



Navigating the Energy Transition- Growing Pains and Path Forward

December 16, 2022

Agenda



1. Housekeeping and Introductions
2. Overview: Navigating the Energy Transition and the Challenges that the Grid is Facing
3. Grid Operators' Perspective
4. What is Illinois Doing?
5. ComEd's Decarbonization Efforts
6. Q&A

- **Introduction and Scope**
- **Power Hour is a series of educational and informative presentations on a wide range of clean energy topics and emerging issues**
- **Today's Power Hour:**
 - During this webinar, the presenters will discuss current issues within the energy grid, look at best practices to help the energy grid transition to clean energy. In addition, the discussion will also shed light on notable policies (both nationally and locally) that are aimed at transitioning Illinois to achieve clean energy future.
 - This presentation is intended for educational purpose only and does not represent a legal interpretation or statement of policy by the IPA or its staff.
 - **Future IPA Power Hour Webinars will cover other topics related to the clean energy economy in Illinois**

- **Independent State Agency created in 2007**
- **Agency duties include**
 - **Development and implementation of procurement plans for electricity supply for utility customers**
 - **Development and implementation of solar incentive programs**
 - **Implementation of the Renewable Portfolio Standard**
 - Development of Long-Term Renewable Resources Procurement Plan
 - Conduct competitive procurements for utility-scale projects
 - Manage programs for community solar and solar for homes and businesses



Overview: Navigating the Energy Transition and the Challenges the Grid is Facing

Dr. Emily Grubert

Navigating the Energy Transition – Growing Pains and Path Forward

Emily Grubert

Associate Professor, Keough School of Global Affairs

University of Notre Dame

16 December 2022, Illinois Power Agency Power Hour 11



KEOUGH SCHOOL OF GLOBAL AFFAIRS

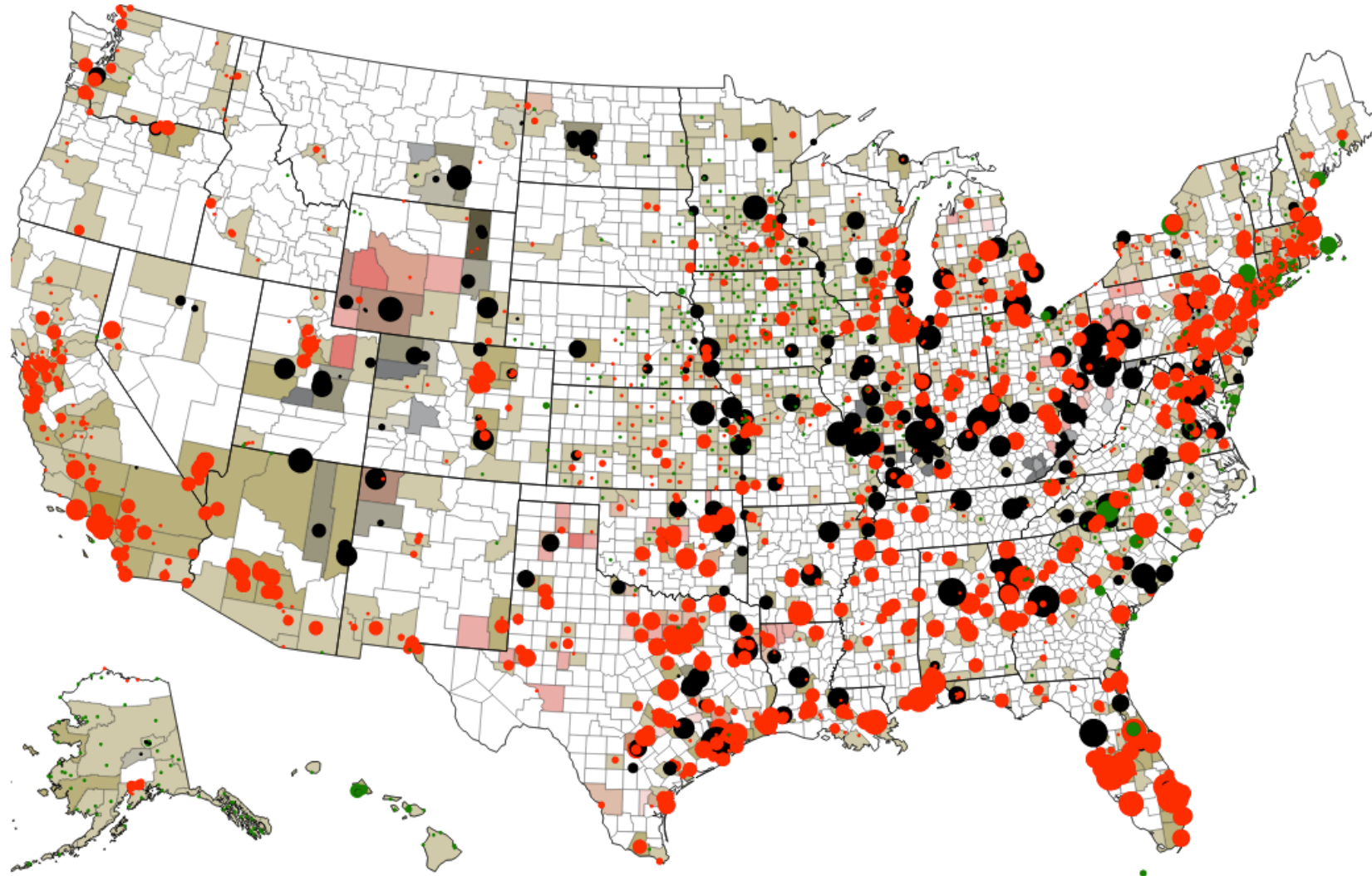
Decarbonization is two things: Industrialization and deindustrialization

- We talk a lot about the benefits of industrialization
- We talk a lot about the benefits of decarbonization
- We talk much less about
 - The disbenefits of industrialization
 - Anything about deindustrialization
 - How we manage the mid-transition
- **How do we facilitate a just transition away from fossil fuels?**

The future of United States fossil fuel-fired electricity

Environmental and labor implications of retiring generators at the end of their typical lifespans

Analysis: [E. Grubert, Georgia Tech](#). Web map implementation: R. Phillips. 2020.



