managing impacts to ESA-protected bat species: a general seasonal (May 15 to October 15), dusk-to-dawn blanket curtailment of 7 meters/second ("m/s"), or a sitecustom-tailored approach.

Pattern appreciates MECP's proposed 23.20 Species Additions. These species have already been benefiting from existing efforts under 23.20 and project REA approvals prior to their listing. Pattern's concerns are principally focused on the proposed 23.20 Bat Revisions and, in particular:

1. a common approach requiring a 7 m/s seasonal bat curtailment regime;

2. a custom approach that is not sufficiently flexible to allow for site-specific mitigation approaches, adaptive management and enable operators to use any andall mitigation tools that are commercially available; and

3. operating facilities must be able to consider existing fatality data on impacts and minimization measures in the development of a Mitigation Plan for the proposed 23.20 Species Additions.

We believe that the existing regulatory framework in Section 23.20 coupled with consideration of the requirements of project-specific REA approvals already provides a successful and demonstrably effective regulatory mechanism for managing wind facility impacts to SARO-listed bat species, including the three species covered by the Section 23.20 Species Additions.

Further, we believe that the proposed 7 m/s curtailment approach will have unintended consequences that greatly outstrip the potential conservation benefits of such a bat curtailment regime. These unintended consequences would have a material negative impact on Pattern's operating wind facilities in Ontario and potentially significantly reduce or eliminate altogether our development pipeline of high-quality wind projects. We believe that greater flexibility should be provided for in the project-specific approaches detailed in the 23.20 Bat Revisions, and that operating projects must be able to integrate existing information into the O Reg 242/08 regulatory approach for managing these bat species.

Lastly, we strongly believe that the consequential process of reviewing the efficacy of O Reg 242/08 for managing impacts of wind facilities to bat species should not be rushed and should recognize that the proposed revisions to Section 23.20 are not filling a regulatory vacuum. That is, it is not our view that existing wind generation in Ontario is being complacent to minimize impacts to bat species, but rather are generally already operating under a regulatory framework to manage and minimize impacts to these species. As such, Pattern strongly encourages MECP to take additional time to engage in further consultation on these important matters to ensure a practicable and effective regulatory framework that accomplishes MECP's goals of minimizing impacts to protected bat species without having significant unintended consequences.

Pattern's Interests in Wind Energy and Bat Risk Management in Ontario

The Canada Pension Plan Investment Board is the largest shareholder of Pattern. Pattern has significant and diverse interest in how wind facility operations relative to bat species are managed in Ontario. Pattern has a global portfolio of more than 30 renewable power facilities and transmission assets, serving various customers and providing low-cost clean energy to millions of consumers.

Pattern Operating Wind Facilities

Pattern owns and operates one of the largest wind energy fleets in Canada and operates seven wind facilities in Ontario totaling 1,385 MW, several in direct partnership with First Nations communities (*see* Figure 1). Our operating fleet in Canada includes Henvey Inlet Wind in the Province, a 300-megawatt ("MW") facility jointly owned with the Henvey Inlet First Nation and representing the largest First Nation wind energy partnership operating in Canada.

Figure 1. Pattern Canada operating wind facilities

Pattern's Wind Energy Development Projects

Additionally, Pattern is actively developing a substantial portfolio of wind energy projects in Ontario, which it expects to finance, construct, and operate in partnership with First Nations in the province and expects to compete in the Independent Electricity System Operator ("IESO") upcoming LT2 energy and capacity procurement windows. Pattern has a strong track record of socially and environmentally responsible wind development in Ontario and anticipates successfully bringing to commercial operations multiple future wind projects in the province, working closely with Indigenous communities, industry stakeholders and partners. Along with the decarbonization benefits associated with adding additional renewable energy generation capacity to the Ontario grid, Pattern is conscious of the desire to ensure that all new generation and capacity sources are delivered to Ontario ratepayers at the lowest possible cost.

As demonstrated by the impacts of our operating wind facilities in Ontario, these development-stage projects represent tremendous opportunities for the Province of Ontario, local communities and First Nations.

Pattern's Leadership in Studying and Managing Bat Risk of Wind Facilities in North America

Pattern is committed to protecting the environment and this commitment plays a fundamental role in achieving our business objectives. We believe that renewable energy sources are fundamental to producing energy in a way that respects the integrity of the environment both on a global scale and at a local project. Our objective is to exceed industry standards and be a leader in the advancement of best practices for the identification, assessment, and mitigation of environmental impacts. Pattern has over a decade of experience actively managing wind energy facilities to evaluate, monitor, and minimize impacts to bat species across North America. Pattern is an industry leader across North America in environmental policy, science, and adaptive management of the relative risks to bat species of wind operations.

Pattern is actively engaged in efforts across Canada and the United States to increase our understanding of bat mortality as a result of wind turbine operation and has extensive experience developing and implementing various bat mitigation strategies across an array of different operating sites. Through our work across our fleet and as part of industry and stakeholder groups such as being a founding member of the board of the Renewable Energy Wildlife Institute, and sitting on the Executive Committee for the Renewable Energy Wildlife Research Fund, Pattern is committed to understanding and advancing bat mitigation science and has over a decade of experience working with conservation stakeholders and scientists to understand wind energy's impacts to bats and how we can reduce those impacts in a sustainable way.

OVERVIEW

While Pattern supports the addition of the three species covered by the Section 23.20 Species Additions to this framework, we do not believe that there is a clear and present need for a fundamental revision of Section 23.20 relative to protected bat species.

Pattern believes that the existing Wind Facilities conditional exemption (i.e. Section 23.20) provides a solid framework that will enable an assessment of impacts and development of Mitigation Plans based on site specific and best available information to minimize impacts on the 23.20 Species Additions.

However, Pattern believes that if MECP is going to revise the Wind Facility Regulations relative to the Section 23.20 Species Additions, that it is important that any such changes be complementary to how these regulations are currently applied to operating wind facilities and to take different approaches for operating wind facilities (that may already be implementing the Wind Facility Regulations and/or operating under the Renewable Energy Approval bat management framework), and wind facilities currently under development.

Further, it is critical that MECP understands the potential impacts of a blanket curtailment approach (as detailed in the proposed 7 m/s curtailment in the Section 23.20 Bat Revisions) to a) operating wind facilities, b) future wind facilities, c) potential local communities and First Nations, and d) Ontario's current and future energy needs and objectives as well as clean energy goals.

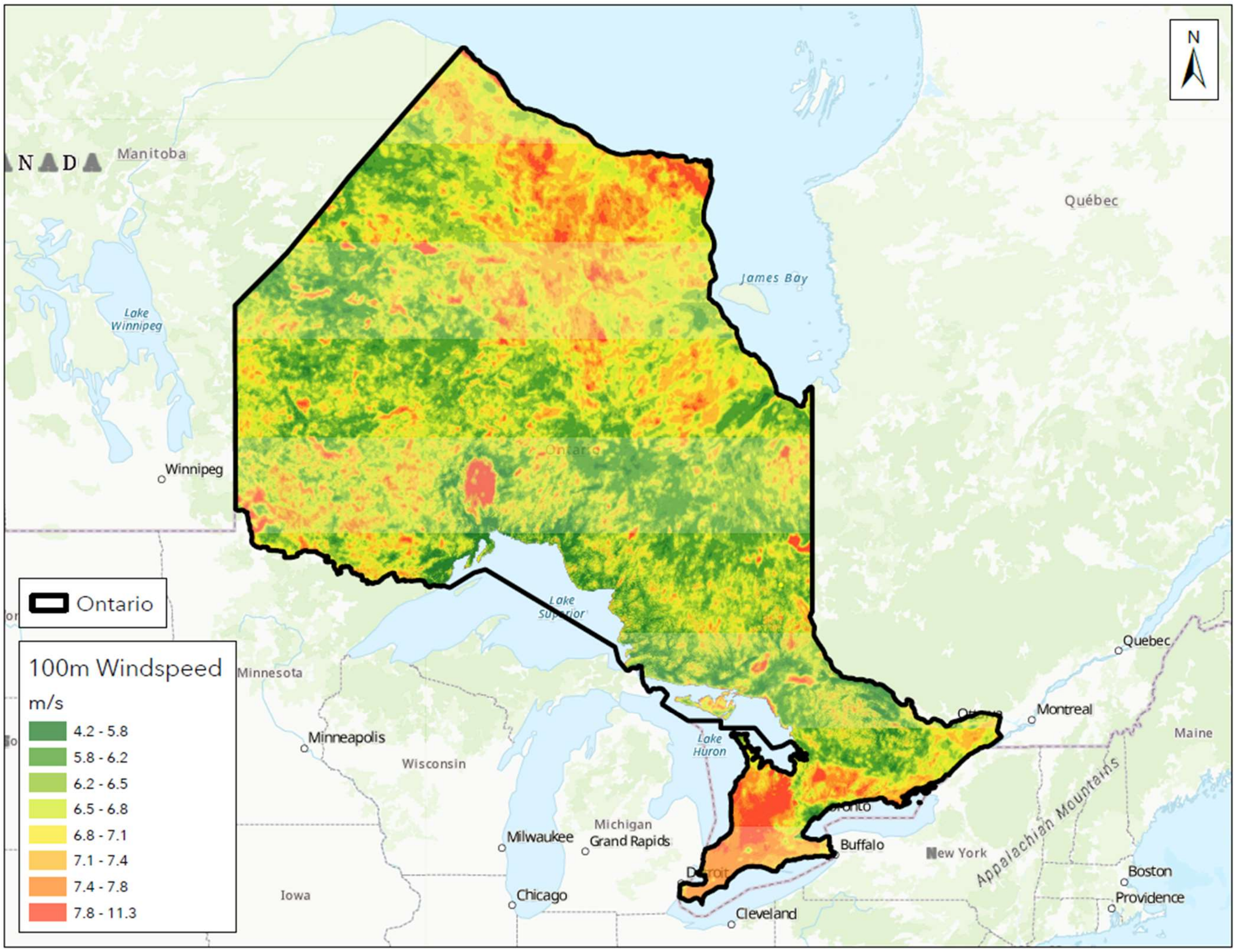
Pattern recognizes that seasonal (i.e. blanket) curtailment can be an effective tool for reducing impacts of wind facilities to bat species. However, it is generally considered a relatively coarse approach that results in curtailment during times when bats may not be at risk. Over the past several years there have been significant advancements in our understanding of bat risk and mitigation approaches with a recognized need to implement practical mitigation solutions that achieve bat conservation while also enabling renewable energy production (*see,* e.g., REWI 2025; Bat Conservation International, 2025). There are currently several approaches for "smarter" curtailment strategies (e.g. broadly defined as mitigation strategies that are based on more variables than wind speed) as well as other mitigation options such as deterrents, which can achieve similar ecological value while reducing energy generation losses. Mitigation approaches that reduce bat risk while also minimizing losses of clean energy generation are essential.

Further, it is important to understand how different curtailment regimes can impact wind generation as well as how different curtailment regimes may benefit bat species. To this end, Pattern herein provides an overview of how seasonal bat curtailment can affect wind generation facilities and will connect this information to recommendations for how MECP should approach operating and development-stage wind facilities, should it ultimately conclude that the Wind Facility Regulations do indeed need to be amended to provide a prescriptive framework specific to SARO listed bat species.

<u>How wind energy production interacts with wind speed</u>

The power generated at wind facilities is a measure of several factors including wind speed frequency, air density, as well as the area where the turbine blades are rotating (i.e., the rotor swept area). Small changes in these variables in wind speed will have large impacts on wind power production. The energy output of a wind facility is highly dependent on the average wind speeds of its geographic region. Average wind speeds in most of Ontario range between 6 and 7 m/s, with wind speeds generally lower further north, and higher inthe south of the province (e.g., wind speeds in the region of Toronto may average over 8 m/s) (*see* Figure 2).

Figure 2. 100-meter Ontario wind speed map



The characteristics of wind speeds experienced at the hub height of a wind turbine are well-documented and statistical analysis allows us to calculate the Annual Energy Production ("AEP") of a wind turbine, measured in MW-hour ("MWh") or Gigawatt-hour ("GWh"). The AEP represents the amount of energy a wind facility can deliver to the grid.

Figure 3 below illustrates two elements that are foundational to the relationship between wind energy production and wind speeds, using a 2.25 MW wind turbine at a site with an annual wind speed of 6 m/s. First, the distribution of the blue bars reflects that the highest average output of the wind turbine occurs at lower wind speeds. Second, red line graph shows the non-linear relationship between wind speeds and wind energy production. In other words, the power generated in a given hour at the wind turbine increases exponentially as the wind speed increases.

