

Welcome to ESIG's Fall Technical Workshop!



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Executive Director, ESIG

Providence, Rhode Island
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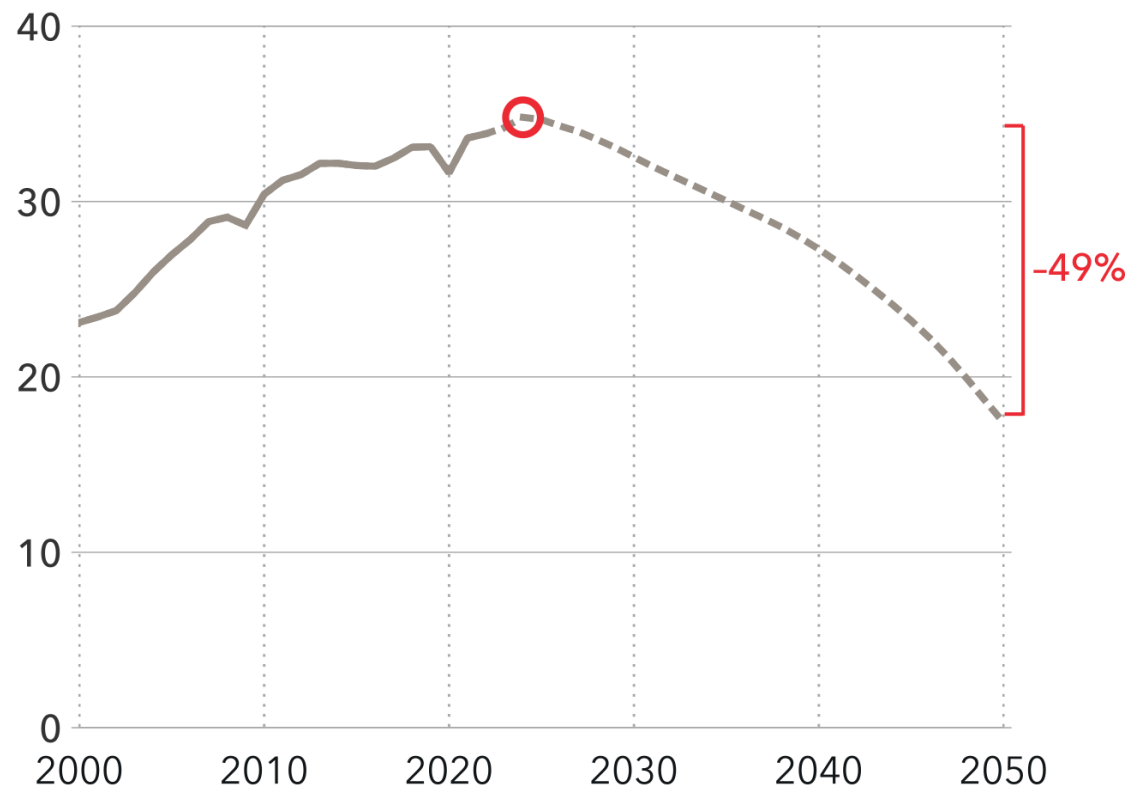
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Emissions may peak in 2024

