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Energy Industry Update

Just Can’t Get Enough

Webinar | June 15, 2023

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Cristin Lyons

Partner and Energy Practice Leader

Cristin Lyons is a partner with ScottMadden and leads the firm’s energy practice. Since joining the firm in 1999, she has consulted with myriad clients on issues ranging from process and organizational redesign to merger integration to project and program management. Cristin led the firm’s grid transformation practice for three years before becoming the energy practice lead. She is a frequent speaker and panelist at conferences across the country. Cristin earned a B.A. in political science and Spanish from Gettysburg College and an M.B.A. from the Cox School of Business at Southern Methodist University. She is also a member of Phi Beta Kappa.

Energy Is Who We Are

ScottMadden is a management consulting firm with 40 years of deep, hands-on experience. We deliver a broad array of consulting services—from strategic planning through implementation—across the energy utility ecosystem.

Our energy practice covers the following areas:

- GENERATION
- RATES & REGULATION
- TRANSMISSION & DISTRIBUTION
- NATURAL GAS
- GRID EDGE
- ENERGY CORPORATE SERVICES

Australia’s Energy Transition

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Kevin Hernandez

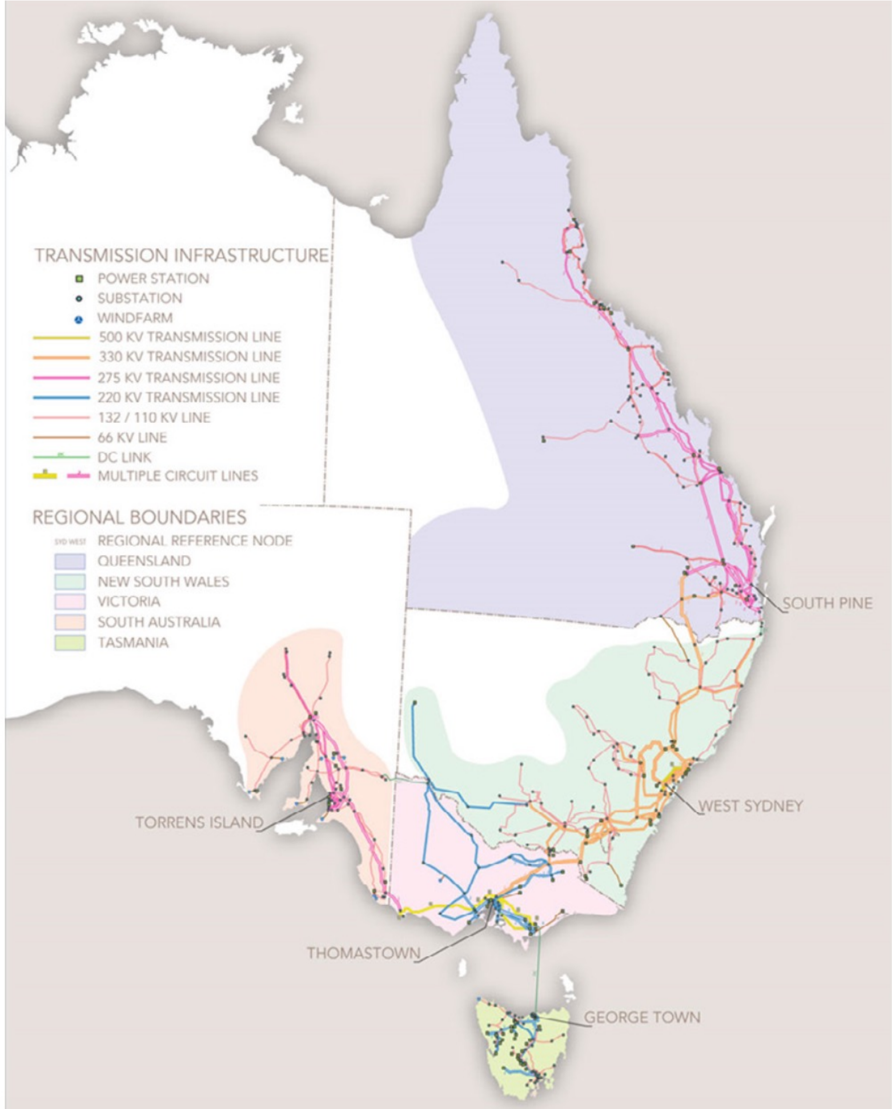
Partner

Kevin Hernandez is a partner with ScottMadden where he specializes in grid transformation, energy storage and transportation electrification. Since joining the firm in 2012, he has consulted with a variety of utility and industry clients on issues ranging from fleet electrification to EV infrastructure planning. Kevin earned a B.A. from the University of Tennessee, Knoxville, an M.A. from the U.S. Navy War College in Newport, Rhode Island, and an M.B.A. from the Fuqua School of Business at Duke University. He is also an eight-year veteran of the United States Navy.