Figure 3. Relationship between average wind speed and power generation at a 2.25 MW wind turbine with annual average wind speed of 6 m/s based on Ontario wind facilities

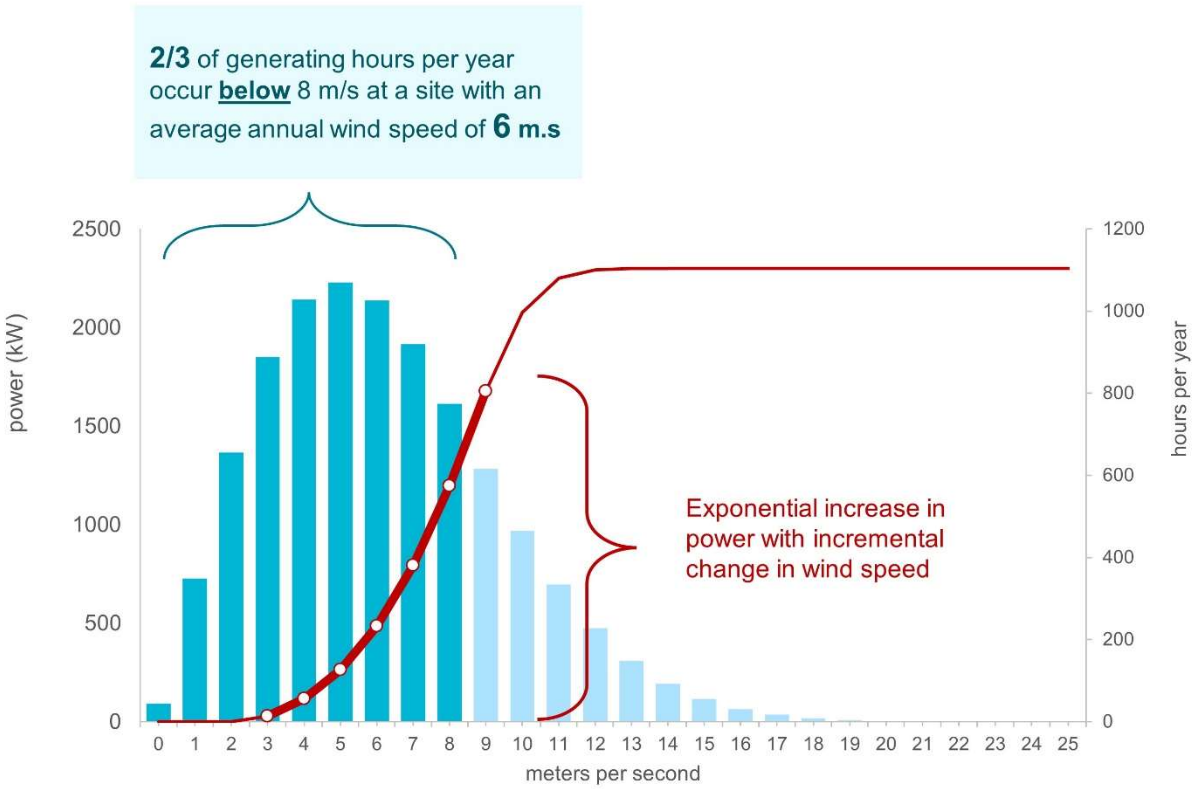
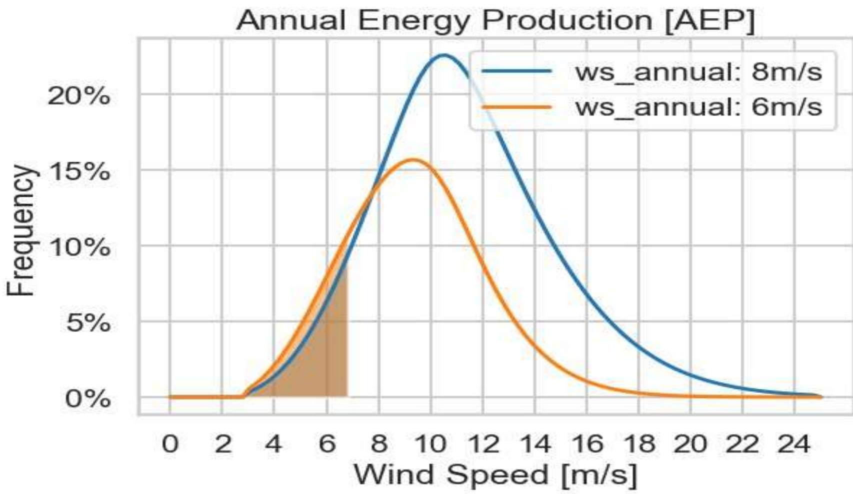


Figure 4 illustrates how a large percentage of AEP is comprised of lower wind speeds, particularly for areas with lower average wind speed (i.e., 6 m/s). As demonstrated in Figure 4, a wind facility in an area with high average wind speeds (e.g., 8-10 m/s) will be generating a much lower proportion of its AEP at lower wind speeds, whereas a wind facility at a location with a lower wind speed (e.g., below 7 m/s), such as large swaths of Ontario, will be heavily dependent on generating electricity at lower wind speeds.

Figure 4. Ontario Wind Facility AEP at 6 and 8 m/s



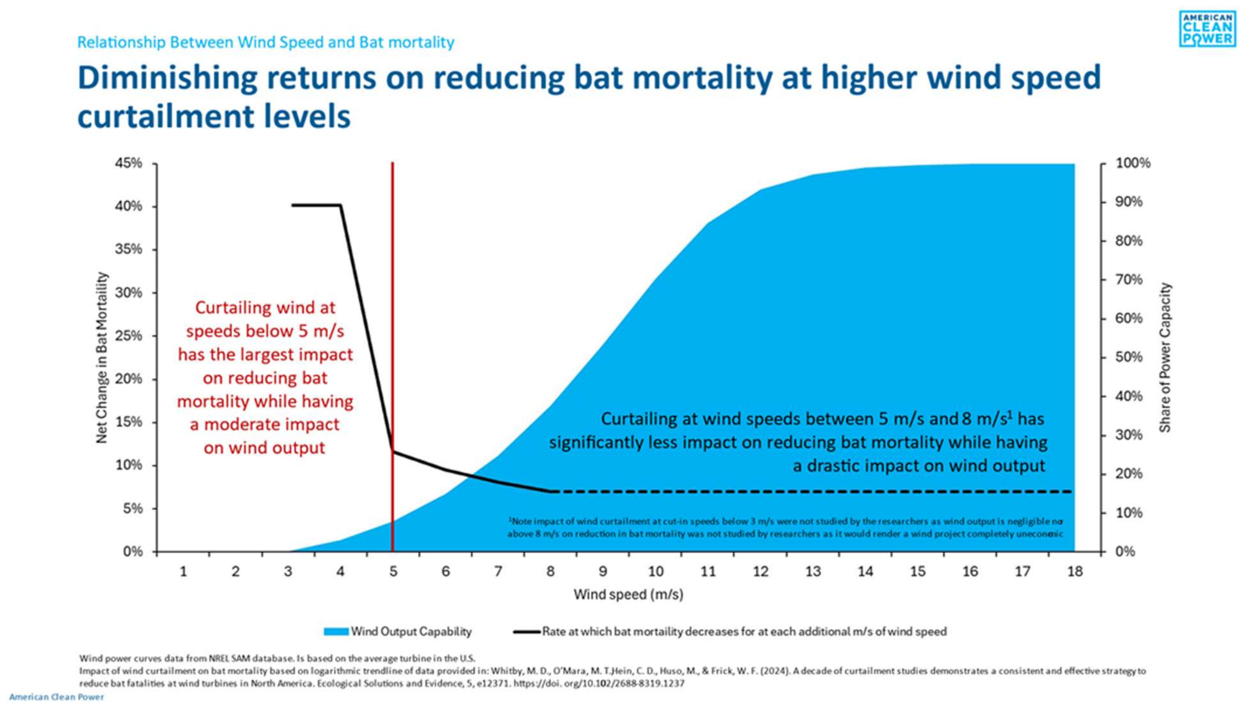
<u>How does blanket and custom-tailored curtailment of wind facilities affect bats</u>

It is well-understood that curtailment of wind turbines during periods of locally high bat activity at a facility can reduce impacts to bat species. Numerous site-specific studies have demonstrated that bat activity is higher at lower wind speeds, with additional factors such as temperature, precipitation, and various site-specific considerations further driving relative bat activity. This makes sense, as North American bats are small, light-weight animals with high metabolisms ill equipped to fly in high wind speed conditions or during precipitation or cold weather. It stands to reason and is borne out by these studies that the greatest impact reductions of incremental increases in curtailment for bat species occur at lower wind speeds, with diminishing returns (as measured by reduced fatality) per additional m/s of wind speed curtailed.

As noted in Barnes et al. 2018, the optimal strategy for minimizing impacts to bats is unknown, particularly with respect to the benefits of raising cut in speeds above 4.5 m/s (Barnes et al., 2018). Adams et al. 2021 found "[w]hile the overall effect of curtailment on bat fatality was clear, the relative effect of incrementally larger increases in curtailment cut-in speed was not" (Adams et al., 2021). A recent meta-analysis study documented an average bat fatality reduction of 62% at a 5 m/s cut-in speed, but that beyond that, found that as cut-in speed increased, only small incremental increases in bat fatality reduction were realized (Whitby et al. 2024). Currently, the lack of empirical data on migratory bat population sizes and demographic parameters, including for the hoary bat, limits our ability to determine to what how much wind turbine mortality should be reduced to avoid material population-level adverse impacts (Friedenberg and Frick, 2021).

What is clear is that 1) seasonal curtailment can reduce bat mortality and wind facilities but 2) the relative benefits to bats of incrementally higher cut-in speeds of bat curtailment at wind facilities decreases as the cut-in speed is increased. The data clearly demonstrates that benefits to bats of increasing curtailment are inversely related to the impacts to wind project AEP (*see* Figure 5).

Figure 5. Relationship between Wind Speed and Bat Mortality



As detailed above, the impact of incrementally higher cut-in speeds of bat curtailment to the wind facilities' ability to generate power is dramatically higher as the cut-in speed is increased (*see*, e.g., example power curve in Figures 3 and 4 above). The increase in power lost between a cut-in speed of 5.0 m/s to 7 m/s will vary from project to project, depending heavily on local wind speed conditions as well particular wind turbines and project generation curves. However, at any facility in Ontario, 7 m/s would have significant impacts to AEP, while realizing uncertain or only incremental increases in bat fatality reduction beyond what is realized at lower wind speed cut-ins (see Figure 6 and Adams et al., 2021, Barnes et al., 2018). This is expected to be exacerbated as wind generation in Ontario is further built out and projects are developed in lower wind speed regimes, particularly given the preponderance of lower wind speed regimes in areas further away from population centers (*see* Figure 2), where wind energy is expected to be further developed.

Bat fatality rates and mitigation effectiveness at any one site are influenced by many parameters, therefore, mitigation implemented by each site should consider the site-specific parameters of fatality, commercially available mitigation solutions, site specific economics and the latest science on bat mitigation when identifying suitable mitigation options for a Project.   To date the optimal strategy for managing bat fatalities isn't known; minimization strategies are at various stages of development and new research is ongoing. What is clear is that there may not be one single solution for all scenarios or sites (see discussion in Hein and Straw, 2021). Currently available mitigation approaches include curtailment regimes consisting of various approaches (optimized, informed, real time, acoustic risk based etc.) as well as commercially available deterrents (*see*, e.g.; Peterson et al., 2021; Rabie et al., 2022; Squires et al., 2021; Hein and Straw, 2021; Weaver et al., 2020, Iskali et al., 2019; Teat et al., 2024). There can be various approaches to minimizing impacts to the migratory bats included in the 23.20 Species Additions, and all approaches that can reduce bat impacts while also reducing energy generation losses should be able to be employed within a conditional exemption under O. Reg 242/08.

How curtailment of wind generation impacts a facility's wind generation

The 23.20 Bat Revisions propose a "common approach" for managing impacts to SARO listed bat species of a cut-in speed of 7 m/s from dusk to dawn from May 15 to October 15. What this means is that a wind generation facility within these temporal windows would not be able to generate electricity below 7 m/s at the facility. The wind turbines would cut-in and begin spinning and generating electricity only while the wind speed at the facility reaches 7 m/s or higher. The impact of a 7 m/s common approach would be dramatic, particularly at facilities at lower average wind speeds.

The dynamics discussed above demonstrate that each incremental m/s increase in curtailment will have dramatically more impact on a wind facilities ability to generate MWhs of electricity (i.e., AEP). Wind facilities in lower average wind speed regimes are much more impacted by these changes in curtailment. While a wind facility located anywhere in Ontario may not be significantly adversely impacted by curtailment at 4-5 m/s, few projects will avoid being significantly adversely impacted by curtailment at 6-7 m/s both at higher wind speed facilities and lower wind speed facilities.

Pattern data analysts developed a statistical model assuming 1,800 hours per year of active bat curtailment, which mirrors the seasonal and time-of-day prescriptions proposed on the Section 23.30 Bat Revisions common approach. This analysis illustrates how curtailment speeds would impact the annual electricity production of two model facilities based on actual province-specific data, one in a high and one in a low wind region of Ontario. We found that facilities located in low wind regions would disproportionately experience electricity losses, and by as much as double the rate of losses. For instance, a curtailment cut-in speed of 6 m/s would impact otherwise identical wind sites in a low and high wind regions very differently: the impact to projects in lower wind speed regions of Ontario could be double that at higher wind speed regions.

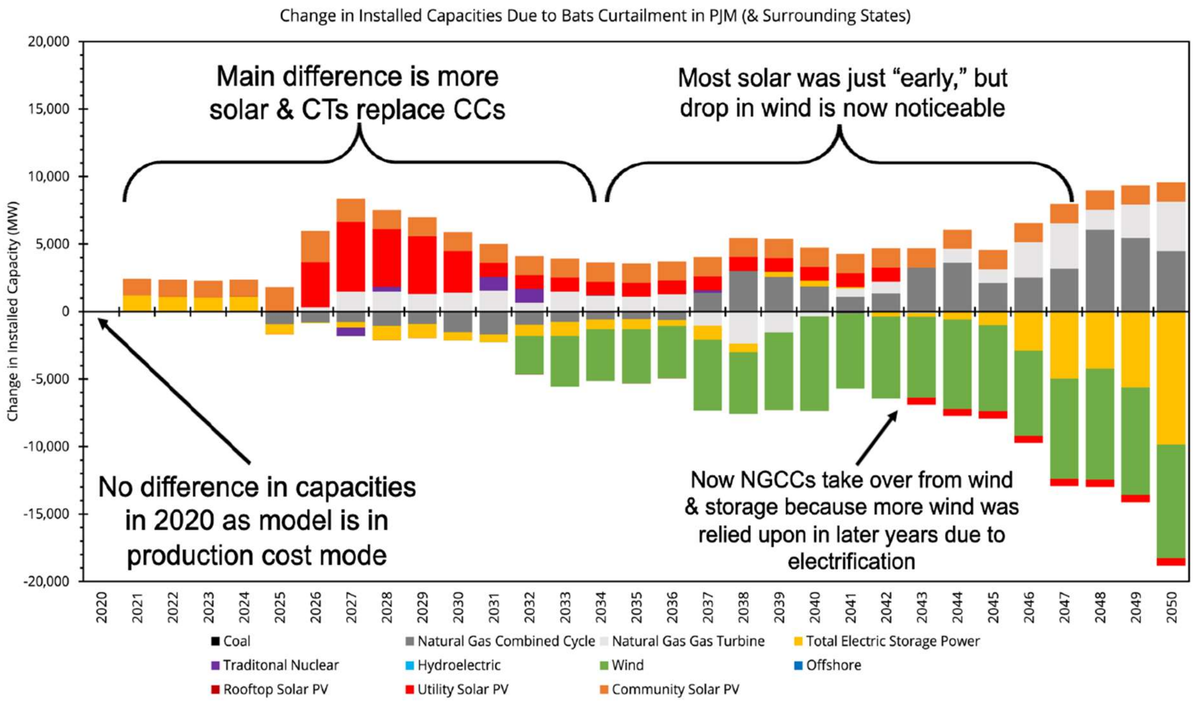
As the energy grid increasingly becomes decarbonized, the mutually beneficial relationship between solar and wind generation becomes more and more pronounced. In regions in the United States such as California and Arizona, where significant solar energy has been deployed, the grid has experienced what is called the 'duck curve', where solar generation rises quickly before falling off at sunset. Conversely wind energy in North America is well-understood to increase in the evenings. Thus, solar and wind energy are natural compliments for a balanced grid. When solar energy disappears from the grid, the alternatives are 1) dispatchable natural gas, 2) wind energy, and/or 3) additional solar energy with battery installations. The latter option is not necessarily competitive economically and, in the case of Ontario, not likely to suit the needs of the grid. In this subsection, we provide a case study of a detailed modeling analysis of the potential consequences of different bat curtailment regimes. Notably, the assumptions for this analysis are a 3-month instead of 5-month window, as is proposed in the 23.20 Bat Revisions common approach.