World energy-related CO₂ emissions will peak in 2024

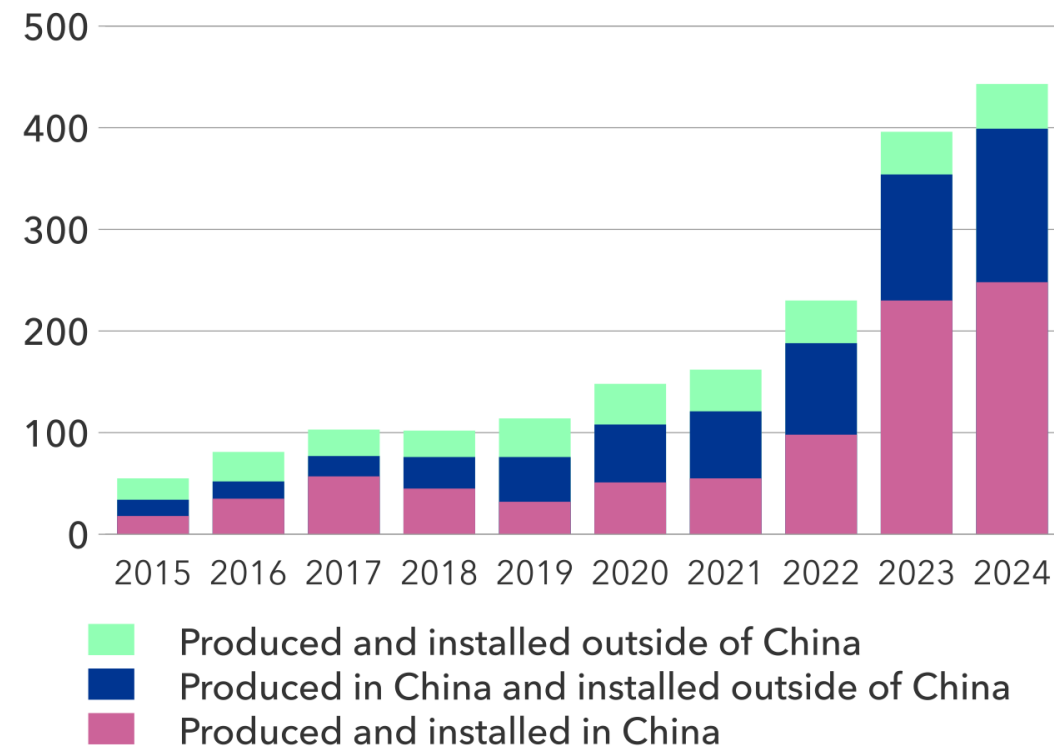
Units: GtCO₂/yr



©DNV 2024

China dominates global solar PV installations

Units: GW annually installed



Note: Capacities in AC
Historical data source: GlobalData (2024), IRENA (2024), IEA (2024), Ember (2024)
©DNV 2024

<https://www.dnv.com/energy-transition-outlook/download/>

We hit new highs in 2024



ERCOT wind plus solar penetration record of 75% on 3/29/24. About 1/3 of their generation is from renewables.

CAISO hit a renewables penetration record of 117% in April. Nearly half of CAISO's generation is from renewables (not incl rooftop PV)

<https://www.caiso.com/about/news/new-renewables-records-what-they-mean-for-the-grid-and-its-carbon-free-future>;
<https://www.ercot.com/files/docs/2024/04/30/ERCOT-Monthly-April-2024.pdf>;
<https://aemo.com.au/Energy-systems/Electricity/National-Electricity-Market-NEM/Data-NEM/Data-Dashboard-NEM>