Display Year

Move slider to display conditions for a given year

2018

Hover over a plant or county for details
Scroll or double click to zoom
Click and hold to drag

Totals in Selected Year

820 GW
2600 TWh
2100 million short tons CO₂
1300000 short tons NO_x
1500000 short tons SO₂
920 billion gallons water consumption
160000 jobs

Data

Background and calculations: [Grubert 2020, Science](#)

Major inputs: [EIA 860](#), [eGRID 2018v2](#),
[BLS Quarterly Census of Employment and Wages](#),
[Grubert & Sanders 2018, ES&T](#)

Legend

Power Plants

<50 MW • ; 500 MW • ; 5000 MW ●
● Natural Gas Plants
● Coal Plants
● Oil Plants

Jobs

Note that color blending occurs in counties with multiple job types
Color categories are orders of 10
<10 1300 Fossil Power Plant Jobs
<10 2600 Natural Gas Extraction Jobs
<10 5600 Coal Extraction Jobs

Interactive map: emilygrubert.org/energy-transition



Grid Operators' Perspective

Stephen Bennett

IPA Power Hour 11: Navigating the Energy Transition-Growing Pains and Path Forward

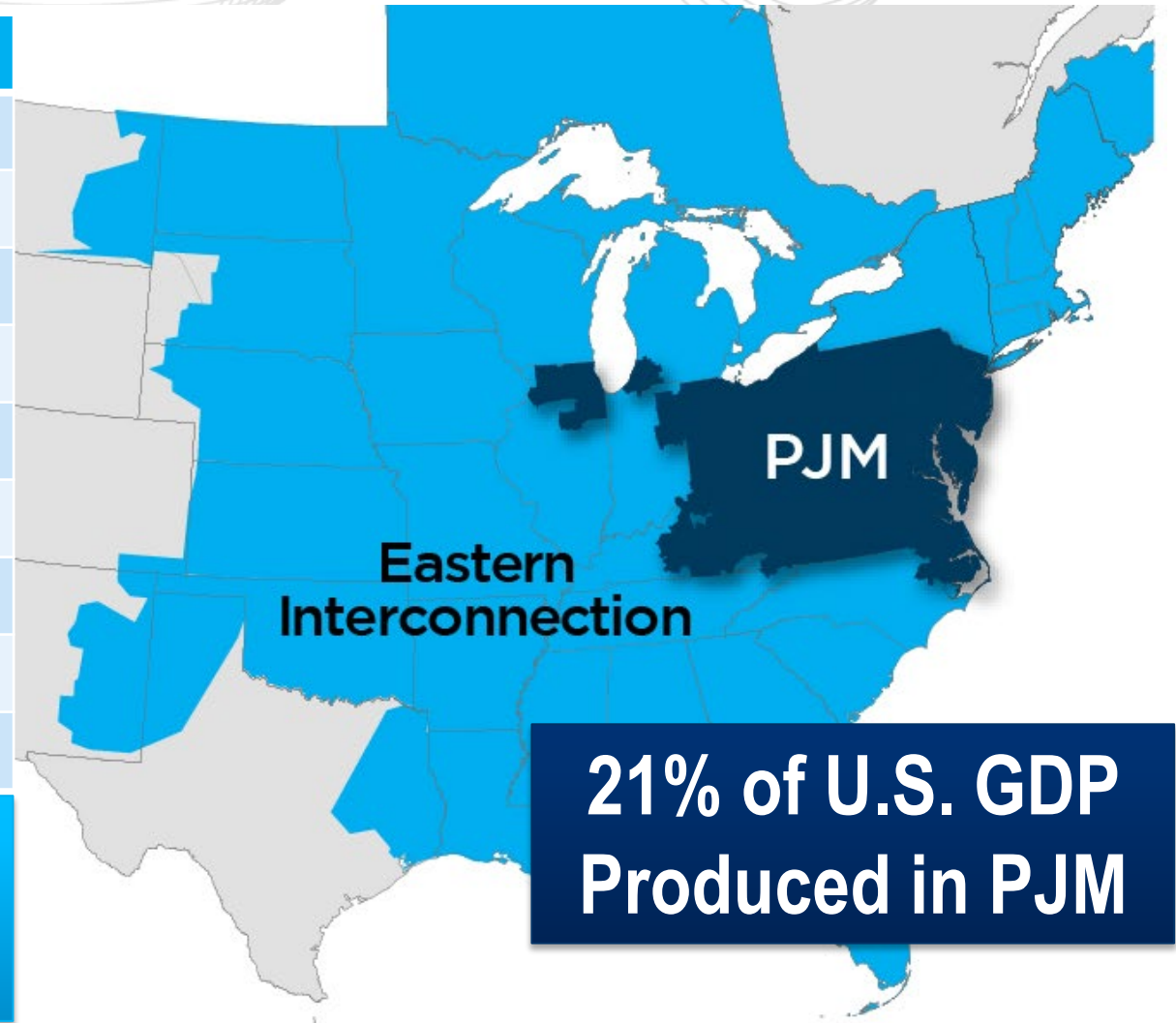
Stephen Bennett
Manager, State Government Policy
PJM Interconnection

IPA Power Hour
December 16, 2022

Key Statistics

Member companies	1,060+
Millions of people served	65
Peak load in megawatts	165,563
Megawatts of generating capacity	185,442
Miles of transmission lines	85,103
2020 gigawatt hours of annual energy	782,683
Generation sources	1,436
Square miles of territory	368,906
States served	13 + DC

- 26% of generation in Eastern Interconnection
- 25% of load in Eastern Interconnection
- 20% of transmission assets in Eastern Interconnection