Bat curtailment analysis case study: PJM modeling overview

Because Pattern is a leader in the renewable industry in developing science and proactive strategies for minimizing impacts of wind energy to bat species in North America, we have been working with other industry partners to analyze the potential impacts *beyond* the individual wind facility of broad blanket seasonal bat curtailment. As part of this exercise, we have engaged in detailed electrical grid modeling of different bat curtailment scenarios using publicly available data of the United States electrical grid. This work, led by Prof. Chris Clack, utilizes the Catalyst & GridLab open-source Resource Adequacy Renewable Energy ("RARE") Power Dataset available at the Catalyst Cooperative 0. Using the RARE dataset and the Weather-Informed Energy Systems: for design, operations & markets ("WIS:dom") model, Prof. Clack modeled the potential impacts of different cut-in speed scenarios of bat seasonal time-of-day blanket curtailment of wind generation ("WIS:dom Bat Analysis"; *see* Appendix) across both the United States as a whole and specifically within the PJM Interconnect ("PJM) Regional Transmission Organization footprint, where the modeling was able to utilize more detailed data sets.

The WIS:dom model relies on the RARE dataset to review as many attributes of the energy economy as possible to model the potential impacts of changes to model inputs (e.g., regulatory or environmental curtailment of generation, price and availability of natural gas) to a range of energy-related outputs from the cost of power to rate payers, to emissions impacts, to future changes in expected energy infrastructure investments (e.g., change in mix of new generation assets between combined cycle natural gas or wind or solar; *see* Figure 6).

Figure 6. Change in installed capacities in PJM as a result of 7 m/s bat curtailment from 7/15 - 10/15



The WIS:dom Bat Analysis indicated that bat curtailment across all wind turbines in the United States would result in lost MWhs of generation of approximately 1,500-2,000 GWhs at 5 m/s to 9,800-11,300 GWhs at 7 m/s (with a significantly narrower seasonal window of July 15 – October 15). This corresponds to the equivalent of annual emissions of 675,000-785,000 metric tons of CO2 at 5 m/s and 4,270,000 to 4,900,000 metric tons at 7 m/s. This is demonstrated at the granular level in PJM, which shows that a 7 m/s bat curtailment regime resulting in a decrease in clean energy generation, principally demonstrated by natural gas plants replacing wind facilities to balance out solar generation buildouts. Notably, the results of the PJM modeling of a 7 m/s bat curtailment 3-month curtailment window indicate not only a reduction in wind energy and an increase in emissions, but also an increase in the cost of electricity in PJM of $5-18 per MWh.

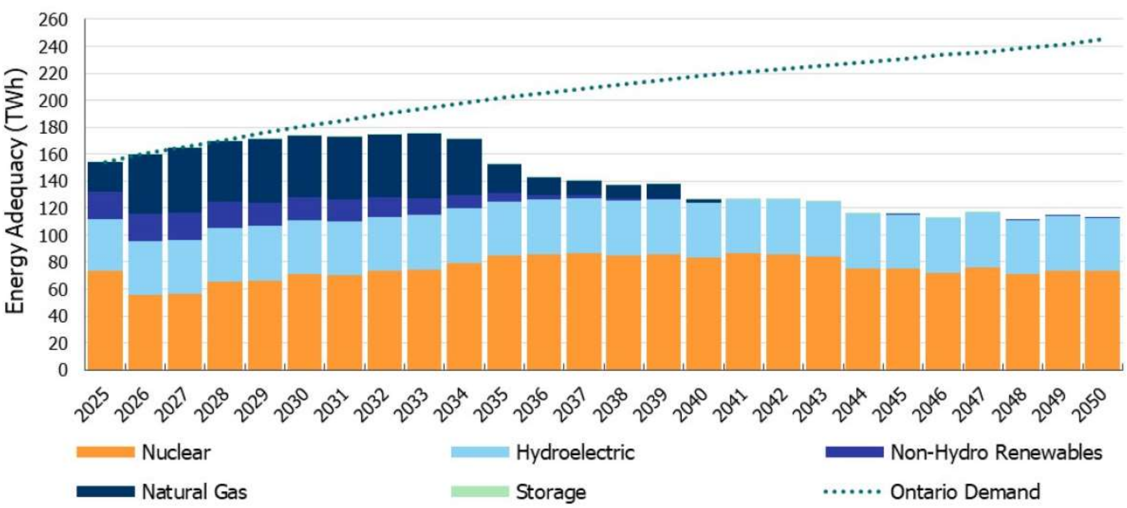
This case study demonstrates broadly applicable lessons on the unintended consequences of bat curtailment of wind facilities and how dramatic are the relative consequences of different cut-in speeds (i.e., 5 and 7 m/s) on determining these impacts. For example, curtailing wind generation will result in an increase in natural gas and associated emissions as well as an anticipated increase to the price of electricity for consumers. This study is also aligned with other analyses, such as a U.S Department of Energy funded 2022, which found that even a cut-in speed of 6 m/s would have the potential to render wind projects in large portions of the United States uneconomical (Maclaurin et. al, 2022).

In Ontario, where the wind speeds are relatively low across the province and solar efficiency is relatively low, and where the common approach outlined in the 23.20 Bat Revisions applies to five months rather than three months of the year, the impacts could be more dramatic.

Balancing bat impact minimization with generation needs, project viability, and other unintended consequences

The Ontario electrical grid is managed by the IESO, which manages the grid in real-time and plans for the province's future needs. The IESO's latest annual forecast estimates that electricity consumption in the province will increase by 75 percent by 2050. Currently, the Ontario grid utilizes over 150,000 GWhs annually, which is expected to increase to over 260,000 GWhs by 2050. Figure 7 shows this increase relative to existing generation capacity. The peak season for electricity consumption is summer, overlapping with the proposed seasonal window for bat curtailment in the 23.20 Bat Revisions, which would put additional strain on the grid.

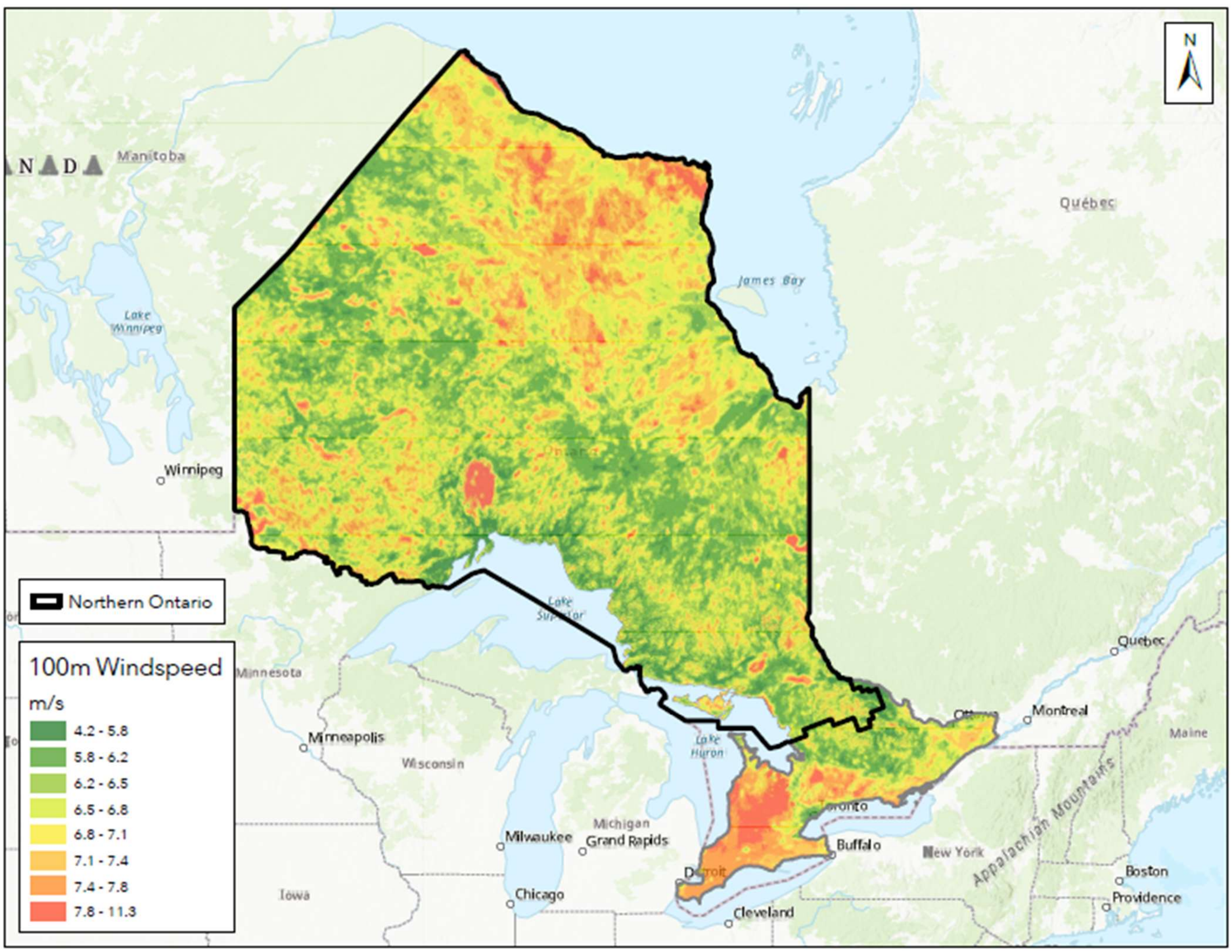
Figure 7. Energy Trends in Ontario



As the IESO continues to manage the Ontario grid towards an increasingly electrified and decarbonized future, it is going to increasingly rely upon a balanced portfolio of wind, solar, and other energy sources to support this anticipated growth. Ontario leads Canada in wind capacity. The share of wind in the operating capacity mix rose from 2% to 13% from 2008 to 2022 – with 4.4 GW of wind added over that timeframe – and it's expected to continue to rise over the coming year. Additionally, while net on-grid demand in Ontario has been on a decline over the last 20 years, owing to conservation programs, growth in embedded generation, and a shift to less energy-intensive industries, demand increased approximately 2.7% from 2021 to 2022. In the coming years, electricity demand is expected to continue to rise due to economic growth especially in the mining, steel manufacturing, automotive, and agricultural sector, in addition to the electrification of the building and transportation sectors. As such, and given Ontario's plans to continue its grid decarbonization, losing a portion of its ever so increasing wind generation will have negative impacts to reliability over the coming decades.

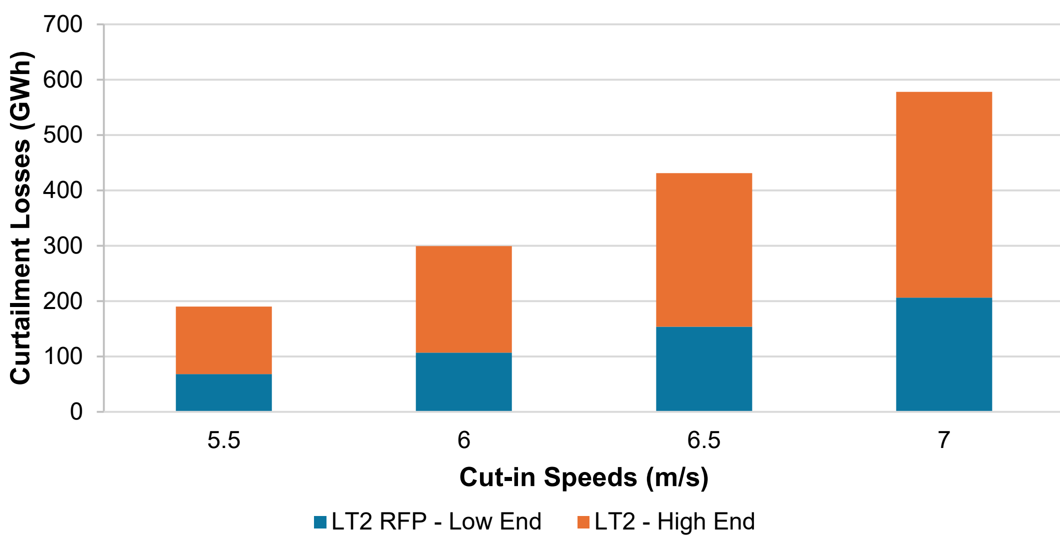
In a January 2025 IESO request for proposals for new long-term energy contracts, wind energy is an important part of the solicitation for proposals with 3,000 GWhs of procurement targeted (IESO 2025; "IESO 2025 RFP"). Facilities that are sited in the Northern Ontario (i.e., the territorial Districts of Kenora, Rainy River, Thunder Bay, Cochrane, Algoma, Sudbury, Timiskaming, Nipissing, Manitoulin, and Parry Sound; *see* Figure 8) are more highly valued, as are areas not actively being used for agriculture, which largely correspond to northern regions. These are regions where the wind resource is less strong. In other words, the IESO is actively encouraging wind energy developers in its long-term planning to pursue areas for development that would be significantly jeopardized by an aggressive bat curtailment regime such as 7 m/s.