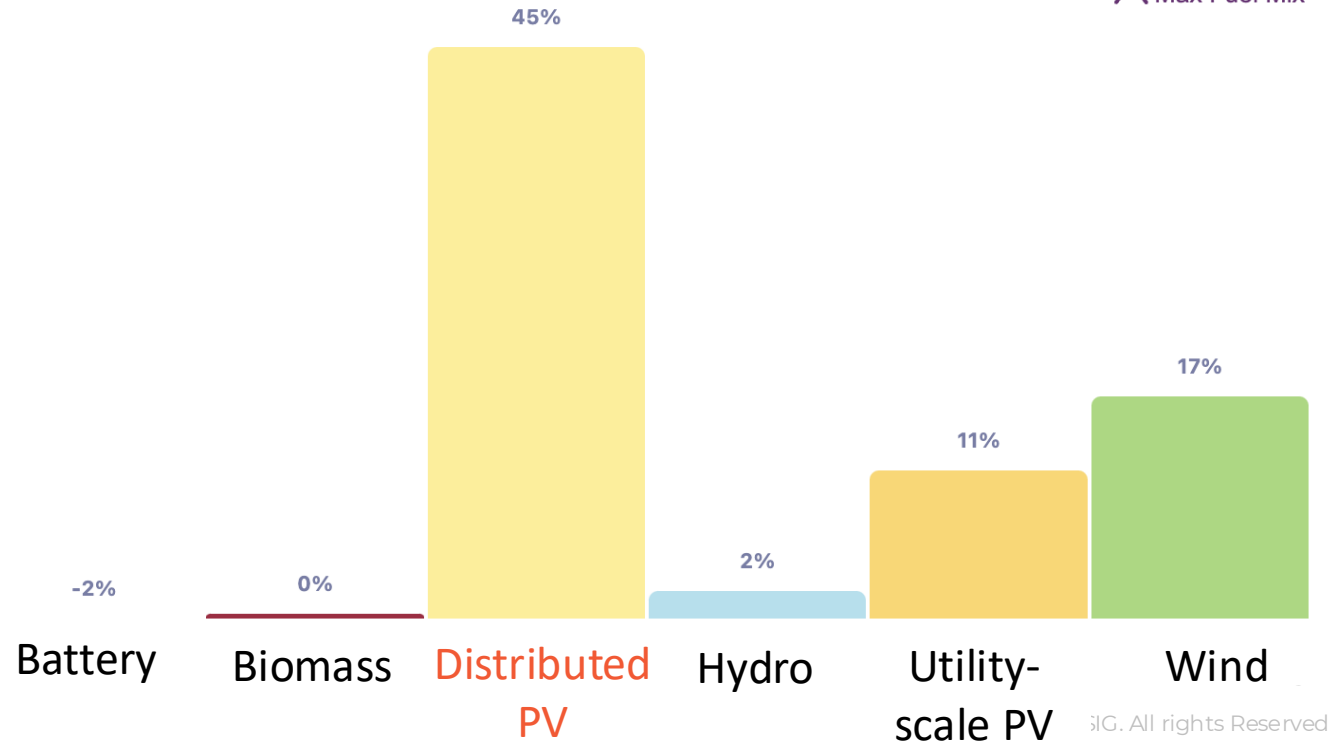
Australia's NEM

MAX

74.1%
19,791 MW

Mon, 7 October, 2024, 12:30

^ Max Fuel Mix



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We also had our share of challenges



Kit Noble, [Nantucket Magazine](#), Aug 30, 2024

107 meter blade broke off a 13 MW offshore wind turbine that was being tested and commissioned near Nantucket.

There's a number of offshore wind plant contracts that have been canceled due to supply chains, inflation, and high cost of capital.

GE laid off 900 people in offshore wind. Siemens anticipates \$2.2B losses this year.

The Inflation Reduction Act has been boosting industry substantially.

Falling inflation and interest rates will also help.

Speed and scale is still an issue

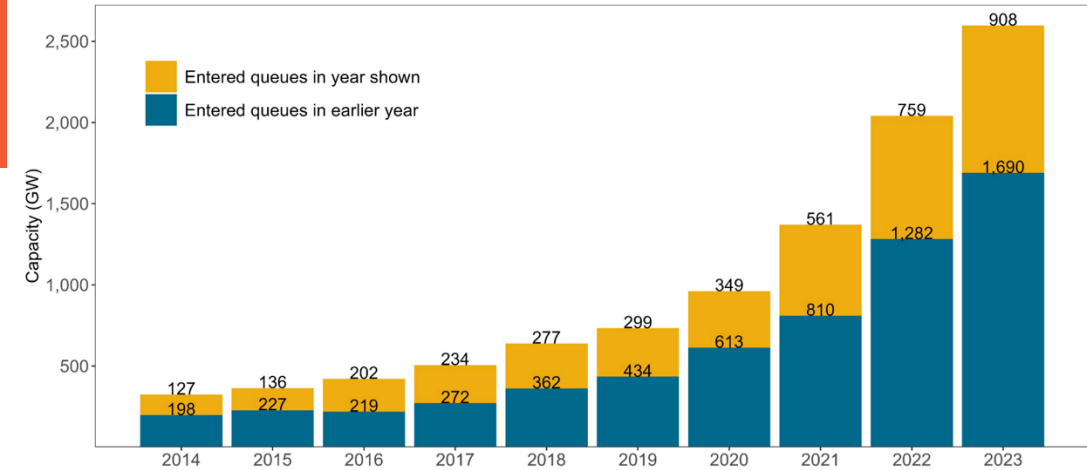
Our total interconnection queue is now over twice the size of our installed capacity.

Yet once resources get through these long queues, there have been delays in construction due to supply chains, etc.

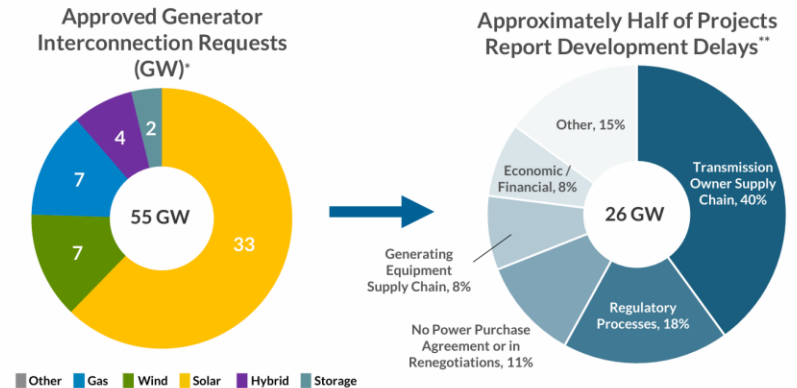
DOE's National Transmission Planning Study was just published, quantifying transmission benefits and identifying high opportunity paths.