Australia's National Electricity Market (NEM)

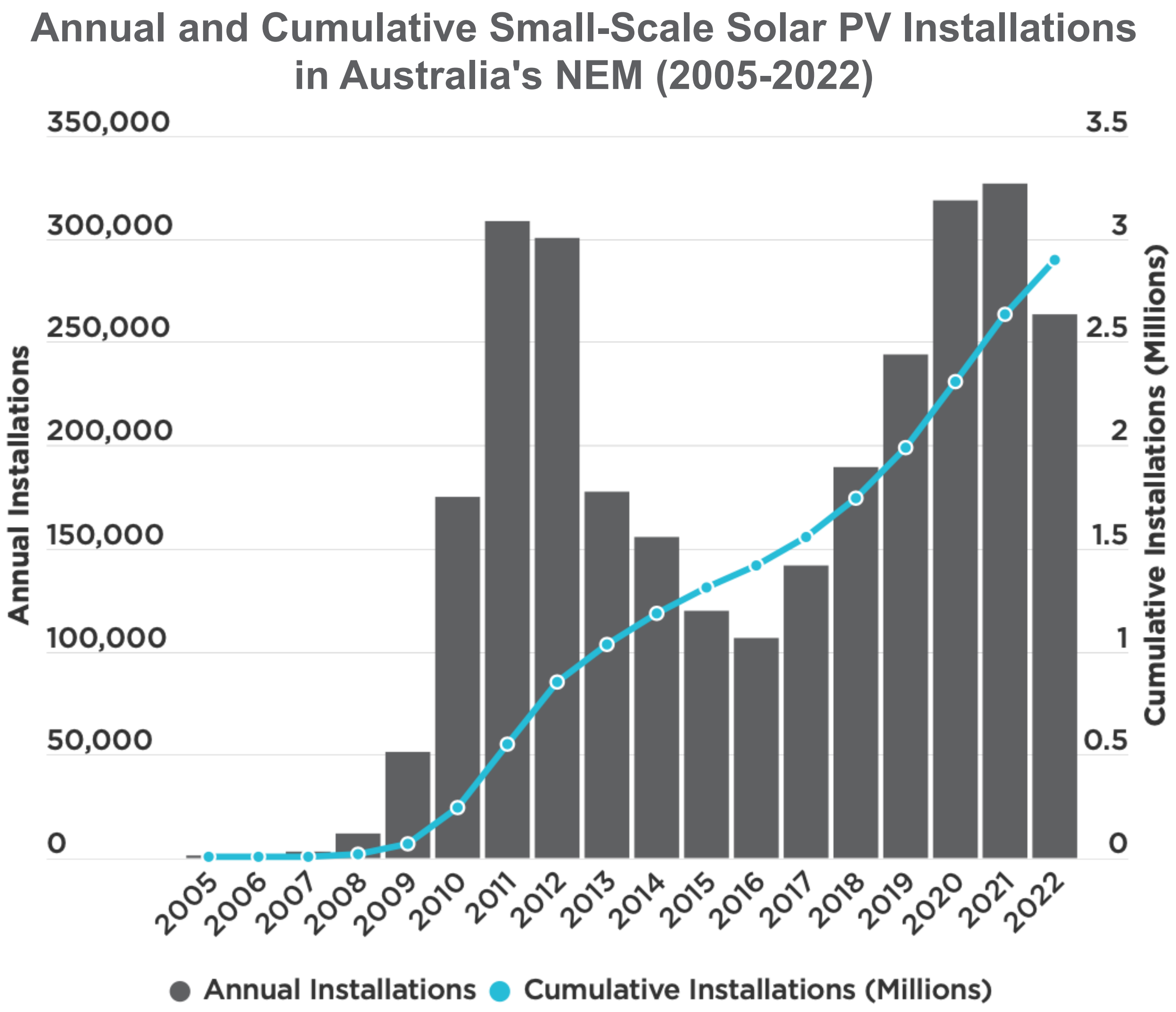
One of the world's longest interconnected power systems.