Figure 8. Wind speed map of Northern Ontario



According to an analysis conducted by Pattern's team of analytical experts, of 3,000 GWhs of wind sources that could be procured by the IESO this year, an estimated 124 GWh of clean electricity would no longer be produced and delivered as a result of the 7m/s seasonal required in the 23.20 Bat Revisions. This would translate to a loss of 475 GWh on average when looking at the near 5 GW of existing wind capacity in the province as of 2024. Looking at the IESO 2025 RFP Window 2 Energy Targets (5 – 14 TWh by 2033), losses vary depending on the cut-in wind speeds, but Pattern's analytics team estimates losses to range from 68 GWh for 5.5 m/s cut in speeds at the low end of the RFP target (5 TWh) to nearly 600 GWh at 7 m/s cut in speeds at the high end of the RFP target (14 TWh) (*see* Figure 19 below).

Figure 9. Curtailment Losses by cut-speed, total LT2 RFP 2033 Target



An aggressive cut-in speed for seasonal bat curtailment would not only impact grid management but also directly affect Pattern's operating facilities, development pipeline, the communities where our current and planned facilities would be located, and the First Nations with which we partner and plan to partner further.

Facilities operating in Ontario that are currently actively managing for impacts to bats under approved REAsthe existing regulatory frameworks are actively minimizing impacts for the 23.20 Species Additions and have invested significant resources into monitoring of realized impacts. Starting from scratch to develop new Mitigation Plans that align with the prescriptions of the 23.20 Bat Revisions under a custom approach will be costly. Following either the common or the custom approach idenified in the 23.20 Bat Revisions, despite the bat measures already in place at these facilities, will impose additional costs that are not anticipated. These costs will be incurred not only to the projects but to the local communities and, where applicable, First Nations partners.

A strict 7 m/s cut-in speed for the common approach and an associated custom approach tiered off of that target would have significant negative impacts to Pattern's development portfolio in northern Ontario. The impacts of such a framework could result in uneconomic projects that could dissuade Pattern from further investment and development. These projects represent meaningful economic development opportunities for the local economy. Further, like our Henvey Inlet, we anticipate that most if not all of our future wind developments in Ontario will be in partership with First Nations. A cut-in speed that forecloses these opportunities will have a direct impact on First Nations. Lastly, this approach cuts against progress that is being made at advancing technologies and methods for minimizing impacts to bats.

RECOMMENDED ADJUSTMENTS TO THE PROPOSED SECTION 23.20 BAT REVISIONS

We recommended that MECP utilize the existing regulatory framework in the Wind Facilities Regulation (i.e. Section 23.20 coupled with the ability to integrate REA requirements) to allow wind facility operators to register for the potential impact to the migratory bats and to develop a site-specific Mitigation Strategy that is specific to their project. The existing Wind Facilities Regulation outlines a framework that will enable an assessment of impacts and development of mitigation plans based on site specific and best available information that will minimize impacts on the migratory bat species. To the extent that the new O. Reg 242/08 Revisions, including a common approach with a blanket curtailment cut-in speed is pursued by MECP, it must be a feasible and defensible one that balances benefits to bats with economic and social impacts. We provide the below recommendations:

Common approach

If a standard m/s cut-in speed requirement is imposed, it should be a lower wind speed that balances demonstrable benefits to bats with economic impacts. If a project proponent is going to utilize the common approach, this should be associated with an elimination or significant reduction in the amount of post-construction monitoring that should be required. Best available information should be used to refine the temporal windows to remove low risk time periods to bats at the regional and/or local level.

Custom approach

The custom approach should be broadly defined to enable operators to use any one or combination of the existing suite of mitigation measures that are commercially available. The custom approach should have a flexible definition of smart curtailment that can accommodate an open set of variables and technology considerations. Operators should be allowed and encouraged to implement new and emerging mitigation measures as they become available, allowing for an adaptive management approach (adaptive management refers to an iterative process by which recurrent decisions are made based on information gained from the results of prior management actions). Through an adaptive management approach, facilities and the wind industry in Ontario at large can identify the conditions and combined methods that can effectively minimize impacts to bats while maintaining project sustainability.

Existing projects that are currently implementing mitigation plans to manage impacts to bats should not be subject to the applicability of the 23.20 Bat Revisions common approach. Existing projects that have existing monitoring data and mitigation strategies for the migratory bats included in the 23.20 Species Additions must be able to use this information and incorporate these species into Mitigation Strategies for 23.20 compliance.

Please do not hesitate to reach out to Pattern to discuss further.

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APPENDICES

WIS:dom Bat Analysis Summary

Electricity System Impacts of Blanket Wind Power Curtailment for Bats

Dr Christopher T M Clack,

VP Integrated Energy Systems Planning

Pattern

VCE, Catalyst & GridLab release open-source dataset

Introducing the Resource Adequacy Renewable Energy (**RARE**) Power Dataset

First release is 2019 through 2023 hourly, county-granularity wind and solar PV capacity factors.

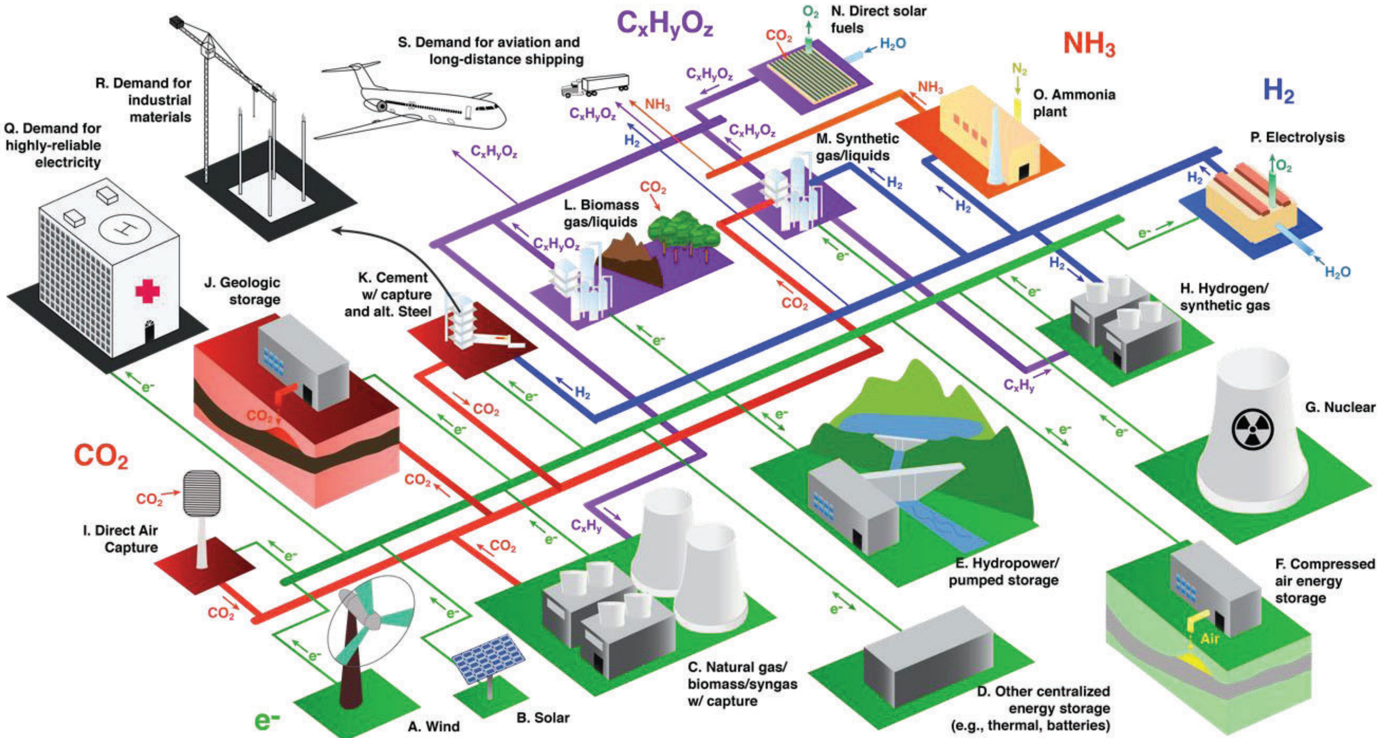
Second release in Q1 2025 will include 2014 through 2018. Annual releases while the HRRR remains operational at NOAA.

Use the QR code to get straight to the raw csv files

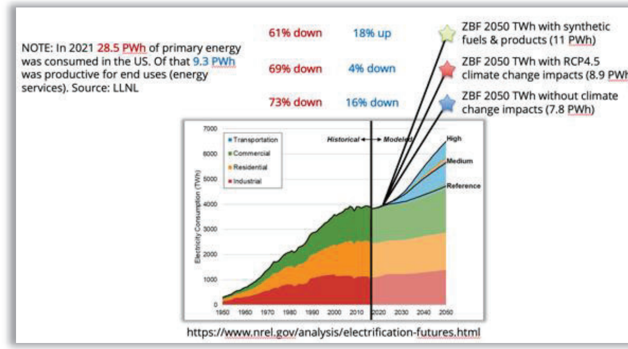
Please visit Catalyst Cooperative to download an exquisitely curated database of the data

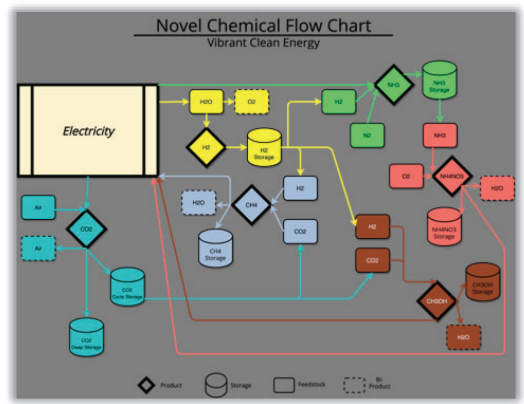
Weather-Informed energy Systems:

for design, operations & markets



Davis et al., 2018



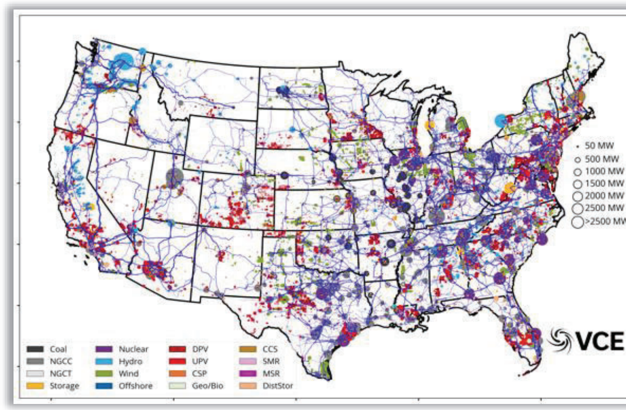


The modeling is designed to encompass as much of the energy economy as possible

WIS:dom-P (Planning)

WIS:dom®-P is a ***combined*** capacity expansion and production cost model.

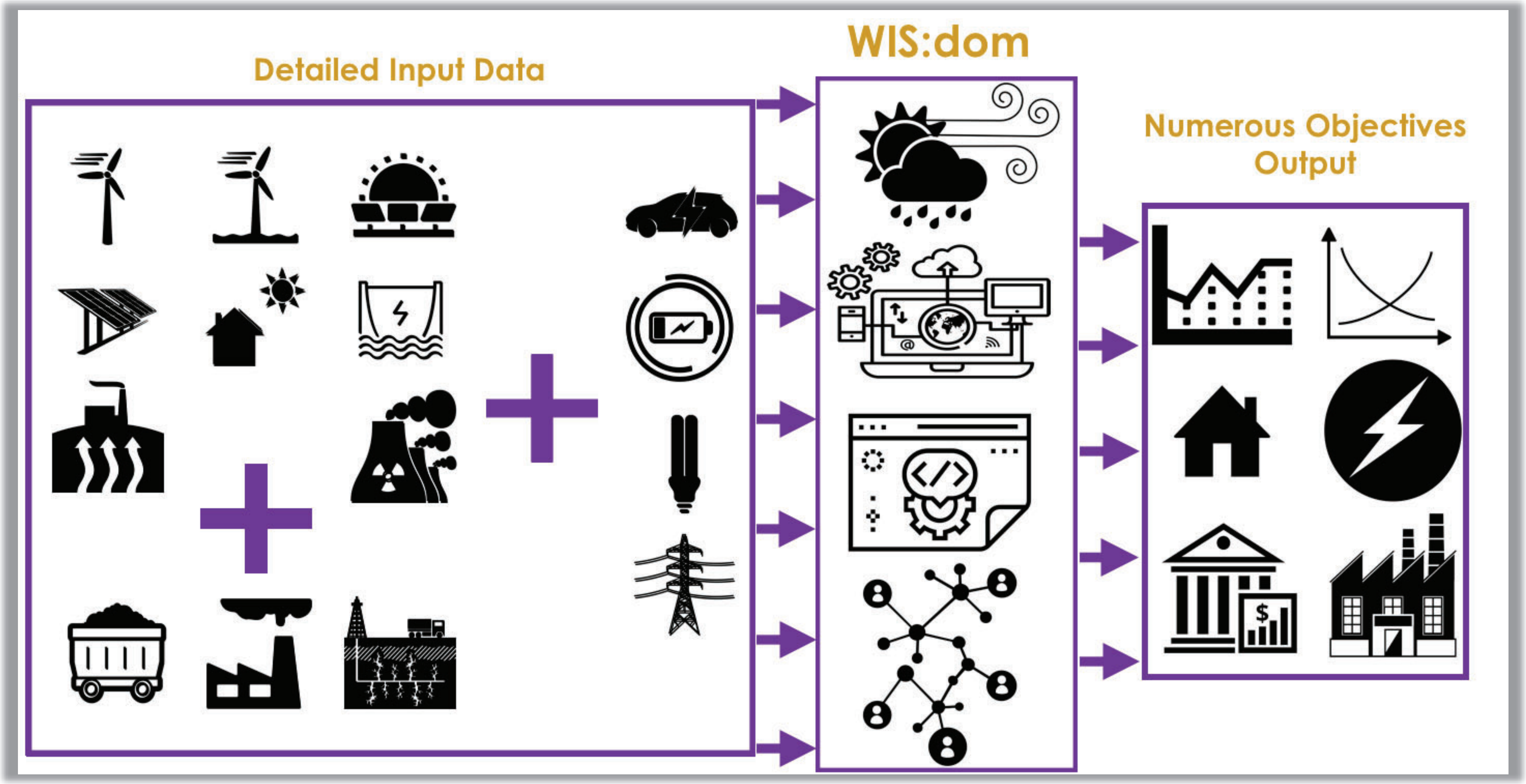
- ***Capacity expansion includes:***
  - ✓ Continental-scale & spatially-determined;
  - ✓ Co-optimization of generation, transmission, storage and distributed resources;
  - ✓ Myopically perform investment periods from 2020 through 2050 (annually);
  - ✓ Transmission can be explicitly resolved at each 69-kV substation;
  - ✓ Generation siting can be explicitly resolved at 3-km spatial resolution;
  - ✓ Existing policies, restrictions and incentives;
  - ✓ Detailed land-use screening for siting of technologies;
  - ✓ Future cost projections for technologies and fuels;
  - ✓ Detail accounting for retirement of generation assets;
  - ✓ Can includes climate change data from CMIP-5 for possible future drivers of infrastructure stress;
  - ✓ **STANDARD MODEL GRANULARITY FOR LONG TERM STUDIES IS COUNTY-LEVEL.**