FERC Order 1920 passed in May, requiring planners to look out 20 years and consider factors like utility resource plans, state energy goals, queues, and corporate commitments.

**Total (cumulative) active capacity in queues is now nearly 2,600 GW (2.6 TW);
New (annual) capacity entering the queues has increased every year since 2014**



While we are approving more new resources, approximately half continue to experience delays in getting online



50 GW of resources approved through MISO's interconnection processes are in or awaiting construction with approximately 50% already signaling a delay

*Queue data as of September 4, 2024

** Reasons for delay based on responses from a subset of delayed projects

6 | Board of Directors, September 19, 2024



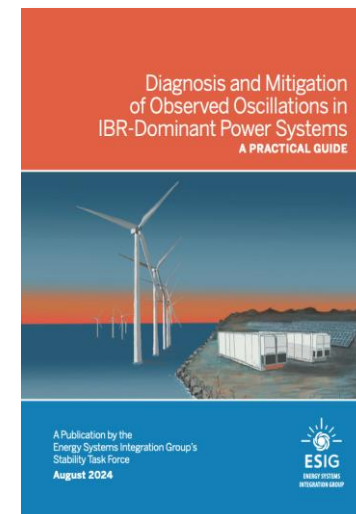
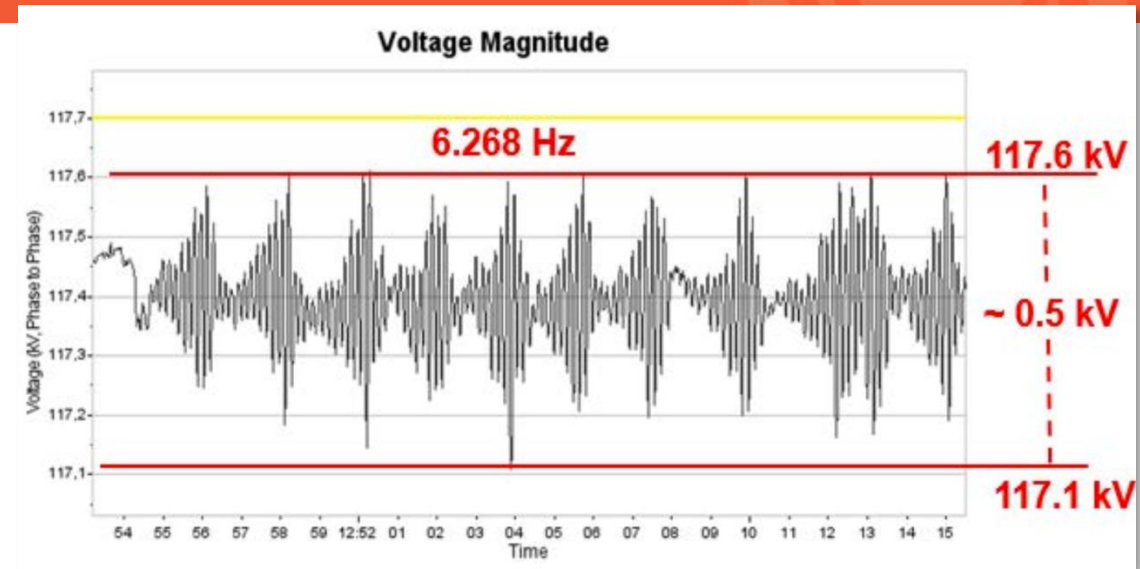
Oscillations are a growing concern

We've always dealt with oscillations but today we have added new types of oscillations with different root causes.

Oscillations can be harmless. They can also trip and damage equipment, and possibly lead to blackouts.

Oscillations Project Team held a workshop in March and just published this guide for practitioners to diagnose and mitigate oscillations.

Improved practice can solve some issues, but additional research is very much needed.