**21% of U.S. GDP
Produced in PJM**

As of 2/2022



**Facilitate
Decarbonization**



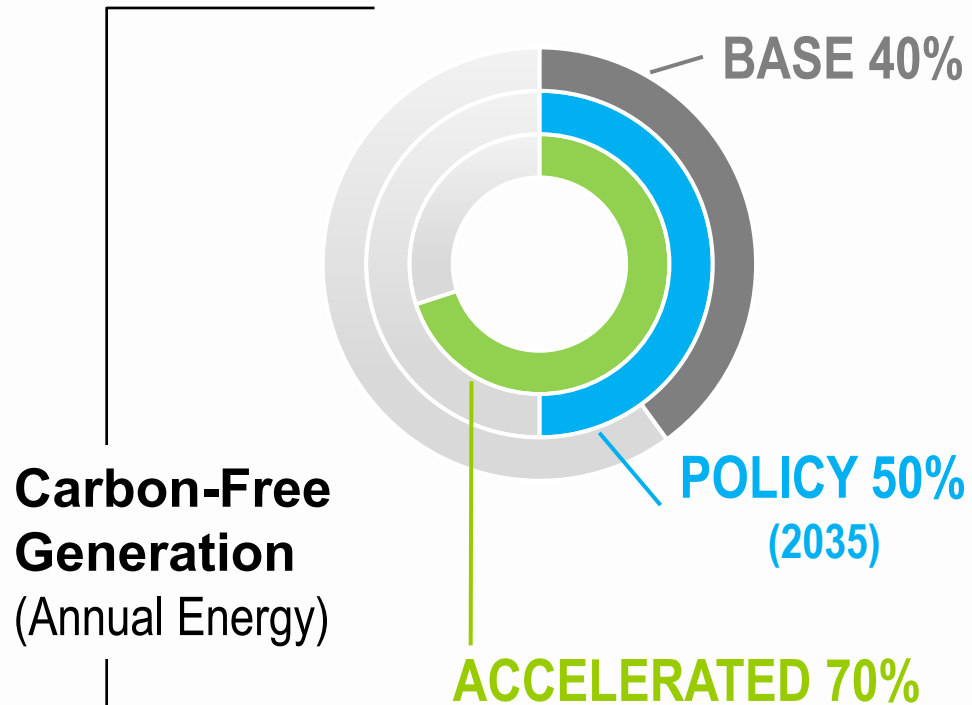
**Grid of
the Future**



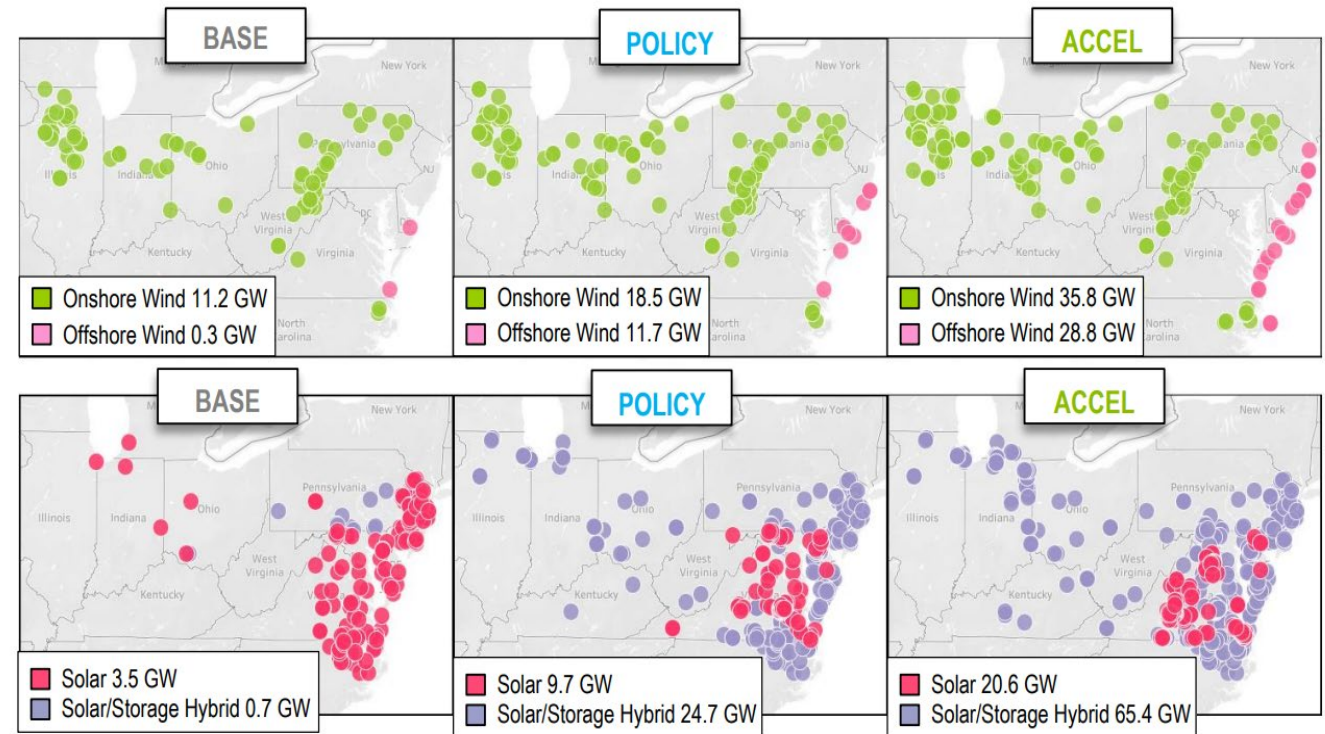
Innovation

RELIABILITY

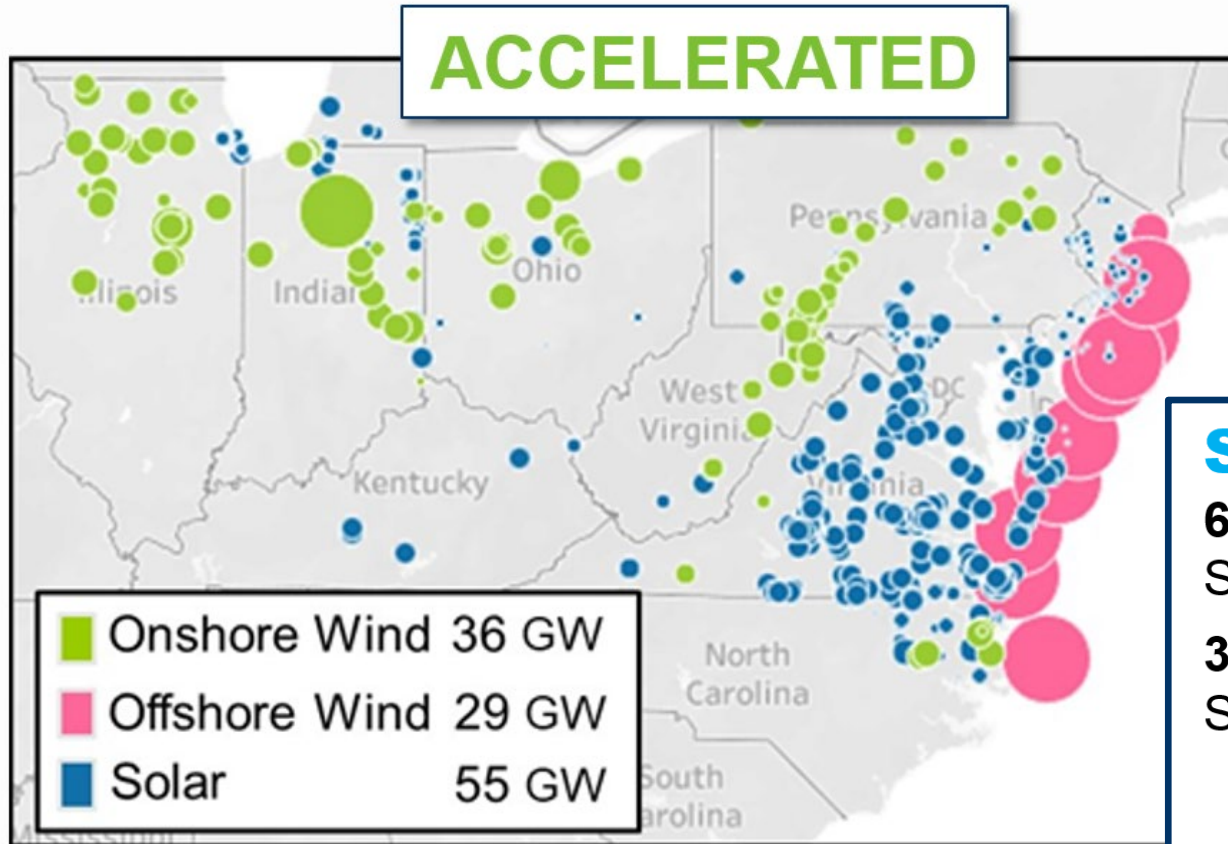
“Living study” to identify gaps and opportunities.



Note: Policies and Market rules “as-is” April 2020.