- **Stretches roughly 3,000 miles**
- **Serves 10.7 million customers**
- **Consists of 25,000 miles of transmission lines and cables**
- **Served by 325 generating units**
- **70.5 GW generation portfolio**



Source: Australian Energy Market Operator

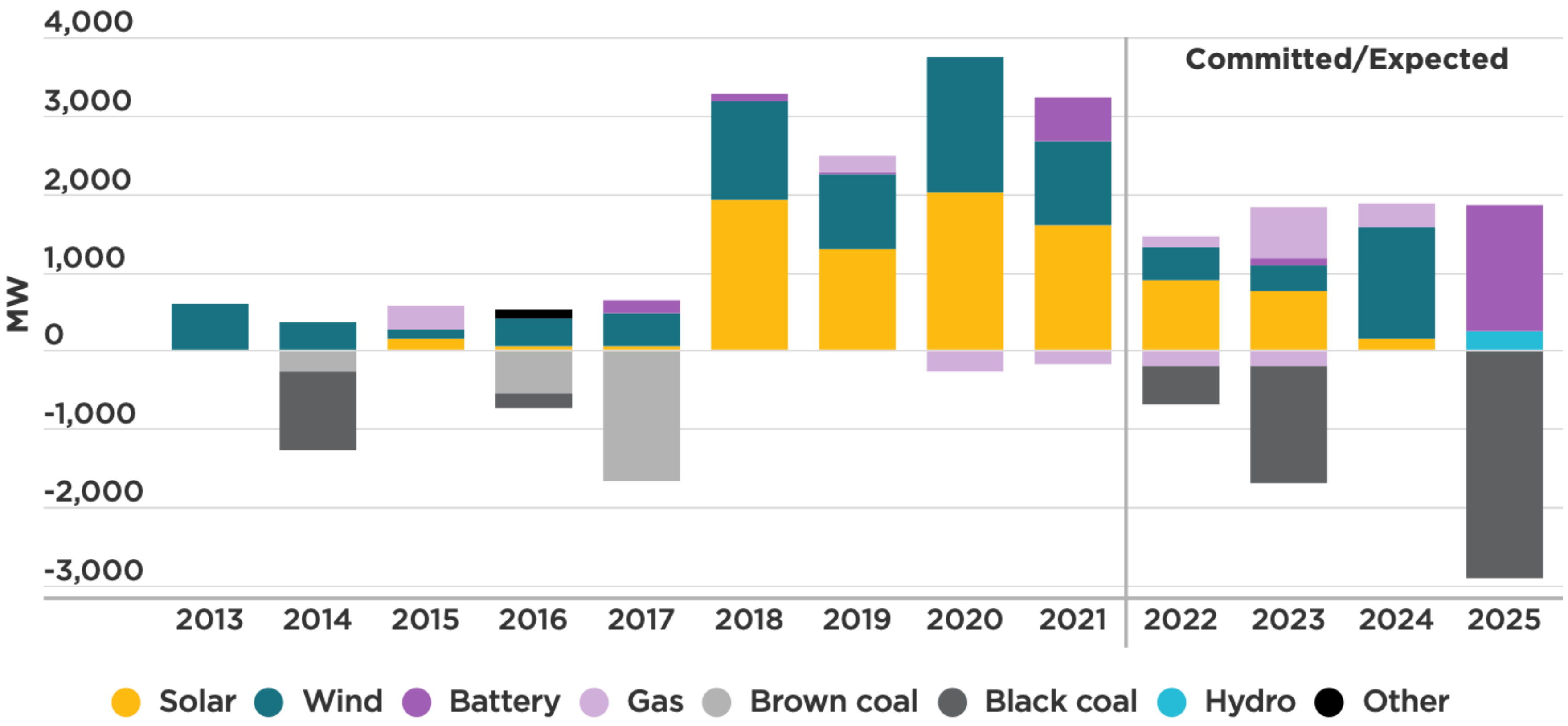
Small-Scale Solar Additions Driven by Aggressive Policy Mandates