R. Korhonen, et al, *TSO Experience with Converter Driven Stability Management in Outage Planning*, 23rd Wind & Solar Integration Workshop, Finland, Oct. 2024.



Working Groups and Task Forces Structure



System Planning WG Josh Novacheck

Resilience Benefit Quantification for Transmission Planning TF

Warren Lasher

Integrated Planning TF (joint with DER&RWG)

Matt Schuerger

Planning for 100% Clean Energy TF

Elaine Hart

Long-term Load Forecasting TF (joint w/ DER)

Julieta Giraldez

Integrating Across Siloes of Transmission Planning

Tim Kopp

System Ops & Market Design WG Aidan Tuohy/Erik Ela

Resource Adequacy TF

Derek Stenclik

Markets for 100% Clean Electricity TF

Robin Hytowitz

Flexibility TF

Aidan Tuohy

Large Load TF (Across all WG)

Sam Morris

DER WG Obadiah Bartholomy

Demand Response Project Team

Derek Stenclik

Buildings TF

Sean Morash

EV Load Forecasting Guide

Matt Schuerger

Reliability WG Jason MacDowell

High Share of IBR TF

Julia Matevosyan

GFM Testing Project Team

Shahil Shah

Oscillations Project Team

Nick Miller

Services Project Team

Matt/Julia/Deepak

Benefits of GFM BESS Project Team

Ryan Quint

i2X Forum for Implementation of Reliability Standards for Transmission

Julia Matevosyan

Research & Education WG Tom Acker

New Large Loads Task Force!



- All 25 utilities responding to an EPRI survey reported data center requests of > 50% of peak demand.
- Dominion connected 15 data centers totaling 933 MW in VA in 2023. They have more than 4 GW of data centers in VA now. These represent 1/4 of their electricity sales.
- PJM needs to build > \$5B in transmission for data centers. Today these costs are spread across all PJM customers.
- Co-location: Amazon bought a 960 MW data center campus at the Susquehanna nuclear plant. Because it's not network load, it doesn't pay transmission charges.
- FERC's technical conference on 11/1.
- Microsoft signed a \$16B PPA to restart a 835 MW unit of Three Mile Island.
- Google and Amazon working with small modular nuclear reactors.

Wood Mackenzie

<https://www.woodmac.com/horizons/gridlock-demand-dilemma-facing-us-power-industry/>

New Large Loads Task Force will have a large number of subgroups



This will include data centers, hydrogen production, industrial electrification, EV charging

Data collection: Characterization of large loads including grid impacts

1. Load forecasting – when, where, how big, how flexible, how certain
2. Interconnection process – managing data, processes, speculative requests
3. Interconnection performance requirements – ride through requirements, oscillations
4. Modeling requirements for interconnection – models for planning studies
5. Transmission planning – considering both generation and load
6. Market participation models – wholesale market price signals; flexibility services
7. Resource adequacy – flexible interconnections, price-sensitive loads

Will coordinate with LBNL effort on regulatory and contractual aspects

Overview of “ESIG week”



- Pre-workshop: Breakthrough Energy sponsored Integrated Planning Workshop
- **Plenary:** The Promise and Challenges of Offshore Wind

Tuesday

- Morning: FERC Order 1920 – Methods and Compliance for Regional Transmission Planning
- 3A: Modeling Protection and Application of Grid-Forming Technology
- 3B: Carbon Tracking and Emissions Transparency
- 4A: Planning and Interconnection of Large Loads
- 4B: Distribution System Resilience and the Role of DERs
- 5A: Reliability with High Levels of Inverter-based Resources
- 5B: 100% Clean Energy or 100% Clean Electricity: The Importance of Energy Sector Coupling

Student and young professionals reception at 5:30pm

Main Reception at 6:30pm

Overview of “ESIG week” (2)



Wednesday

- Morning: Cutting Edge Practices in Integrated Planning
- 7A: Advances in Resource Adequacy
- 7B: Finding Flexibility in Demand
- 8A: EMT Practices and Applications
- 8B: Interregional Transmission
- **Closing Plenary:** Gas-Electric Coordination

Thursday

- DOE i2x Interconnection Standards Workshop
- Electricity Markets under Deep Decarbonization Workshop
- Research and Education Working Group; System Planning Working Group; DER Working Group

Reception at Level 99 at 6pm

Friday - Offshore Wind Tour



See Lacey
or Ryan to
sign up!