Renewables, Storage and Electrification (Phase 2)



Storage

6 GW =
Stand-Alone
31 GW =
Solar Hybrid



Solar

21 GW =
Stand-Alone
65 GW =
Solar Hybrid



Electrification

~19 GW = 17M EVs
14 GW = Heating



Solar = 21 GW Stand-Alone + 34 GW Solar Hybrid
 Solar Hybrid = 34 GW Solar + 31 GW Storage



Electrification Shifts the Seasonal Resource Adequacy Risk to Winter



Retail Rate Design & Energy Storage Become Increasingly Important With Electrification



Market Reforms Are Needed To Mitigate Uncertainty and Incentivize Flexibility



The Integration of Renewable Resources Increases the Need for Balancing Resources To Meet Forecasted Ramping Requirements & Increases the Operational Flexibility Needs in Winter



Energy Storage (4-hours) Enhances Operational Flexibility, but Seasonal Capacity and Energy Constraints Require Transmission Expansion, Long-Term Storage, and Other Emerging Technology

Refining Study Assumptions (Phase-3)

Policy Update

State/federal policy update of Base, Policy, and Accelerated scenarios



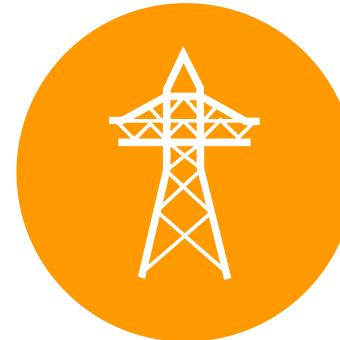
Retirement Sensitivity

Accelerated retirement of thermal resources



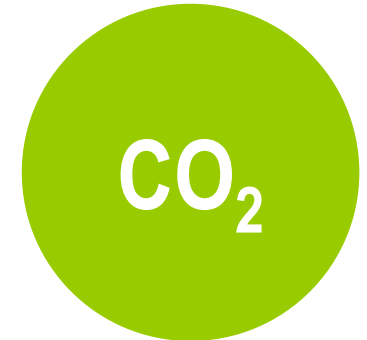
Interchange

Renewables buildout in the Eastern Interconnection; sensitivity on transfer capability



100% Carbon-Free Scenario

Resource Adequacy (ELCC)



**Aging
Infrastructure**
~2/3 are
40+ years old,
1/3 are 50+ years old

**Critical
Infrastructure
Protection –
NERC/FERC CIP-014**



Grid of the Future

Offshore Wind

State Renewable Portfolio
Standards (RPS)

Storage

Distributed Energy Resources

(e.g., rooftop solar, electric vehicles)

Resilience

Beyond conventional
NERC reliability
standards

Electric Vehicles

Microgrids

Power Up with the **PJM Now** App!

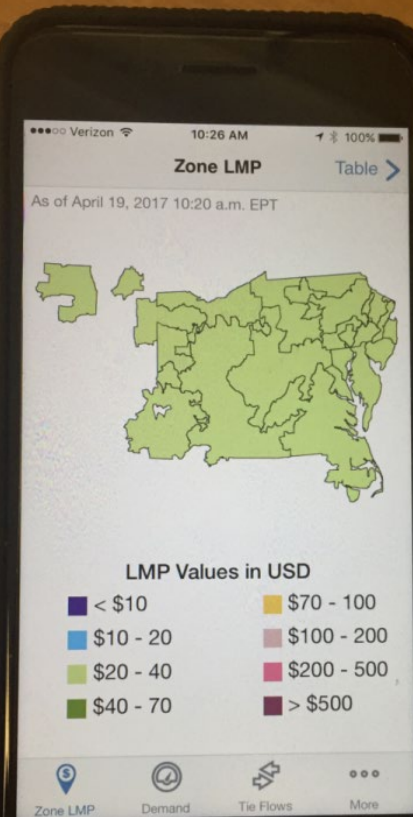
- See real-time demand
- Track power prices
- Get notifications



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The IPA's Role in the Energy Transition

Hannah McCorry

What is Illinois Doing?



- **Climate Equitable Jobs Act (CEJA) has carve-outs for equitable access for communities that have been traditionally left out of the transition**
- **Under CEJA there is increased funding for solar program**
 - **Illinois Solar for All funded by both the Renewable Energy Resources Fund (“RERF”) and utility-funding**
 - **Utility contributions increased from \$11 million/year to \$50 million per year**
 - **Illinois Shines (also known as the Adjustable Block Program)**
 - **Updated REC prices**
 - **3 new project Categories**
 - **Public Schools**
 - **Community driven-community Solar**
 - **Equity Eligible Contractors**

What we are doing continued



- **Under CEJA there is increased funding for our RPS budget**
 - **\$235 million to \$580 million**
- **CEJA has also expanded funding to expand clean energy in this state.**
 - **Expanding the procurement target of RECs from new utility-scale wind and solar projects, as well as brownfield solar development.**
- **Procurement of ZES and CMCs to support at-risk nuclear plants:**
 - **Future Energy Jobs Act (FEJA) in 2017 created the Zero Emission Standard Plan. The plan provided a roadmap for the procurement of Zero Emission Credits from at-risk nuclear plants. The IPA procurement of ZECs provided revenue back to plants.**
 - **CEJA in 2021 created the Carbon Mitigation Credits (CMC) Procurement Program, which preserves existing carbon-free, nuclear generation facilities in Illinois. The IPA procurement of CMCs are critical to keeping Illinois on a path to reach net zero emissions by 2050.**

CEJA's RPS Goals and Targets

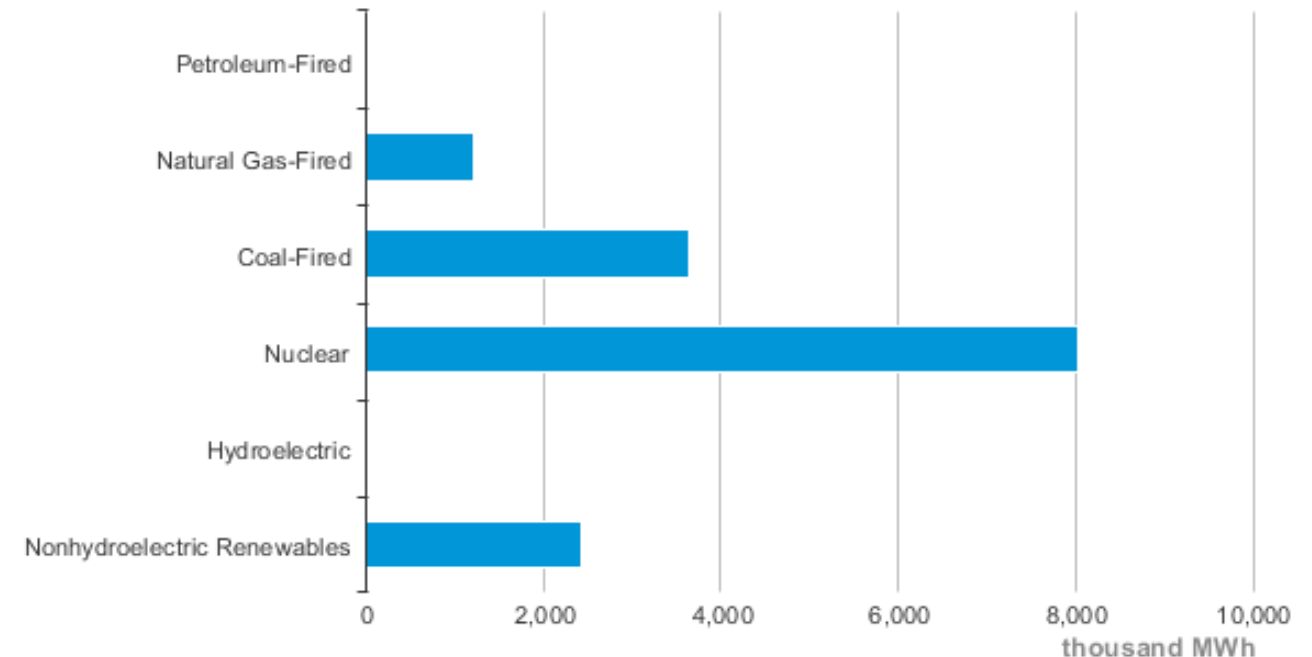
- **40% of energy consumption will come from renewable energy by 2030 then Illinois will push for 50% by 2040**
This calculated from REC procurements, rather than from specific generation in the state
- **Specific to the RPS targets is the distribution of where the RECs come from:**
Illinois has a goal to procure 45 million RECs annually by 2030
 - **new wind and solar development must be built to meet these targets**
 - **45% from wind, 55% from solar**