Source: Australian Energy Regulator

…While Baseload Retirements Accelerate

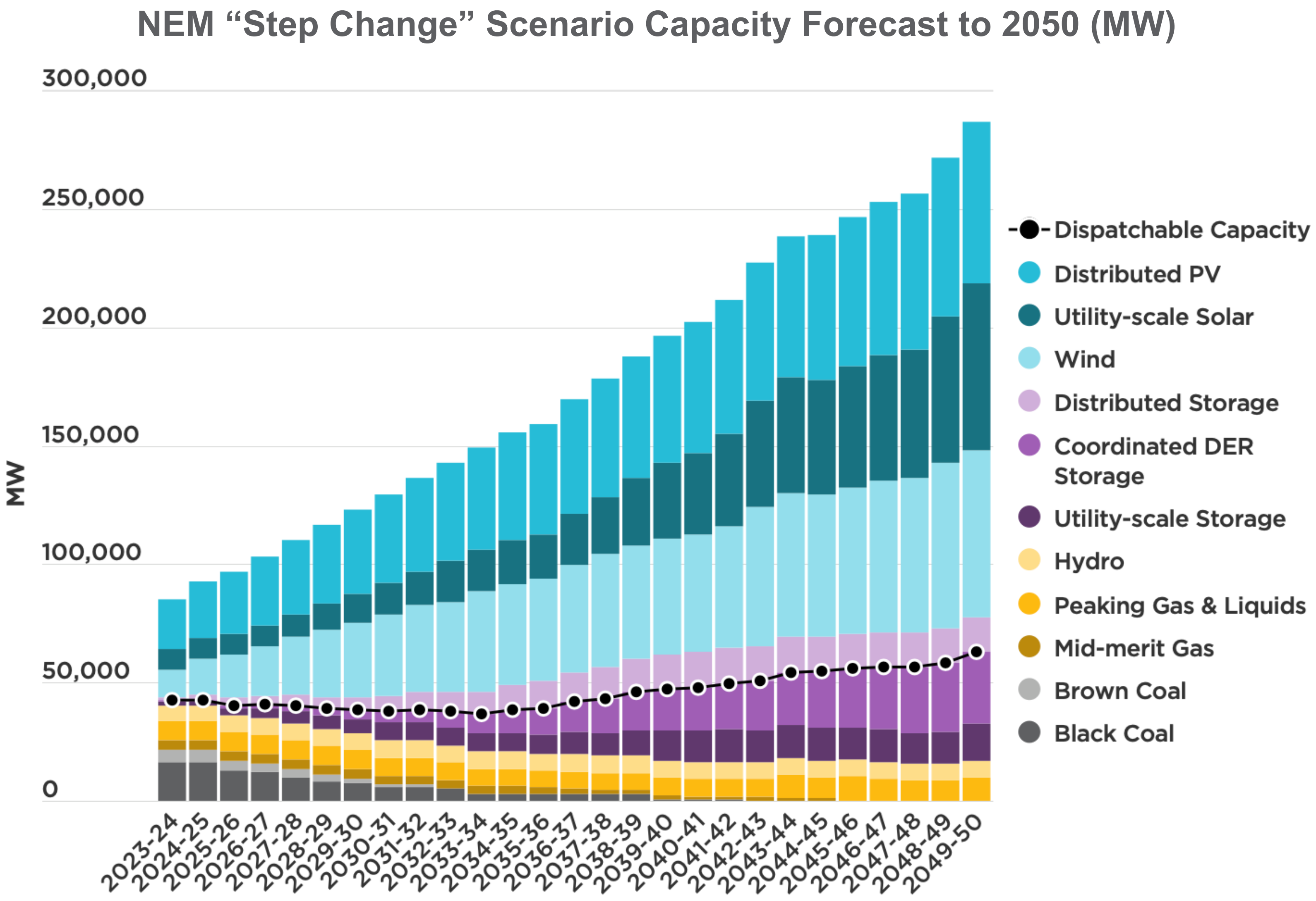
New Generation Additions and Retirements by Fuel Type (2013-2025 Projected) (MW)



Note: Positive values are additions. Negative values are actual (before 2022) or expected (2022-2025) retirements.

Source: Australian Energy Regulator

A "Once-in-a-Century" Transformation



Source: Australian Energy Market Operator

Reliability Gaps Looming

NB: Map excludes Tasmania

1. South Australia

USE above reliability standard after 2029-30

2. Queensland

USE above reliability standard by 2029-30

3. New South Wales

Increased reliability risk in 2023-24 due to delay of the Kurri Kurri generator

USE above reliability standard by 2027-28

4. Victoria

USE above reliability standard after 2027-28

- Expected unserved energy (USE) is within the Interim Reliability Measure (0.0006% USE) for all regions until 2024-25.
- Expected USE to exceed the long-term reliability standard (0.002% USE) in each mainland region forecast horizon of 2027-28 to 2031-32
- All mainland regions forecast to require additional capacity beyond present commitments by 2031-32.

Source: AEMO, Update to 2022 Electricity Statement of Opportunities (Feb. 2023)

Key Takeaways

Australia's Energy Transition Provides Many Useful Insights for U.S. Utilities

Role of Natural Gas in the Transition

- With a strong reliance on coal, Australia has not built out natural gas generation capacity in the same manner as the United States.
- It remains unclear how much natural gas capacity and related gas infrastructure will be needed to ensure system reliability.

Public Policy Drives Operational Risk

- Aggressive policy mandates and incentives accelerate the adoption of variable resources.
- The proliferation of variable resources concurrent with the retirement of baseload generation forces grid operators to develop new approaches to managing the grid in real time.