- ***Production cost includes:***
  - ✓ Unit commitment;
  - ✓ Start-up & shutdown profiles of generators;
  - ✓ Ramp constraints, minimum up and minimum down times;
  - ✓ Transmission power flow, transmission dynamic line ratings, and transmission line losses;
  - ✓ Planning reserve margins and operating reserves, with detailed VRE accounting;
  - ✓ Distribution planning & hybrid optimization of the grid edge;
  - ✓ Weather forecasting and physics of weather engines for resources and demands;
  - ✓ Up to 5-minutely temporal granularity (**STANDARD FOR LONG TERM STUDIES IS HOURLY-LEVEL**);
  - ✓ Zero loss of load at any time or location;
  - ✓ Detailed energy storage dispatch subroutines for arbitrage & transmission asset configurations;
  - ✓ Demand flexibility modeling based on granular weather drivers;
  - ✓ Novel technology inclusion and integration (SMR, MSR, EGS, CCS, DAC, H_2, NH_3, CH_4, P2X);
  - ✓ Existing generator and transmission asset characteristics.

Weather-Informed energy Systems:

for design, operations & markets

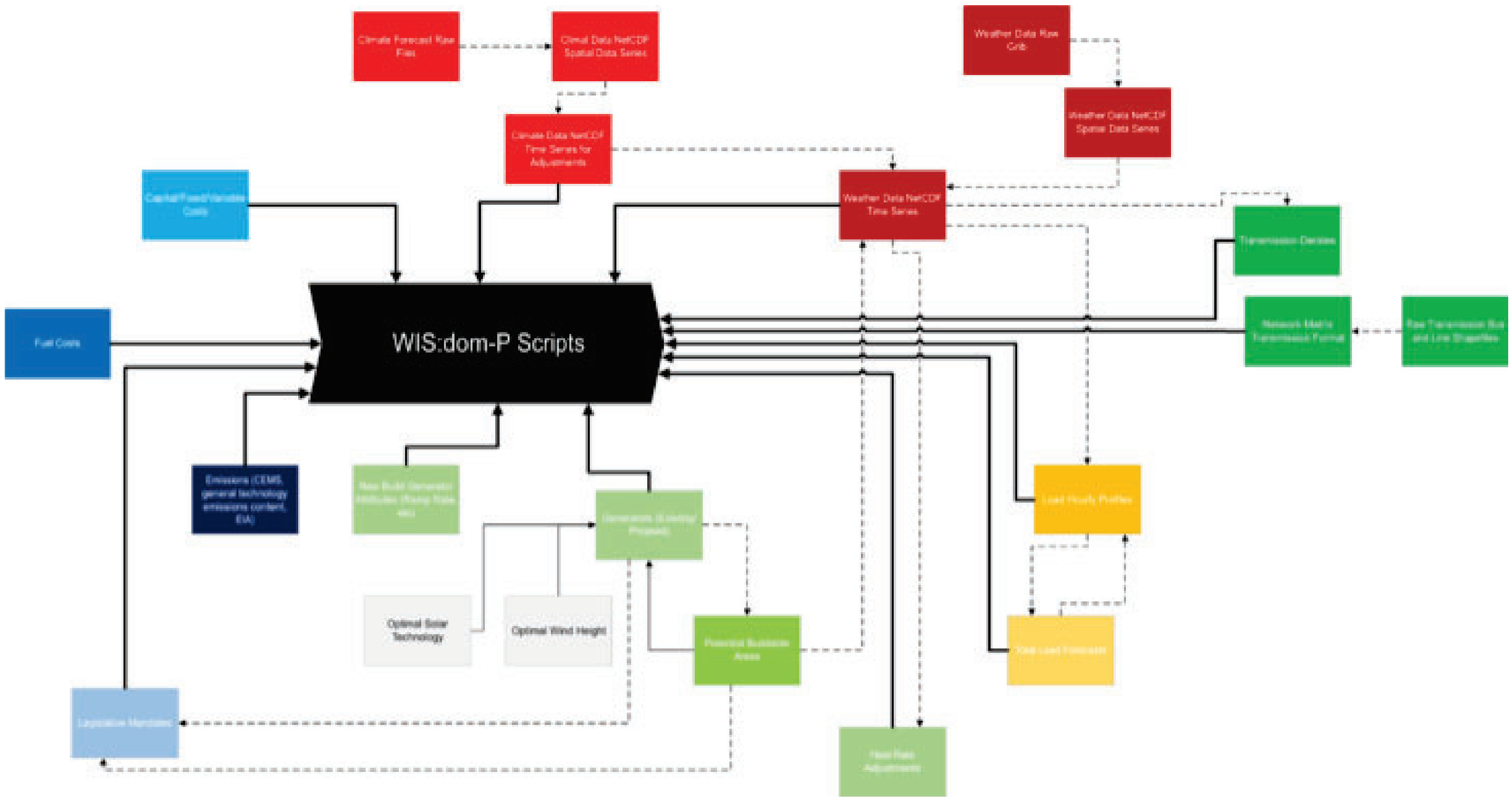


Weather-Informed energy Systems:

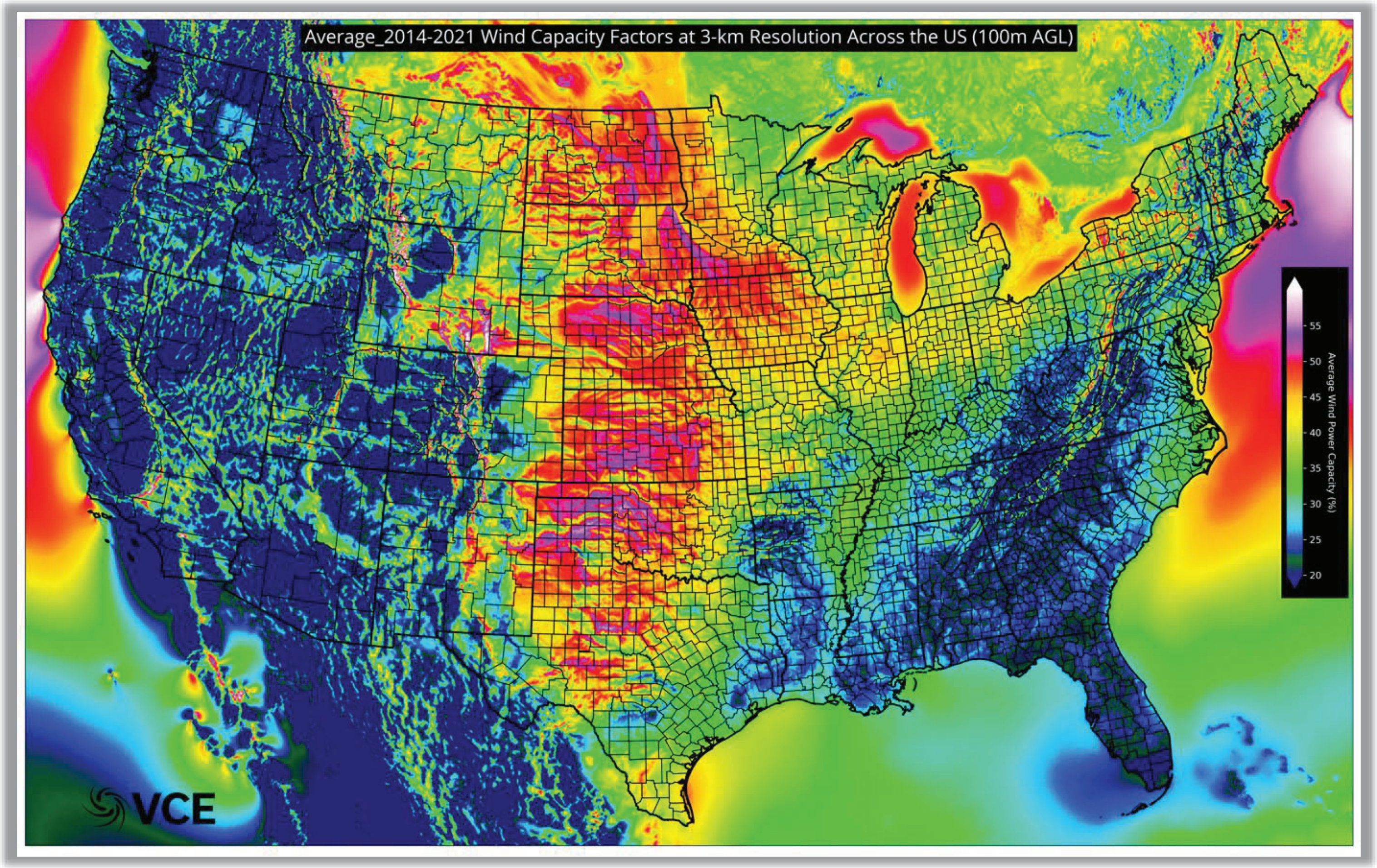
for design, operations & markets

Main Input Dataset Buckets For WIS:dom

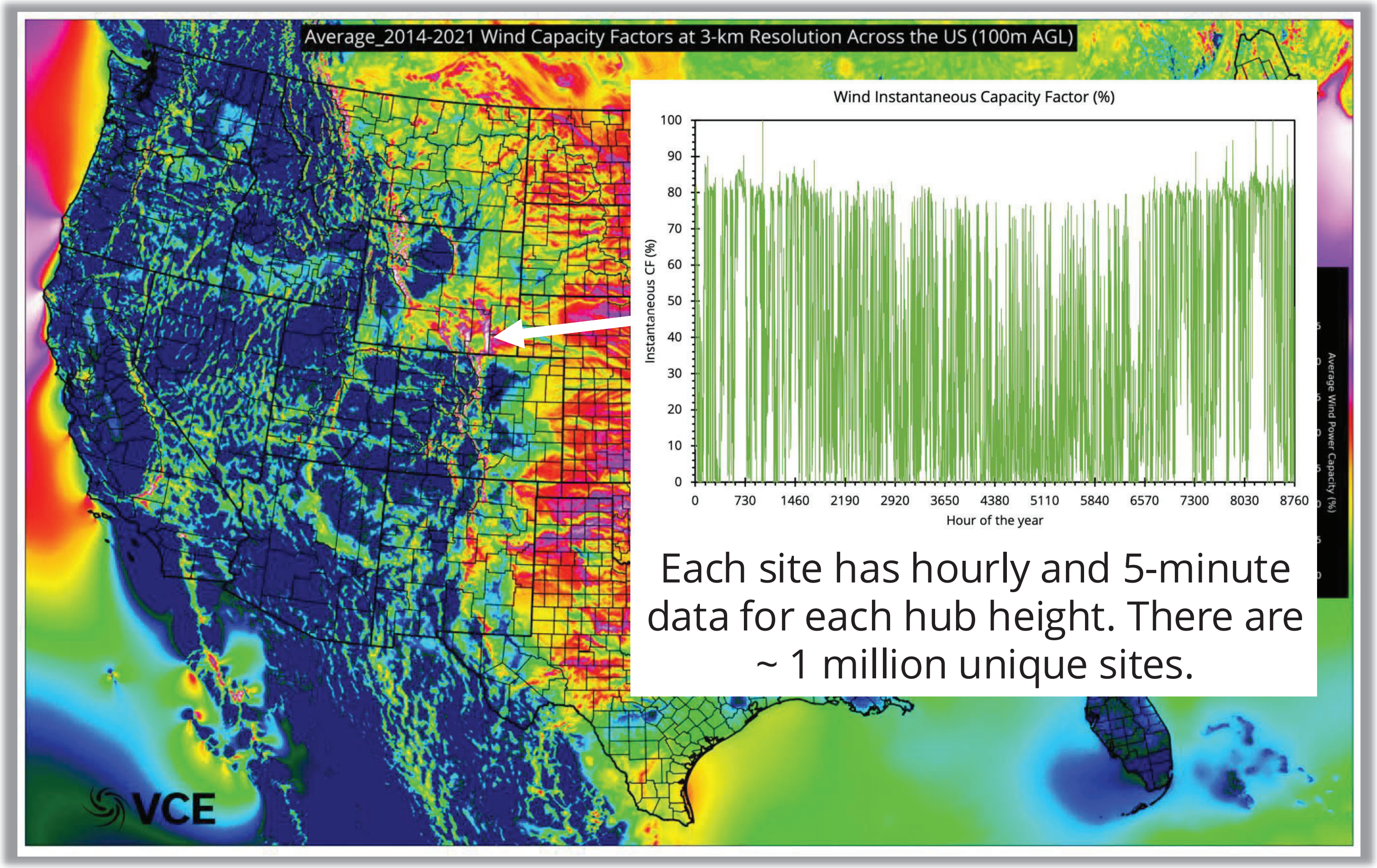
- Weather Data
- Climate Change Impacts
- Load Hourly Profiles
- Total Load Forecasts
- Buildable Areas
- Existing/Proposed Generators
- Transmission Topology
- Legislative Mandates
- Capital/Fixed/Variables Technology Costs
- Fuel Cost Forecasts
- Emission Information
- And More!