Illinois Electricity Generation Mix



- Illinois generates more electricity from nuclear energy than any other state,
 - ~53% of the state's electricity net generation.
- Renewable energy, accounted for 11% of in-state electricity generation
- Illinois also has a Carbon Mitigation Credit program as well as a Zero Emissions Standard to help existing carbon-free, nuclear generation facilities stay online
 - Preservation of these resources, allows the needs of Illinois' customers to be met by nuclear generation

Illinois Net Electricity Generation by Source, Mar. 2022



Source: Energy Information Administration, Electric Power Monthly

Other State Initiatives from CEJA



- The ICC has released its first draft of the Renewable Energy Access Plan (REAP) which outlines the path to meeting Illinois' policy requirements for clean electricity system.
 - This report outlines the pathway towards Illinois's clean energy goals and the steps necessary to meet the target.
- EV rebates: As of July 1, 2022, Illinois residents that purchase an EV will be able to apply for a one-time rebate
 - July 1, 2022, a \$4,000 rebate
 - July 1, 2026, a \$2,000 rebate
 - July 1, 2028, a \$1,500 rebate
 - July 1, 2022, a \$1,500 rebate
- Charging Incentive Program
 - Those who install and maintain Level 2 or Level 3 charging stations can receive up to 80% of the cost of the installation of charging stations
 - Additional awards may incentivize charging infrastructure in eligible communities



ComEd's Decarbonization Efforts

Scott Vogt



Energy+Environmental Economics

ComEd Deep Decarbonization Study

December Discussion



Study Motivation

- + What are the impacts of Climate and Equitable Jobs Act (CEJA), the Inflation Reduction Act (IRA), and carbon neutral scenarios on ComEd's customers?
- + What else beyond CEJA and the IRA needs to be done to achieve Governor Pritzker's US Climate Alliance (USCA) pledge of net zero by 2050?
- + What is ComEd's role in Illinois toward achieving carbon neutrality by 2050?