Transition Pace Drives Cost

- Aggressive investment in lower or zero-carbon technologies can produce rapid reductions in greenhouse gas emissions but comes with a steep cost.
- Australia continues to monitor the investment needed to address emission reductions and ensure reliability.

Transmission will be Critical

- Similar to the United States, Australia must build new transmission to connect renewable resources at the scale required to meet emission-reduction goals.
- Local opposition is a growing challenge in both Australia and the United States.

Resource Adequacy

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Preston Fowler

Director

Preston Fowler is a director with ScottMadden focused on the energy sector. He joined ScottMadden in 2006 after obtaining an M.B.A. in finance, organization, and management from the Goizueta Business School of Emory University. Since joining ScottMadden, he has primarily worked on utility projects focusing on process improvement, business planning, strategy development, benchmarking, and project management. While pursuing his degree, Preston interned at EarthLink, serving as an internal consultant and creating a new process map for improved project management for the customer support organization. Prior to business school, he worked as a project and design engineer for Delphi Corporation. In addition to an M.B.A., Preston holds a B.S.E. in mechanical engineering from Duke University.

Resource Adequacy Defined

Defined

"The ability of the electricity system to supply the aggregate electric power and energy requirements of the electricity consumers at all times, taking into account scheduled and reasonably expected unscheduled outages of system components." (NERC)

Resource Adequacy (RA) is a long-term consideration (years/months) versus system balancing (days/hours/minutes) and system stability (minutes/seconds).

Traditional resource standard: Up to 1 day in 10 years loss of load expectation.

What's Changing

- Energy adequacy vs. capacity at peak
- Late summer duck-curve impacts
- Risks during shoulder months
- Pace of transition, higher penetration of variable resources
- More inverter-based and distributed resources
- Extreme weather events
- Gas-power interdependence (not changing but a continuing issue)

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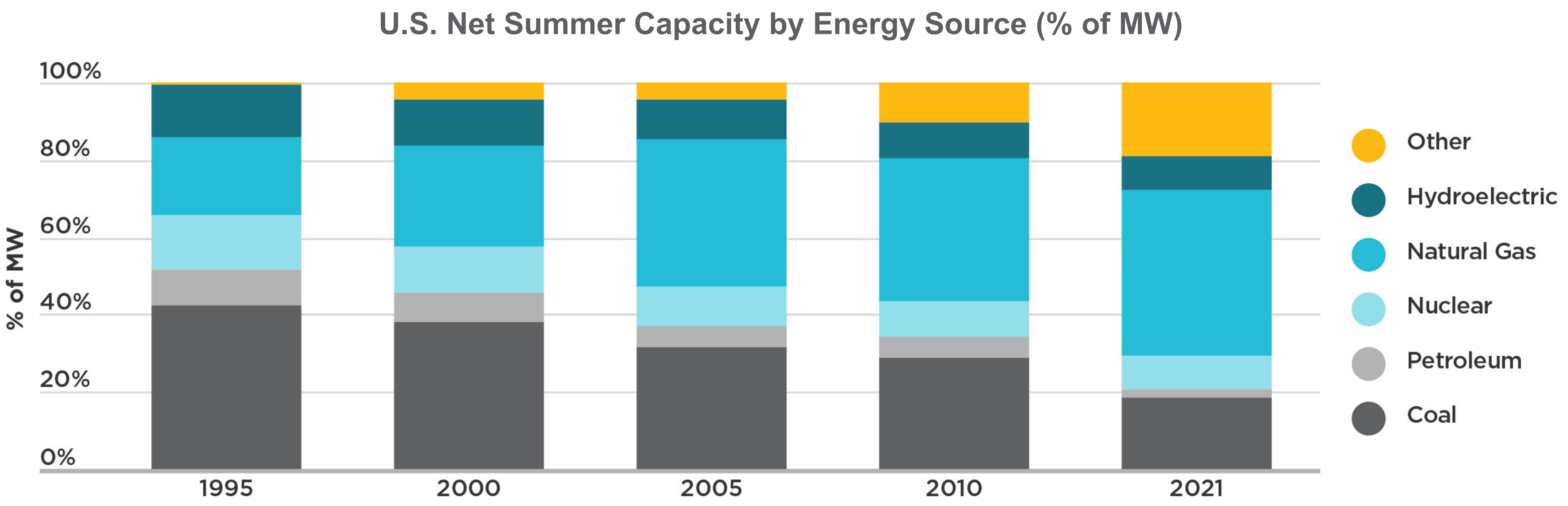
Changing Resource Mix