WIS:dom-P includes highly granular wind data



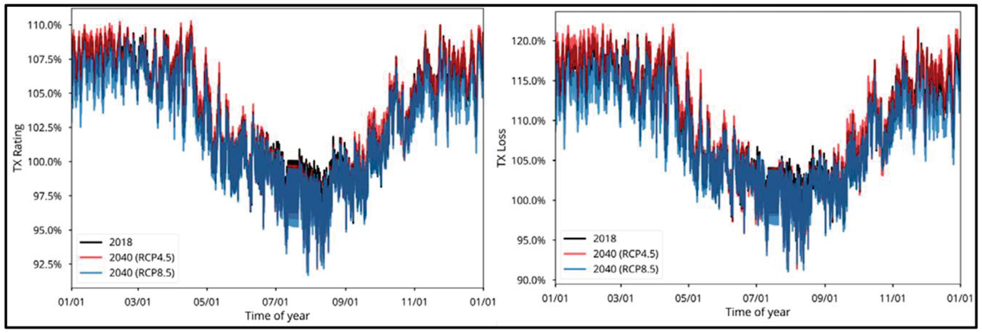
WIS:dom-P includes highly granular wind data



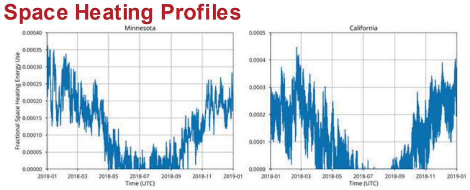
WIS:dom-P includes highly granular weather data

Transmission Ratings Profiles

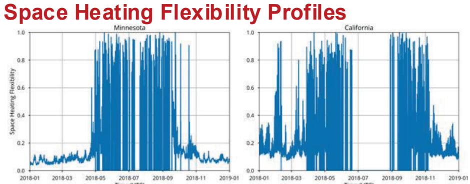
Transmission Losses Profiles



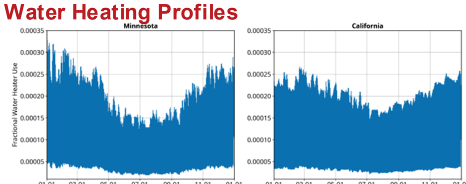
Space Heating Profiles



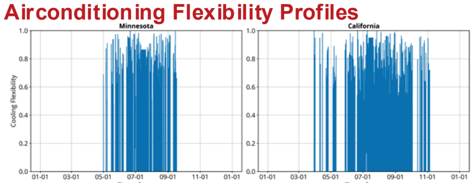
Space Heating Flexibility Profiles



Water Heating Profiles



Airconditioning Flexibility Profiles



Weather inputs are not just about wind and solar power estimates

Weather data provides critical inputs to WIS:dom-P for:

- *Transmission line ratings*
- *Transmission line loss estimates*
- *Heat rate adjustments for thermal power plants*
- *Water availability for thermal power plants and hydroelectricity*
- *Profiles for demands (important for heating, cooling, EVs, etc.)*

Having a consistent physical model for weather across all inputs ensures correlations (positive and negative) are accounted for.

Modeling Procedure for Bat Curtailment Analysis

1. **Initial National-level insights:**
   a. *Use WIS:dom-P wind resources across CONUS and compute the existing (2020 & 2021) fleet generation normalized to actuals;*
   b. *Calculate the curtailment due to proposed bat regulations;*
   c. *Estimate the additional carbon dioxide emissions to replace the wind generation that was curtailed due to a blanket bat curtailment regulation.*

2. **PJM system insights from WIS:dom-P modeling:**
   a. *Use WIS:dom-P tool to optimize the PJM RTO (and adjoining states) from 2020 though 2050.*
   b. *Adjust the wind power for proposed bat regulations and re-optimize.*
   c. *2020 will have identical generation portfolio (to estimate emission and price changes), while future years will be allowed to alter the portfolio based upon the new resource profiles.*
   d. *Output basic metrics for discussion and consider future modeling to provide deeper insights.*

Modeling Procedure for Bat Curtailment Analysis

National-level existing modeling:

a. Write code to compute the wind power generation at every location across the CONUS for 2020 & 2021.

b. Curtail profiles when ALL conditions met:
   i. *7/15 0000 – 10/15 2300 UTC,*
   ii. *0200 – 1400 UTC {8pm – 9am ET},*
   iii. *Solar PV production falls to zero,*
   iv. *Temperature over 50ºF,*
   v. *Hourly capacity factor is below* ***13.5%****.*

c. Repeat above for below ***40.3%***.

d. Repeat above for below ***78.5%***.

e. Calculate the removed generation & the emissions associated with it, assuming natural gas CC replaces it.

PJM-level WIS:dom-P modeling:

a. Repeat the curtailment conditions from the national-level modeling and apply to inputs for WIS:dom-P across PJM.

b. Start from 2020 to identify purely production cost changes.

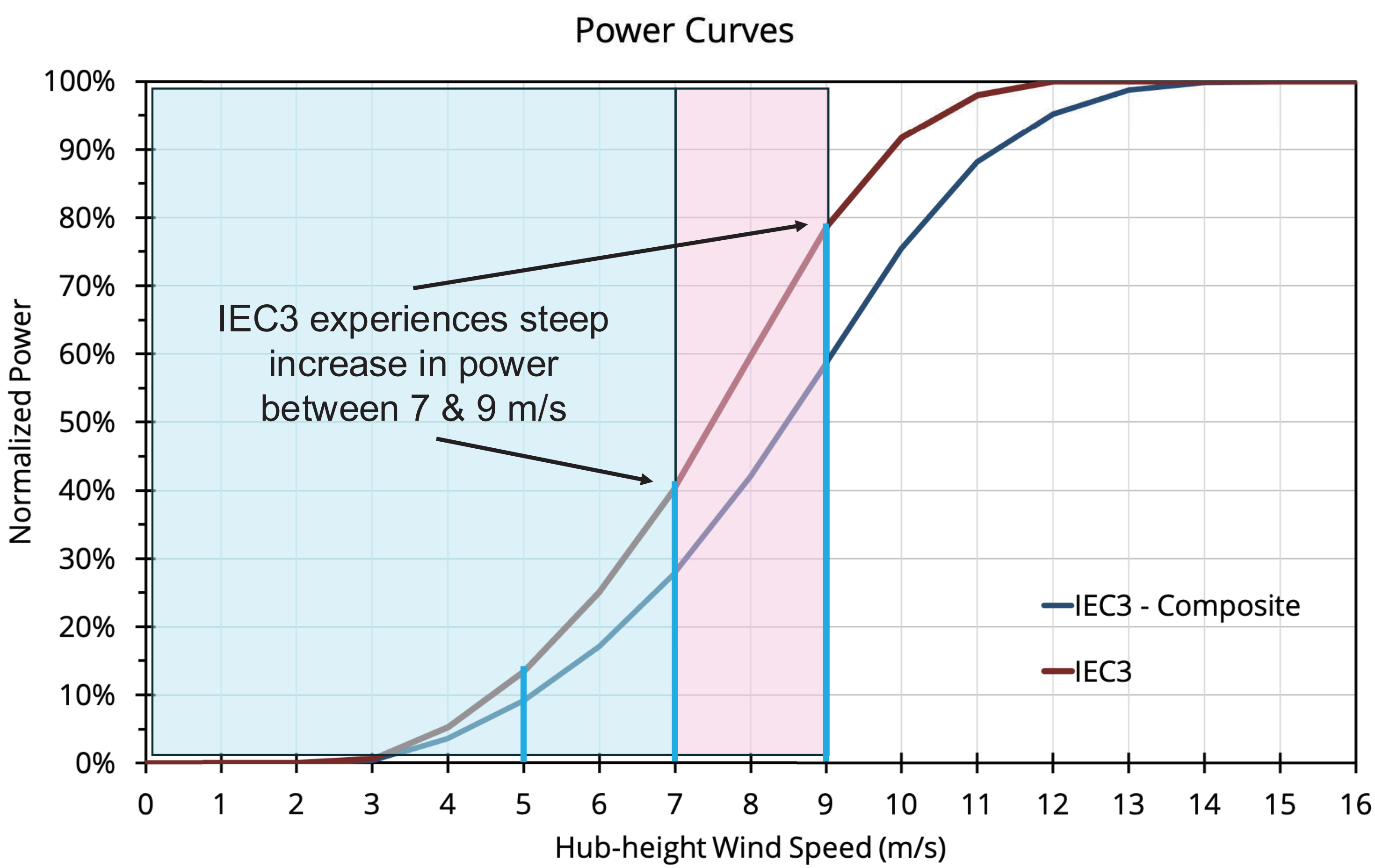
c. Allow optimization through 2050.

d. Compute the differences in capacity, generation, transmission, pricing, emissions and location of wind.

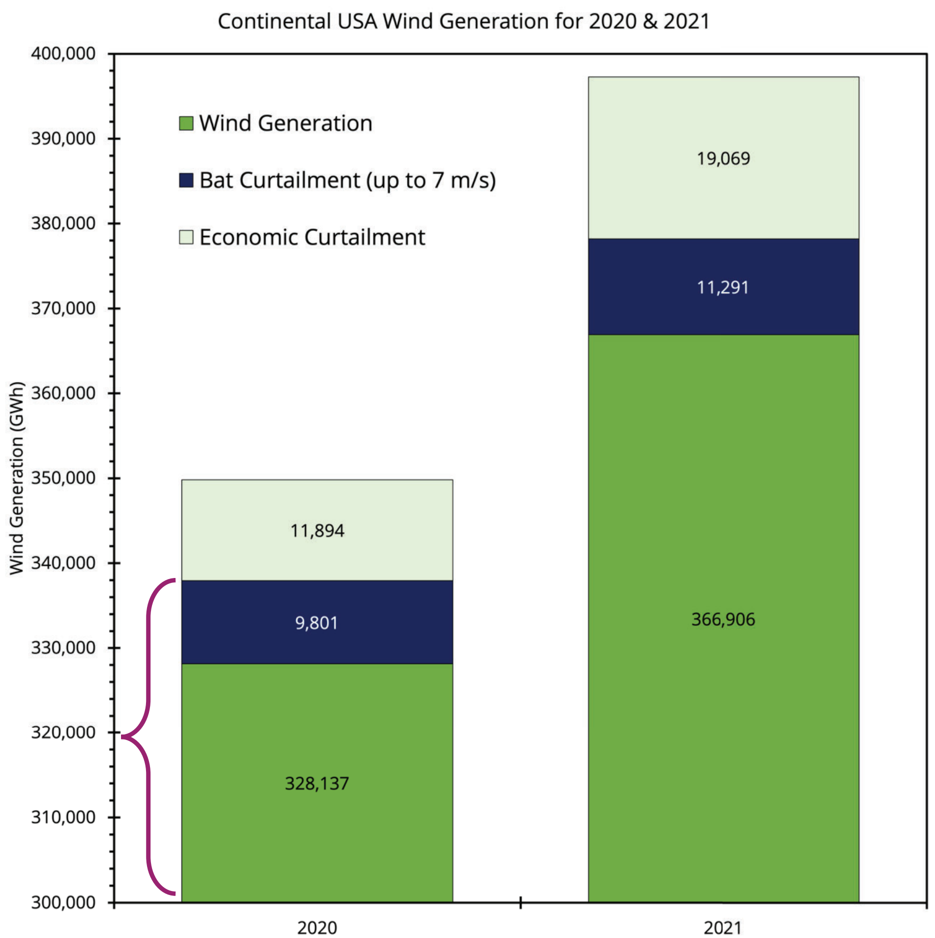
Modeling Procedure for Bat Curtailment Analysis