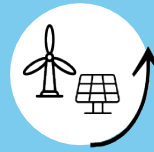
2020

2030

2040

2050

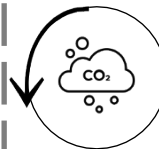
Climate & Equitable Jobs Act



Inflation Reduction Act

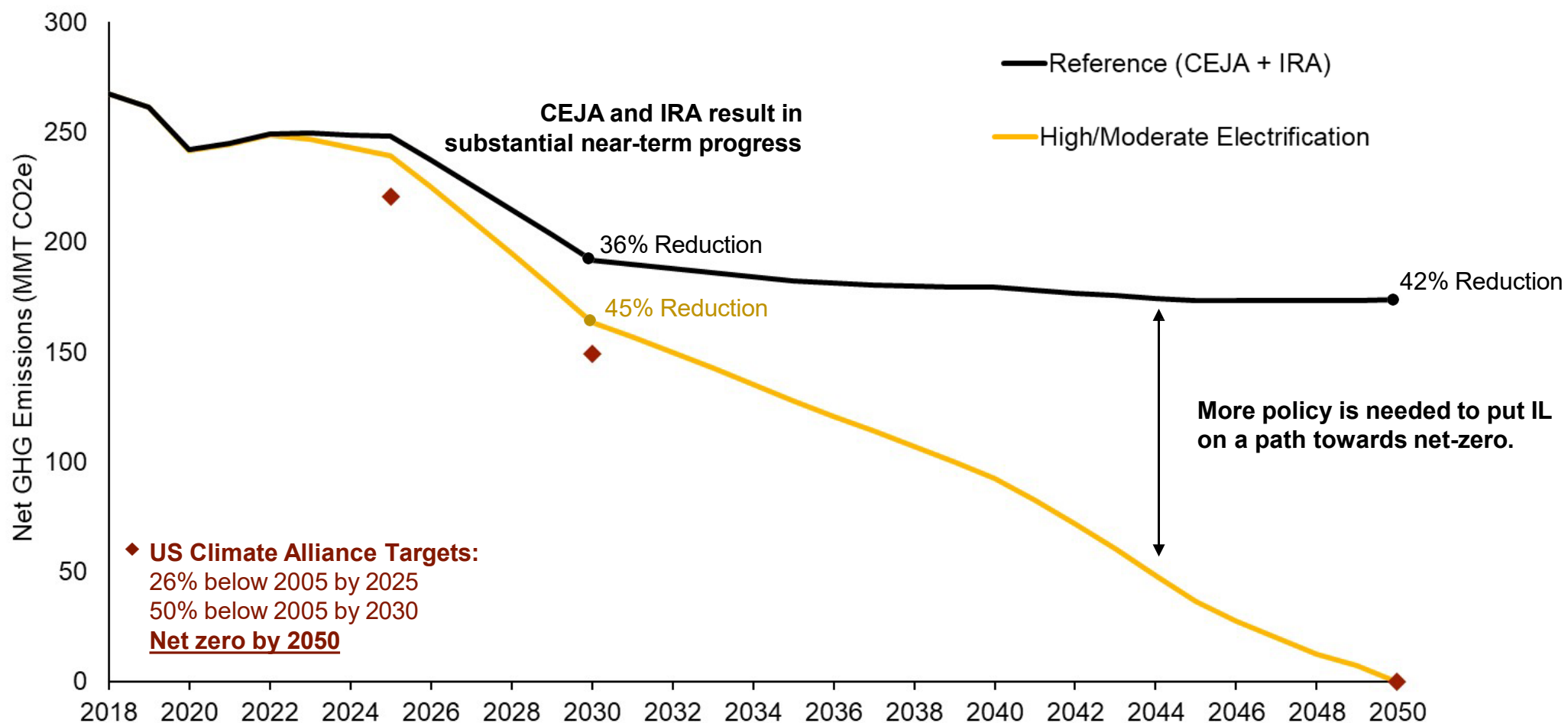


US Climate Alliance Target



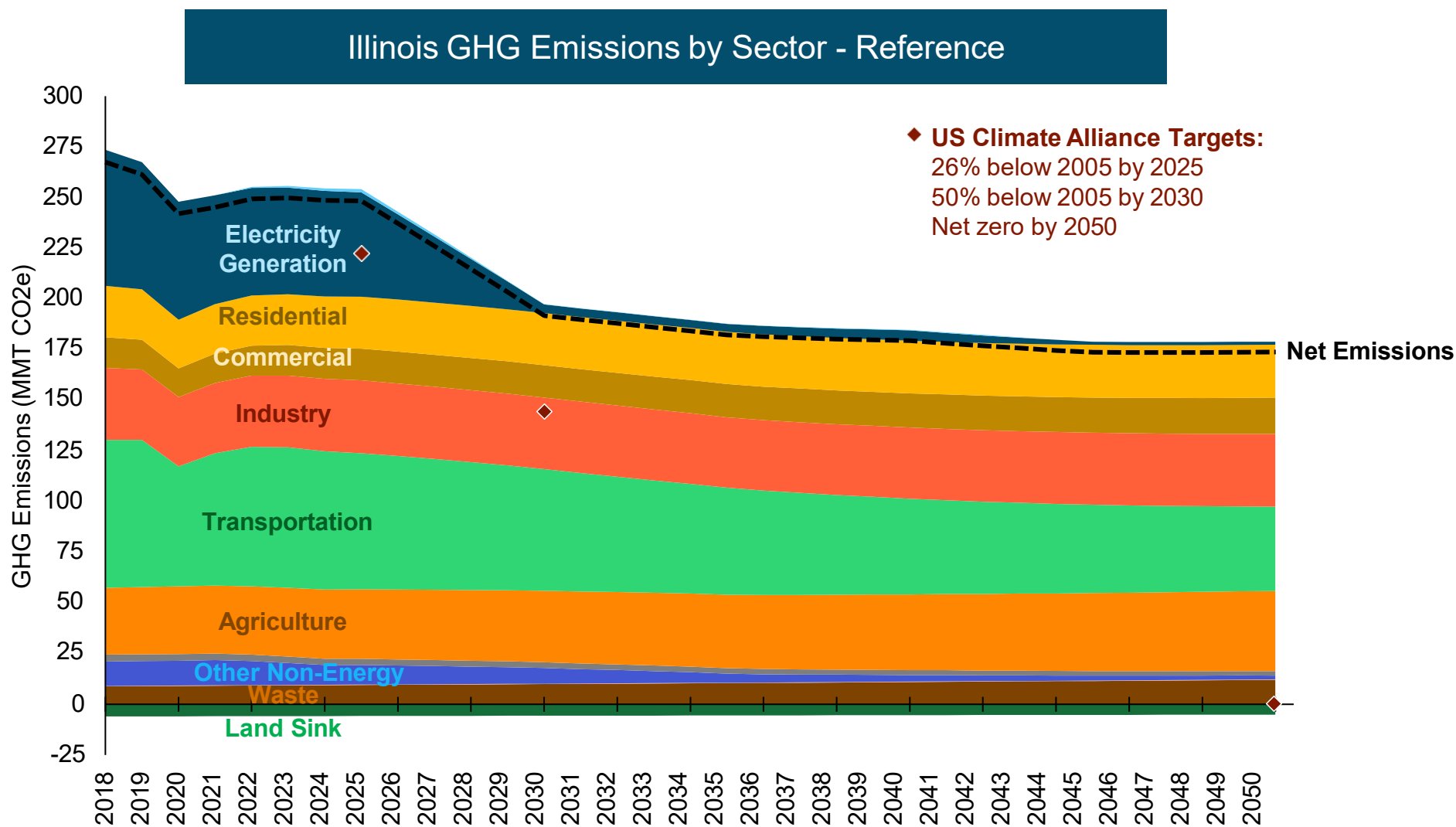


CEJA and the IRA will reduce GHG emissions in Illinois, but more action is needed to achieve net-zero





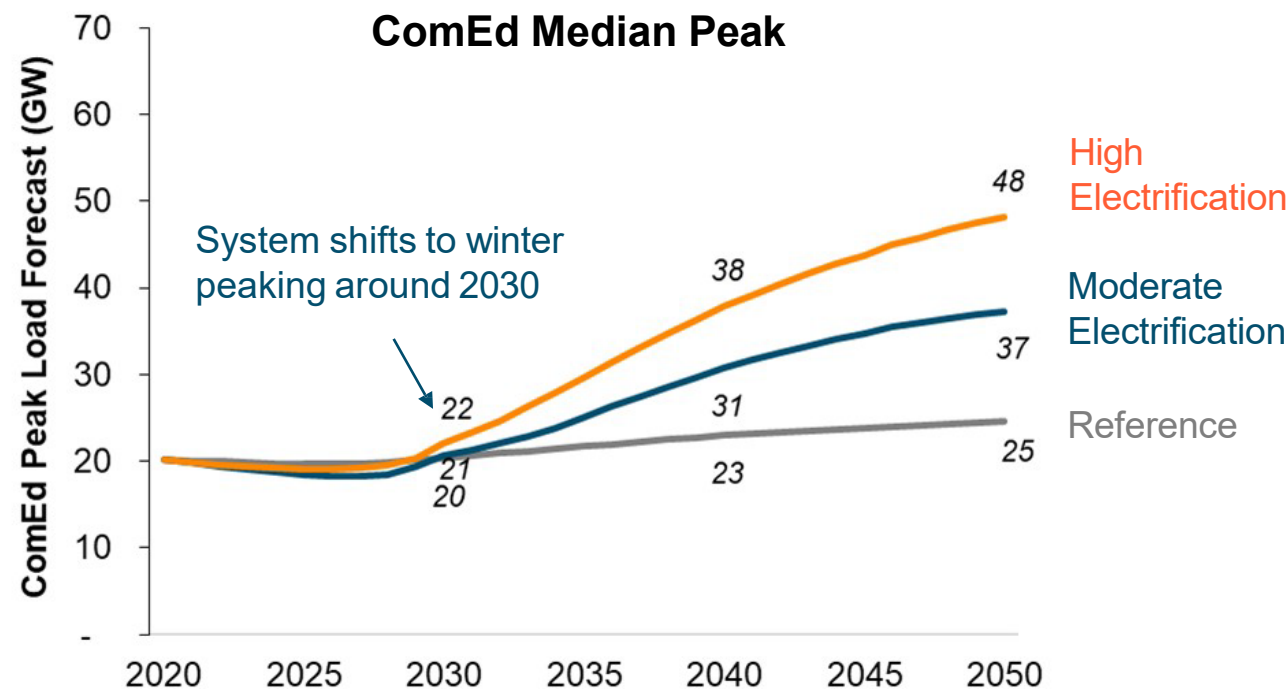
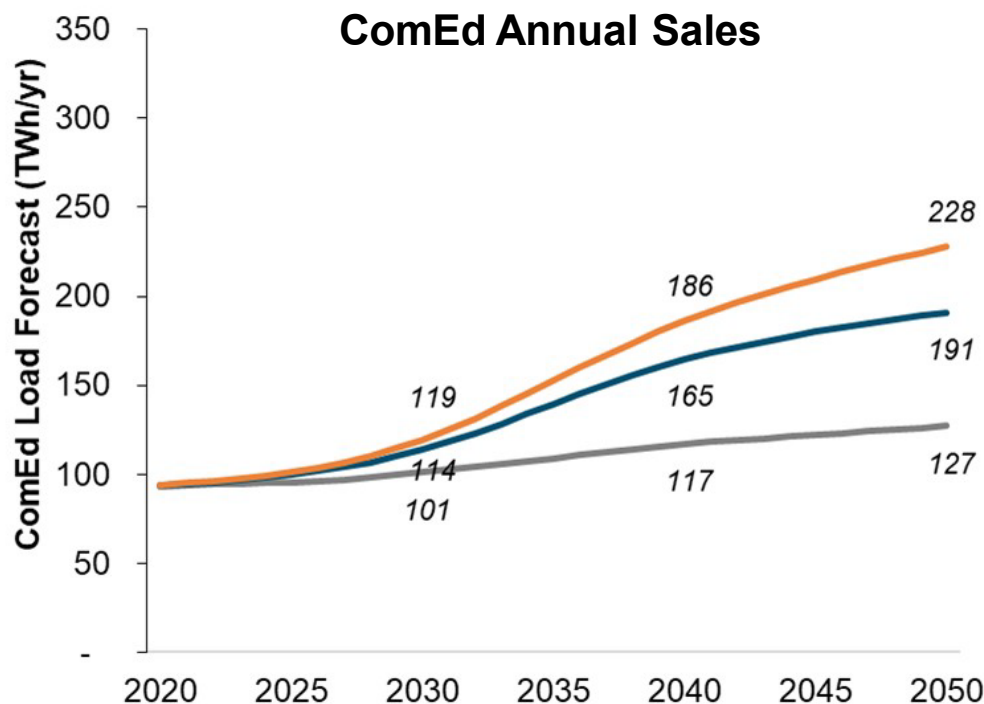
CEJA Reduces Electric Sector Emissions and IRA Reduces some Transportation Emissions