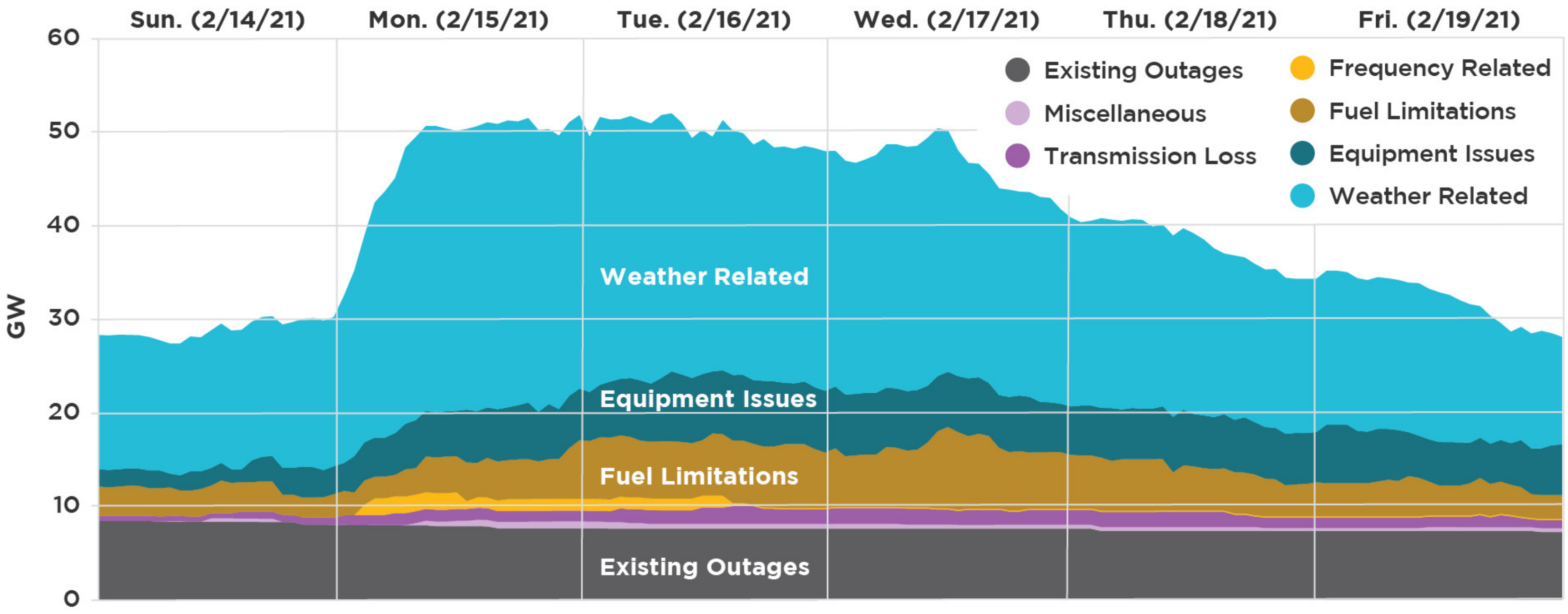


Source: EIA

U.S. renewable, hydro, and natural gas generating capacity has gone from about 1/3 of total capacity in 1995 to more than 2/3 as of 2021.

Extreme Weather – February 2021 Winter Storm Uri

Winter Strom Uri ERCOT Net Generator Outages and Derates by Cause (GW)



Source: ERCOT

Key Challenges

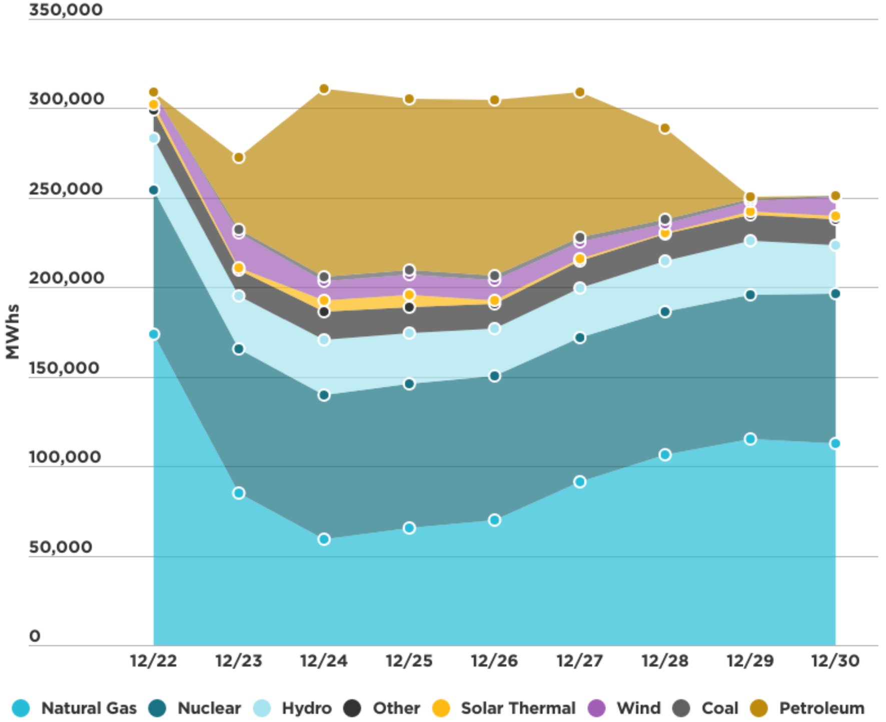
- Resource performance
  - Weatherization
  - Blade icing
- Fuel adequacy
- Gas production dependence on power
- Import capacity
- Demand underestimation