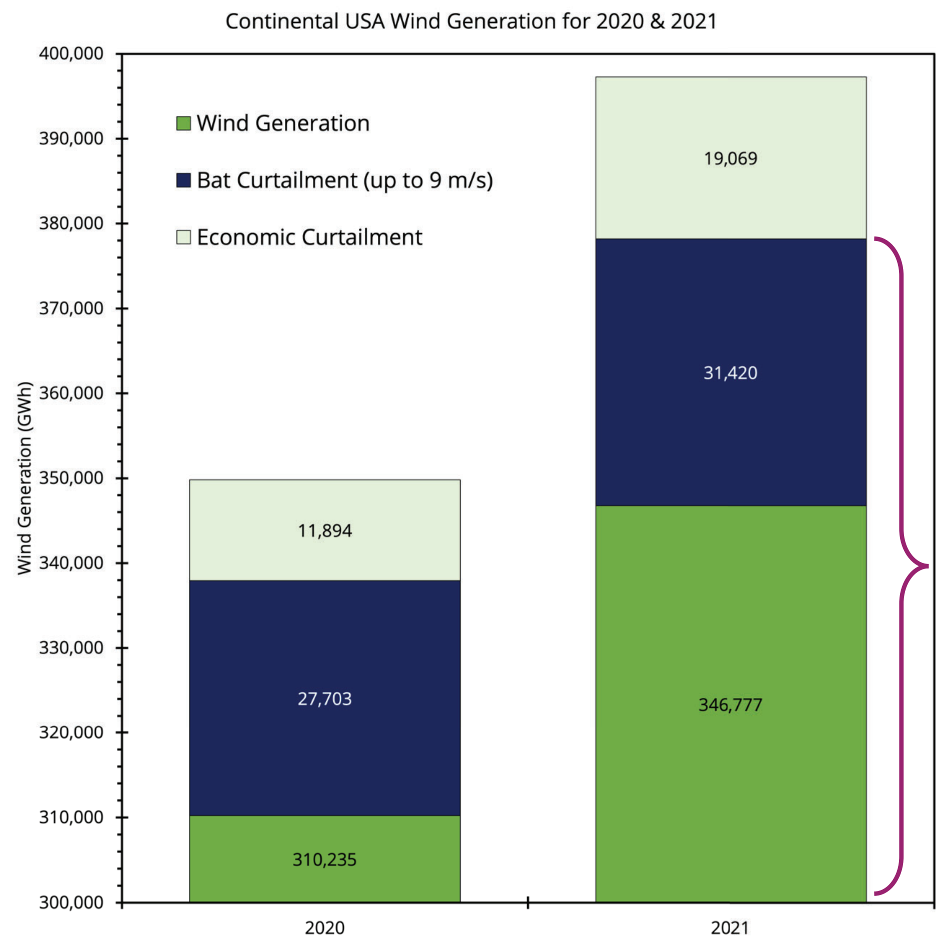
Almost all the US Wind Generation fleet is IEC-III turbines; so, we decided to use the IEC3 power curve:

At 5m/s: 13.5% power
At 7 m/s: 40.3% power
At 9 m/s: 78.5% power



National Insights From WIS:dom-P Data





= Actual Production Reported in 2020 & 2021

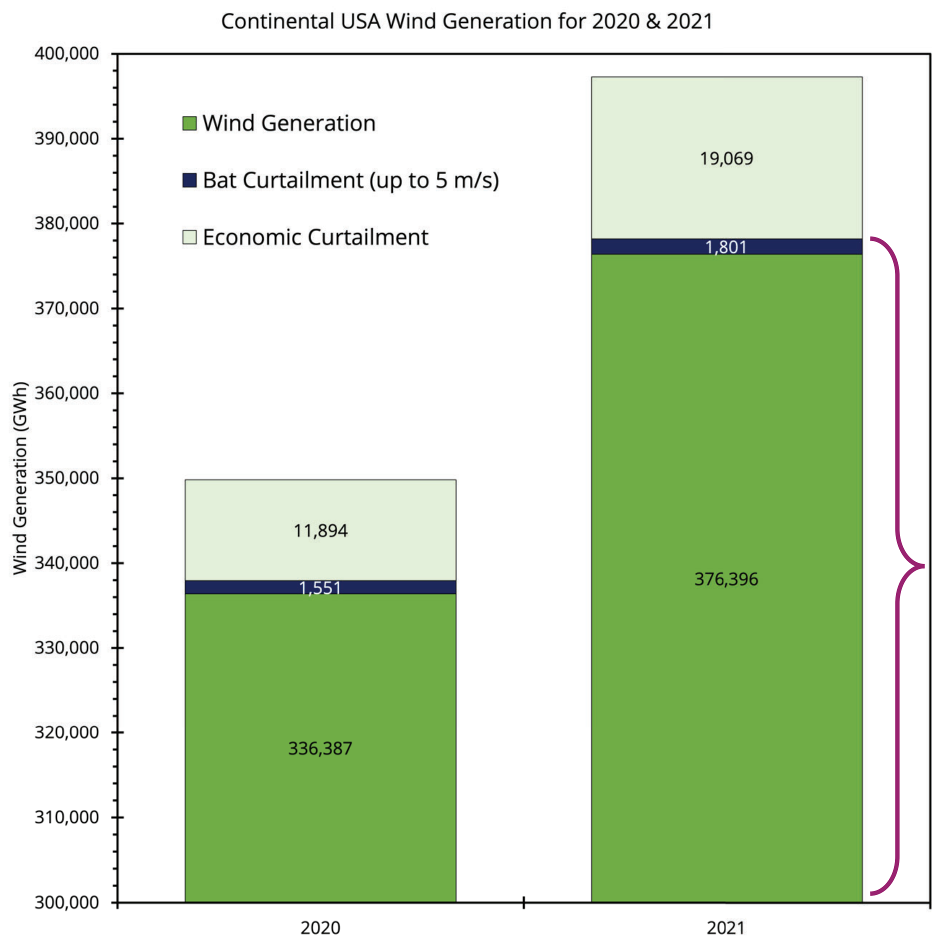
National Insights From WIS:dom-P Data

Voluntary 5 m/s Curtailment limitation:

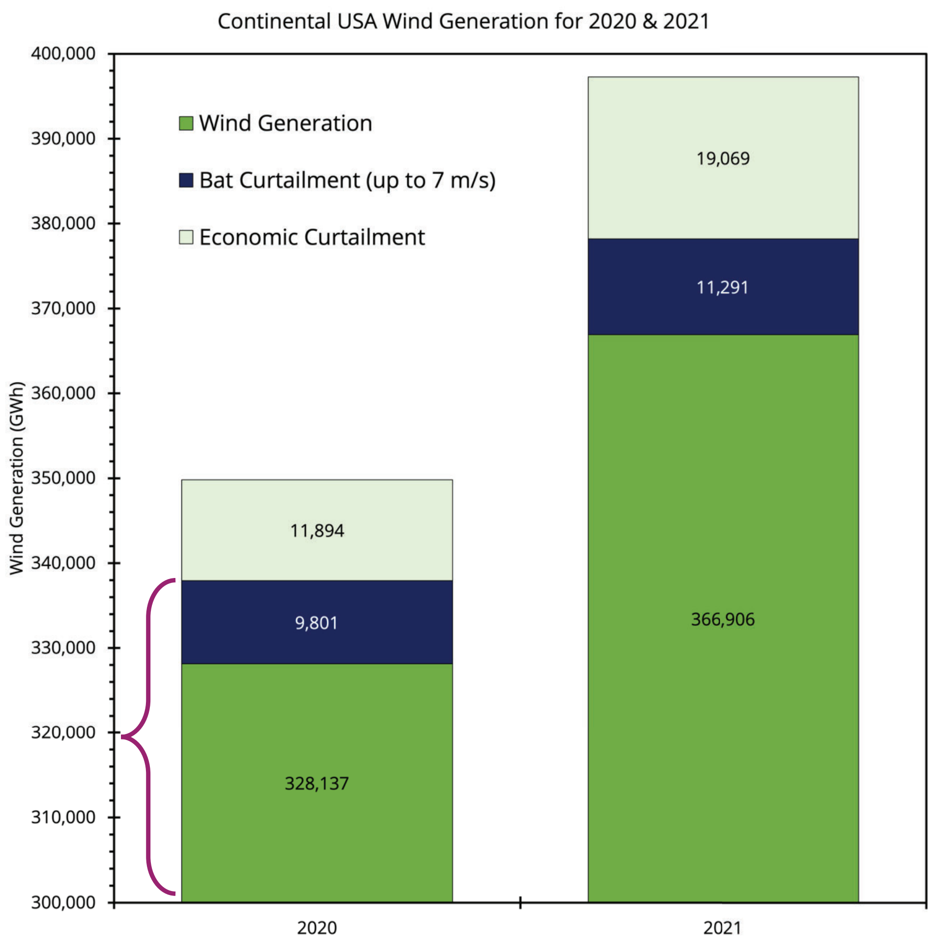
Wind Curtailment 2020 = 3.4% (11,894 GWh)
Wind Curtailment 2021 = 4.8% (19,069 GWh)

Bat Wind Curtailment 2020 = **0.44% (1,551 GWh)**
Bat Wind Curtailment 2021 = **0.45% (1,801 GWh)**

Estimated Emissions 2020 = 676,411 metric tons
Estimated Emissions 2021 = 785,448 metric tons



National Insights From WIS:dom-P Data



For ***7 m/s limitation***:

Wind Curtailment 2020 = 3.4% (11,894 GWh)
Wind Curtailment 2021 = 4.8% (19,069 GWh)

Bat Wind Curtailment 2020 = **2.80% (9,801 GWh)**
Bat Wind Curtailment 2021 = **2.84% (11,291 GWh)**

Estimated Emissions 2020 = 4,273,275 metric tons
Estimated Emissions 2021 = 4,922,922 metric tons

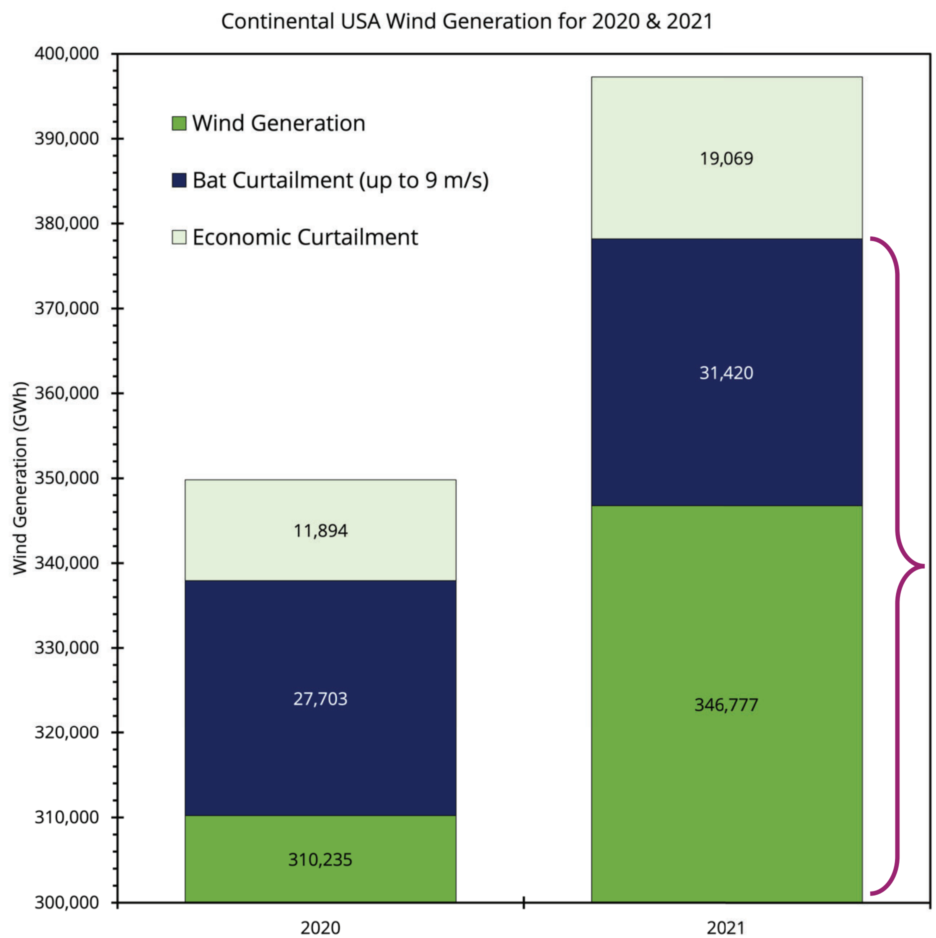
National Insights From WIS:dom-P Data

For ***9 m/s limitation***:

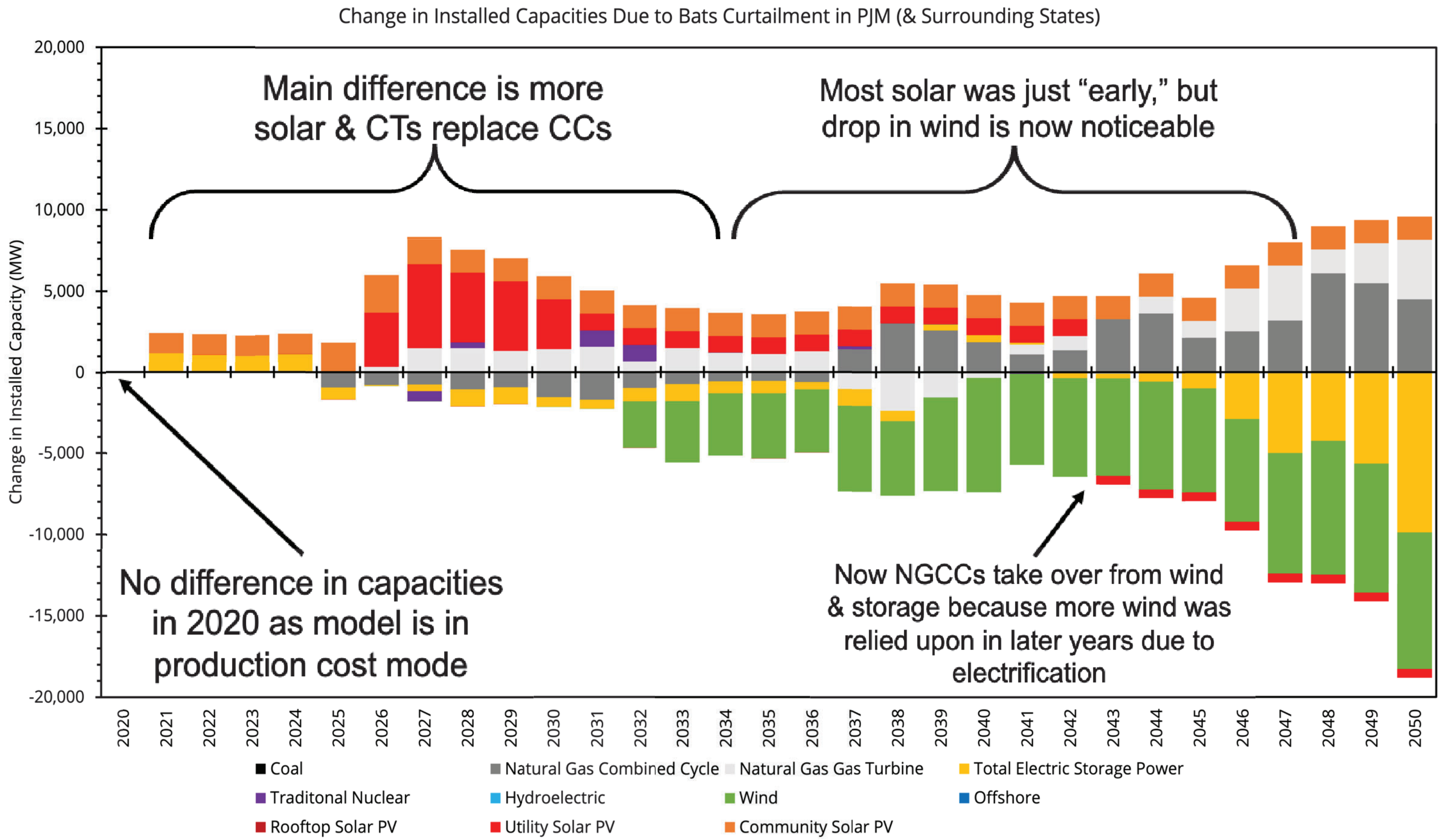
Wind Curtailment 2020 = 3.4% (11,894 GWh)
Wind Curtailment 2021 = 4.8% (19,069 GWh)