Electrification could more than double the size of the ComEd electric system

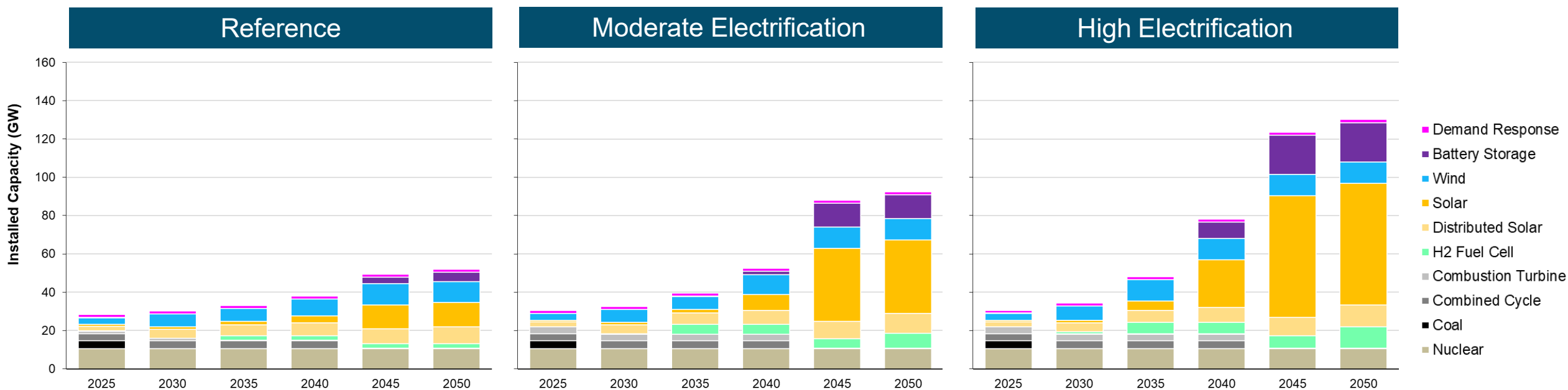
- + Reference load and peaks experience a slow but steady growth, reflecting modest levels of electrification that is tempered by continued progress on energy efficiency.
- + The High Electrification and Moderate Electrification scenarios have consistent and similar growth in load due to increasing electrification in both scenarios
- + The High Electrification scenario experience a larger increase in peak load due higher penetrations of all-electric space-heating





Electrification and CEJA drive large builds of renewables and storage resources, particularly after 2040

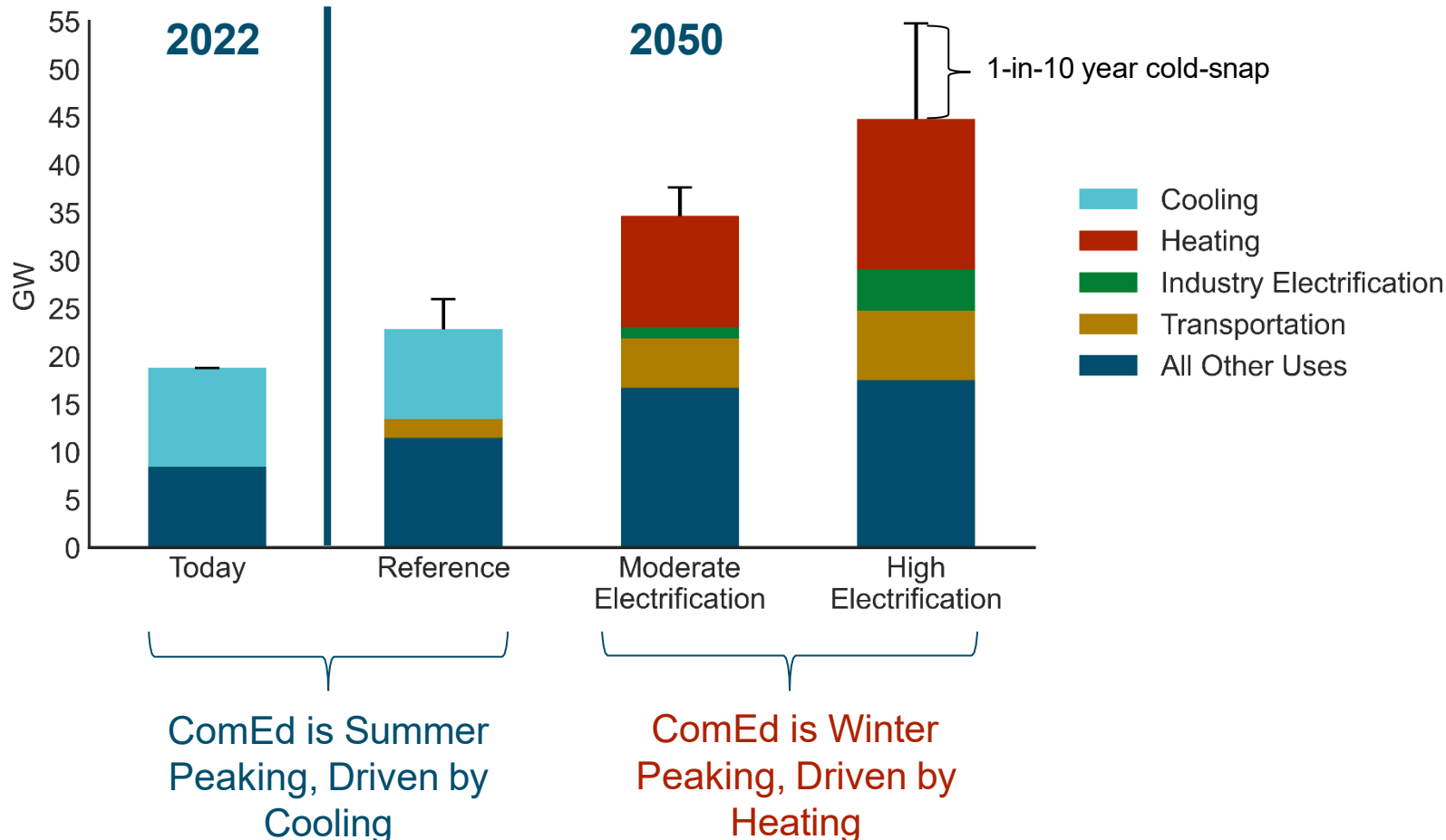
- + Wind resource potential is maxed out in early years, constrained by land use
- + All nuclear capacity is relicensed by 2050, providing both clean firm capacity and energy
- + System needs additional clean firm capacity starting 2035, largely met via hydrogen fuel cells