Weather events have challenged reliability

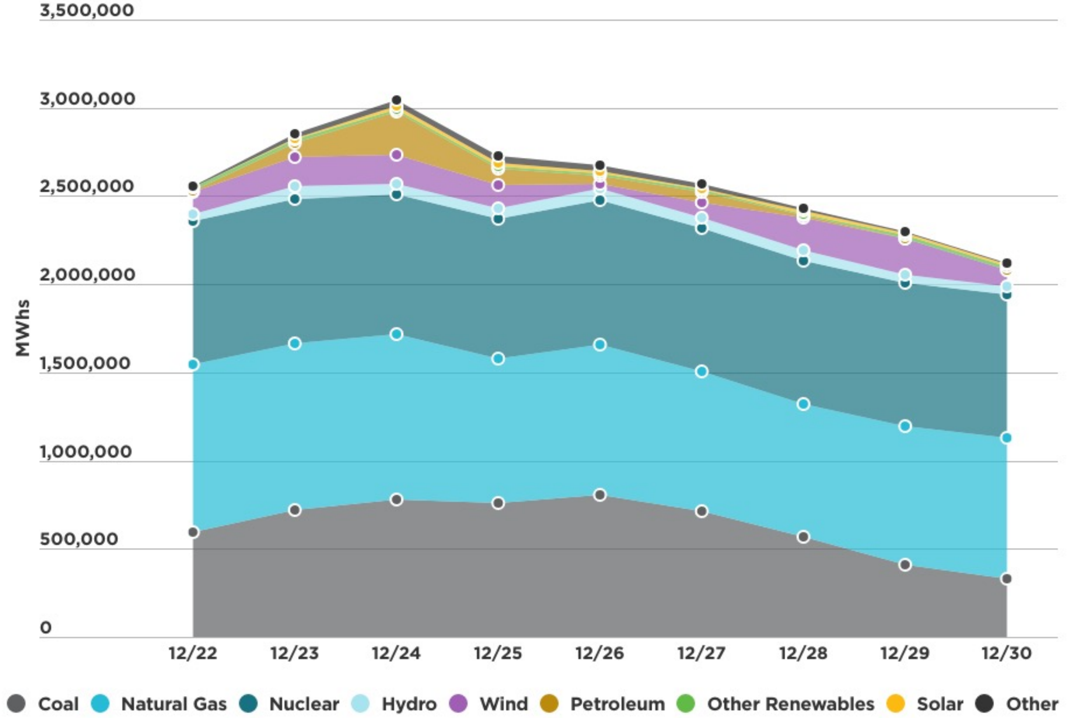
Extreme Weather – December 2022 Winter Storm Elliott

Selected Examples of Generation Fuel Mix (Dec. 22–Dec. 30, 2022)

ISO-New England



PJM



Key Challenges

- Resource performance
- Transmission capacity and wind curtailments
- Fuel adequacy and gas-power interdependence
- Import availability
- Demand underestimation