Bat Wind Curtailment 2020 = **7.92% (27,703 GWh)**
Bat Wind Curtailment 2021 = **7.91% (31,420 GWh)**

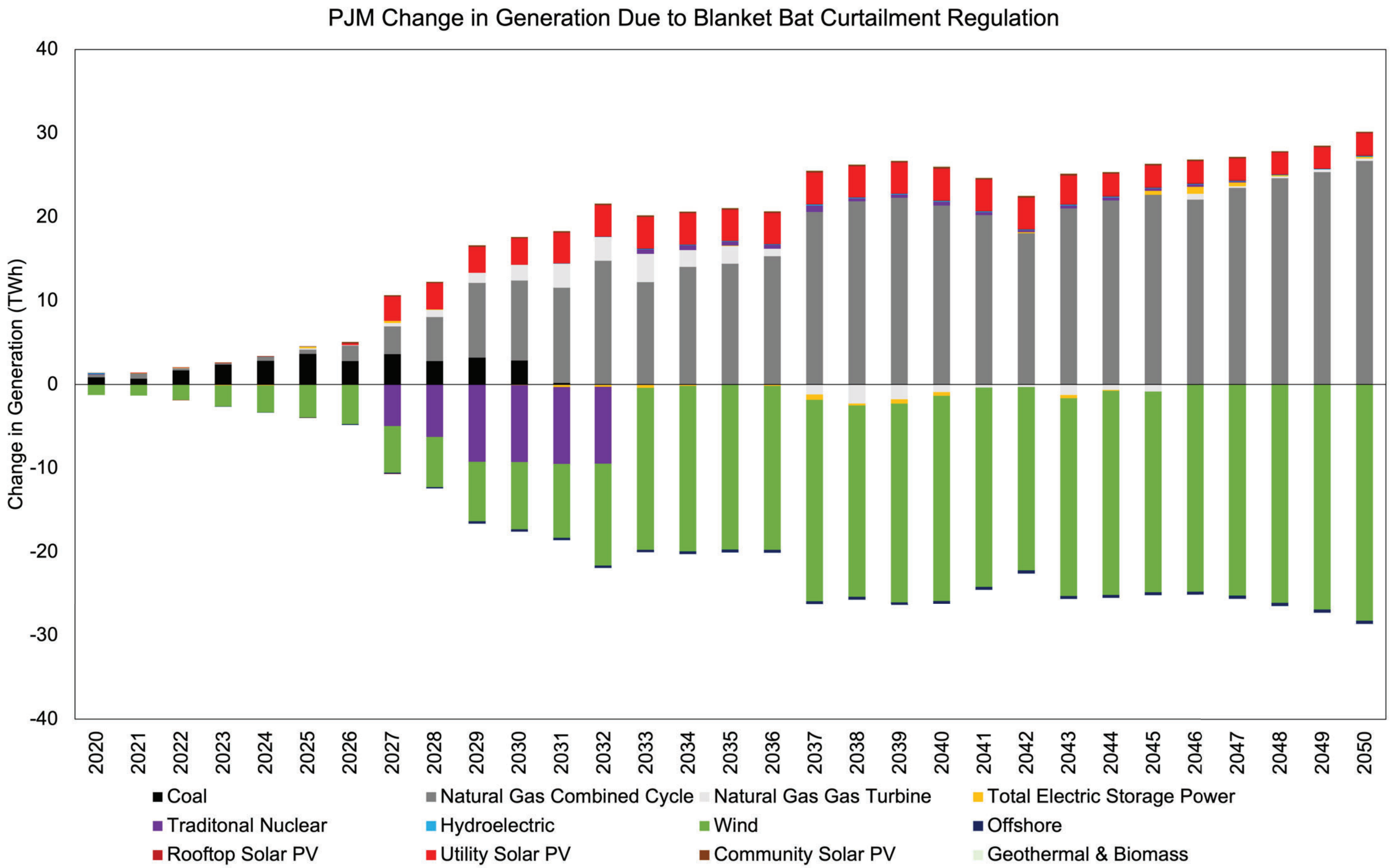
Estimated Emissions 2020 = 12,078,411 metric tons
Estimated Emissions 2021 = 13,699,146 metric tons



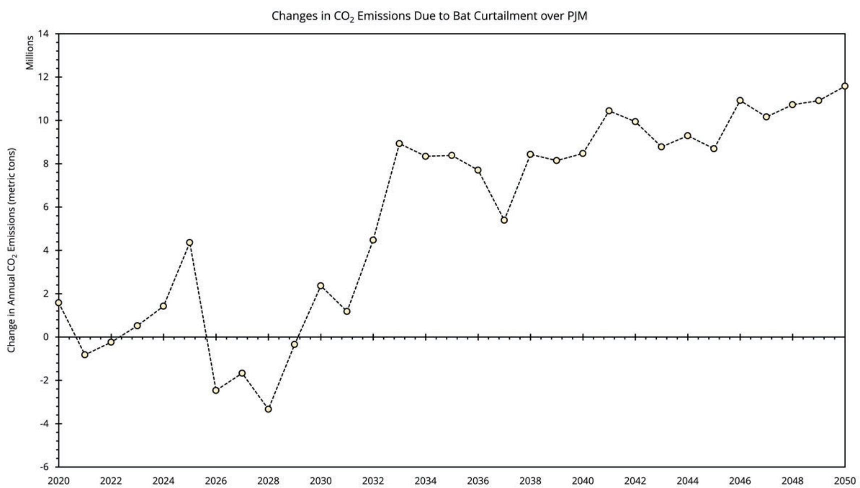
PJM-level Insights From WIS:dom-P Modeling



PJM-level Insights From WIS:dom-P Modeling

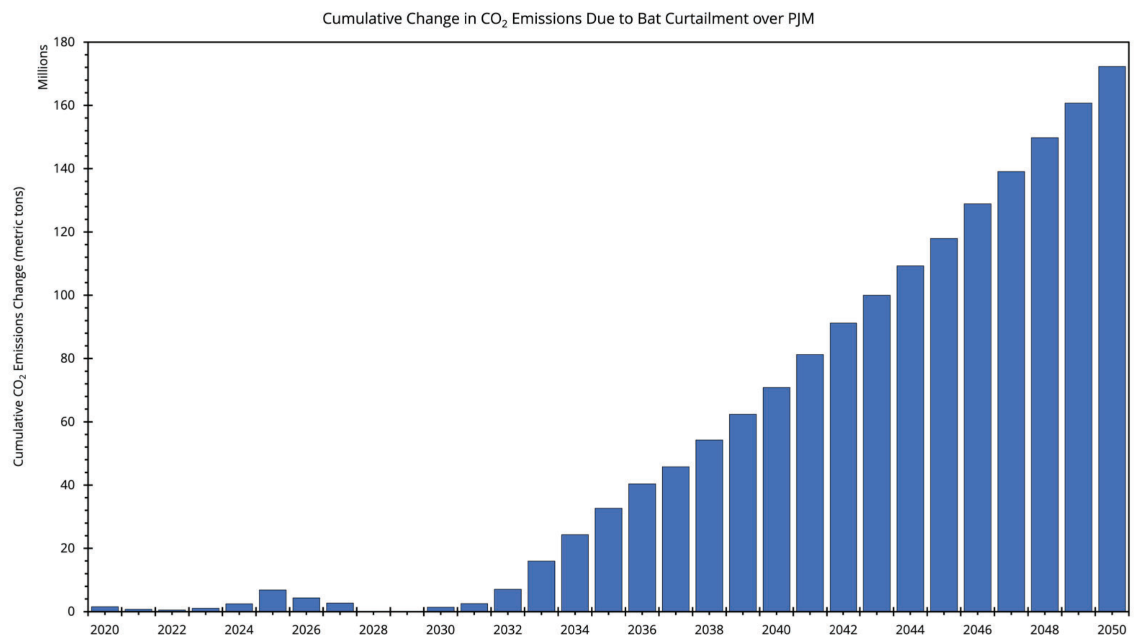


PJM-level Insights From WIS:dom-P Modeling



Once wind generation is not built, then emissions rise rapidly. Before that emissions bounce around.

Cumulatively, emissions in PJM rise substantially through 2050 from 2030.

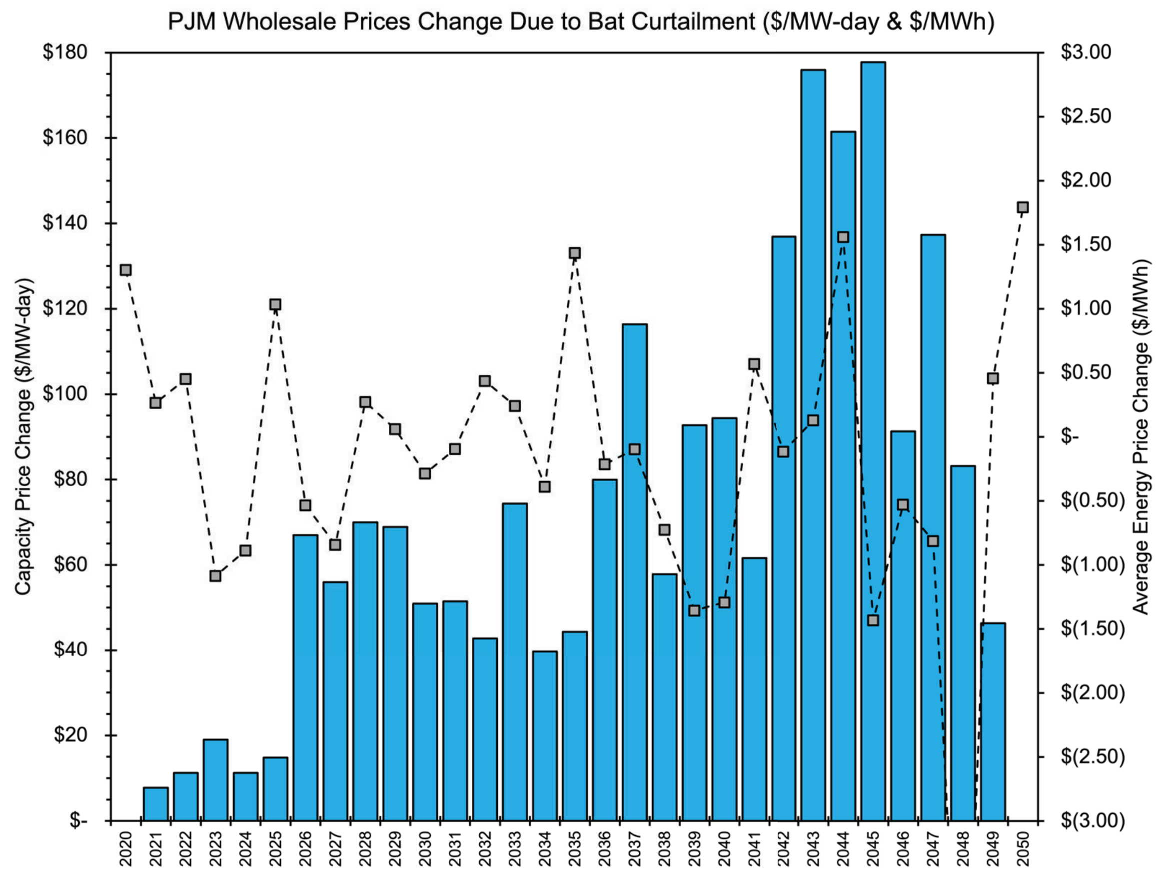


PJM-level Insights From WIS:dom-P Modeling

Marginal pricing changes by **±$1 - 2 per MWh** depending on dispatch stack priorities in fuel costs and curtailments.

The capacity price; however, is increased substantially when wind is not built within the model. Swamping the marginal price changes.

This translates to increases in the cost of wholesale electricity supply by **$5 - $18 per MWh** ($50/MW-day equates to about $5/MWh)



More Modeling To Come

1. **Initial National-level insights:**

    a. *Incorporate regional emissionality to give a more accurate valuation;*
    b. *Include 2022 values to complete the historical vantage point;*
    c. *Others?*

2. **Initial PJM-level insights from WIS:dom-P modeling:**

    a. *Re-optimize with different constraints for the bat regulation;*
    b. *Produce locational difference mapping to show projects that lose out or win;*
    c. *Explain why such a noisy change due to the curtailment enforcement;*
    d. *Others?*

3. **Expand modeling to other RTOs & Nationally:**

    a. Optimize across the nation for a better investigation into the impacts;
    b. Use different power curves and cutoffs – guided by the PJM modeling;
    c. Others?