Heating drive ComEd's peak demands by 2050, particularly during a cold-snap

ComEd Peak Load by Scenario: Median and Cold-Snap

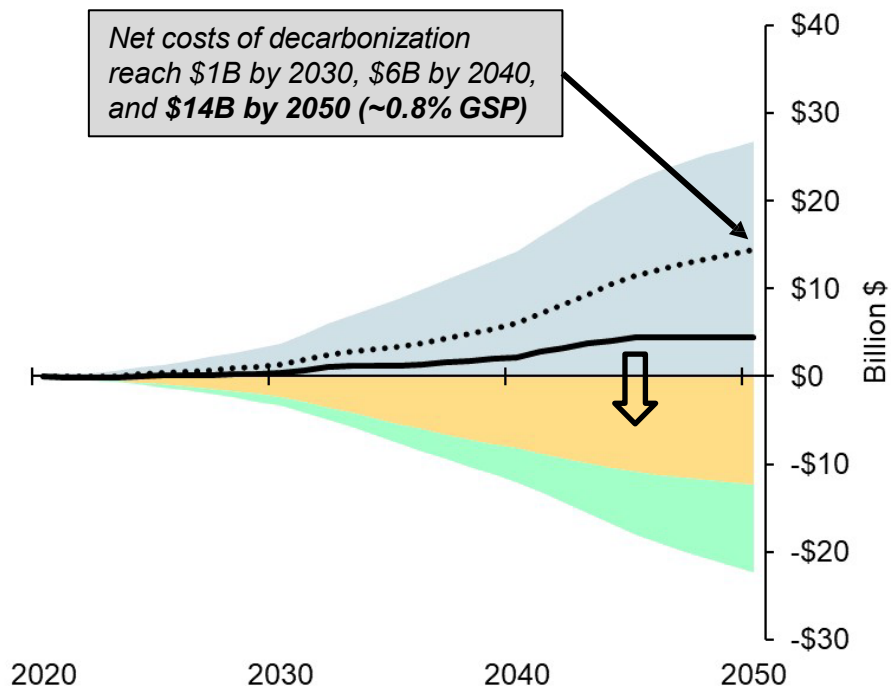


- + Incremental electrification leads to peak load growth, regardless of the scenario.
- + The largest source of peak demand growth is from buildings, especially space-heating.
- + The High Electrification scenario exhibits more sensitivity to extreme weather because of high levels of all-electric buildings. The Moderate scenario leverages hybrid electrification to reduce those impacts.
- + While not shown here, managed EV charging avoids about 5-6 GW peak contribution and shifts system peaks to the morning, coincident with space heating peaks

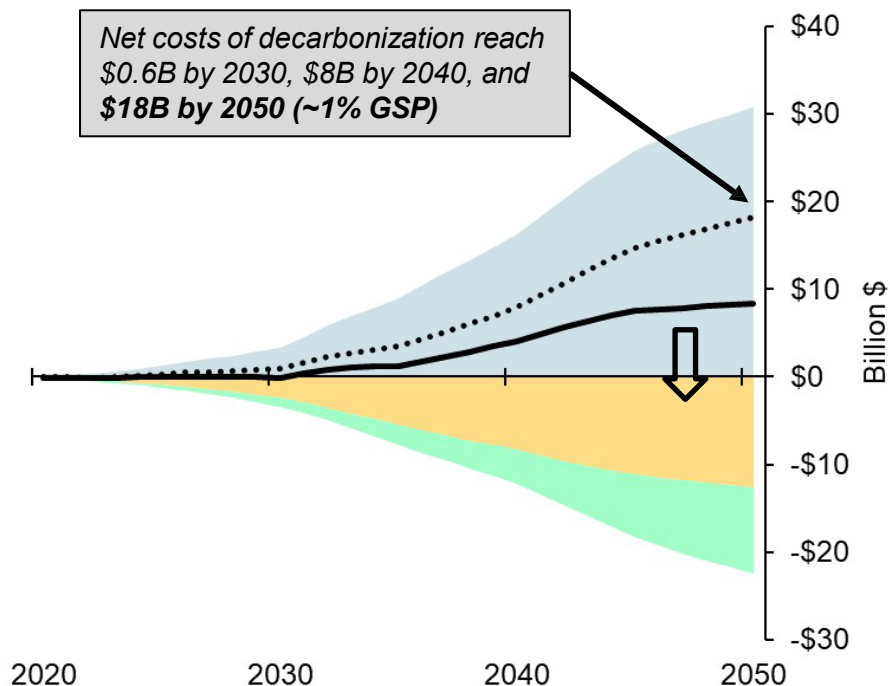


Carbon Neutrality Across ComEd Territory Close to Net Neutral After Accounting for Societal and Air Benefits

Moderate Electrification



High Electrification



- + In 2030, the High Electrification case is less expensive given the downward pressure on rates
- + On a per-capita basis, the net costs of decarbonization in 2050 range from \$125-\$160/person
- + When social benefits of avoided GHG emissions are included, net costs of decarbonization are lower
- + Air quality benefits associated with reduced combustion almost certainly make both cases societally beneficial



Key Takeaways

+ Decarbonization Policy

- + CEJA and the IRA support high levels of electric and transportation sector decarbonization.
 - Renewable resource procurement needs to accelerate to accommodate electrification loads
 - Storage resources, including both batteries and hydrogen, are needed to maintain reliability.
- + New policies are needed to address buildings, heavy-duty transportation, industry and agriculture.

+ ComEd Grid Investment

- + Building electrification shifts ComEd to winter peaking by 2030 and could more than double system capacity by 2050.

+ Affordability and Cost

- + In the near-term (2030), decarbonization could reduce customer energy costs if IRA funding is leveraged.
- + Longer-term (2050), decarbonization puts upward pressure on customer costs due to electric system expansion, building retrofits and fixed cost recovery challenges for gas utilities.
- + Decarbonization is likely to produce net societal benefits when both avoided GHGs and air pollution are accounted for.



Q&A



Thank You Remarks: Acting Director Brian Granahan

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