Sources: EIA; RTO data

Wider geographic scope than Uri but similar themes

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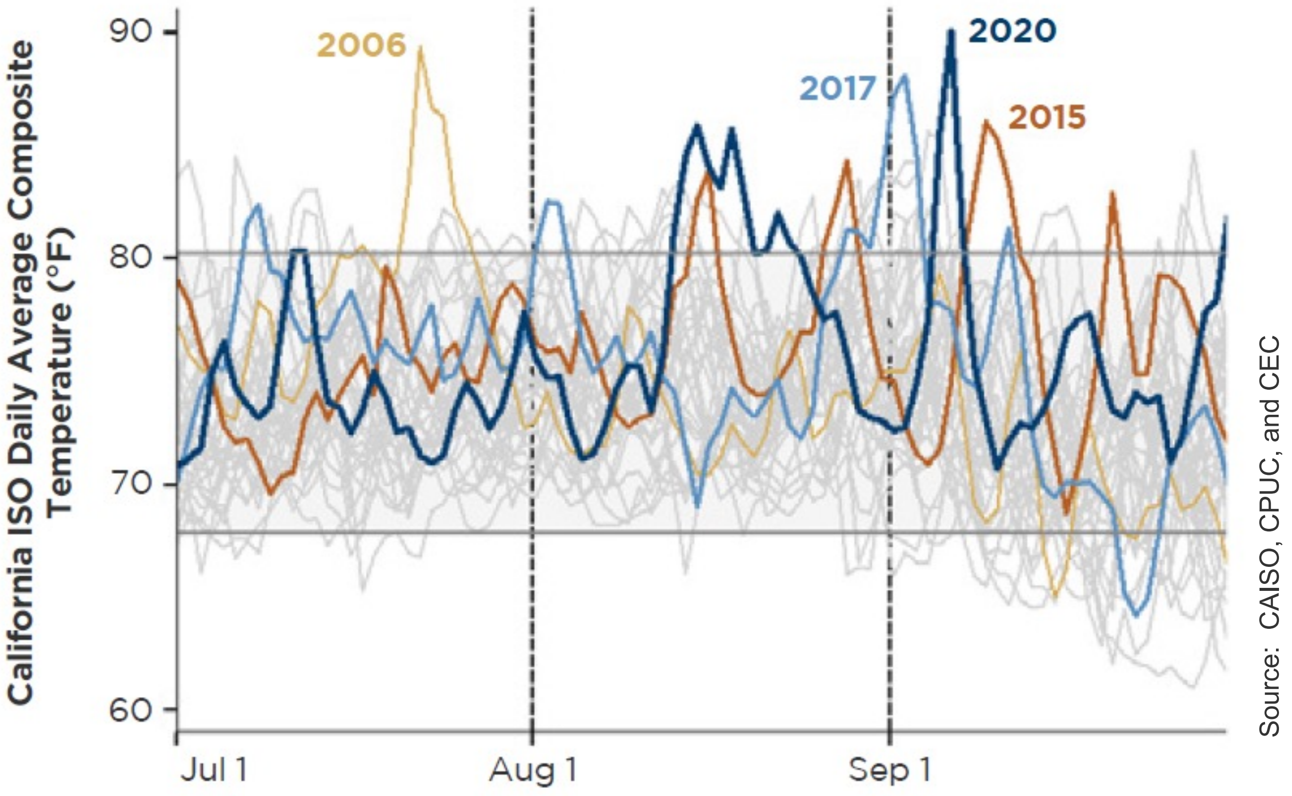
Extreme Weather – California August 2020 Heat Wave

California July, August, and September Temperatures (1985-2020)



Key Challenges

- Resource planning targets not meeting late-day needs
- Resource performance in critical hours
- Resource derates for ambient conditions
- Some solar/wind resources not available
- Demand response performance

Late summer, late-day energy adequacy issues

Western Approach: Resource Pooling and Capacity Transfers

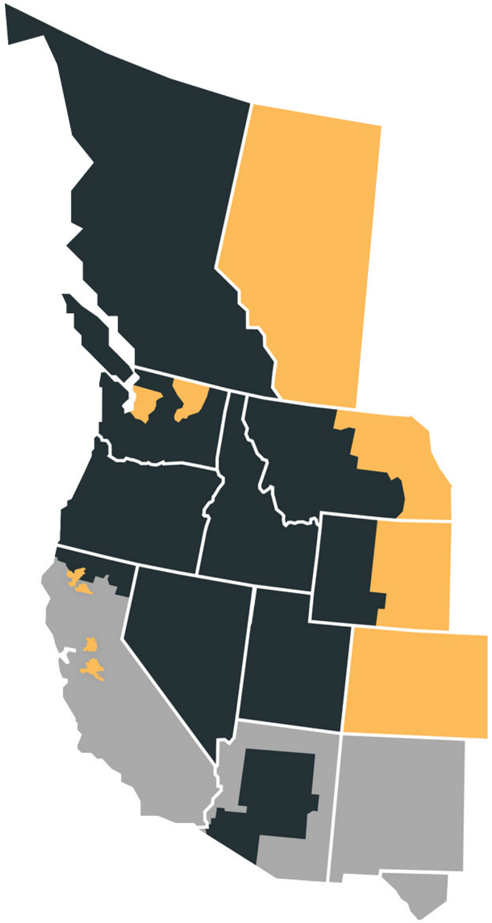
Western Resource Adequacy Program Footprint

WRAP
POWERED BY WPP

ADDITIONAL WPP FOOTPRINT

NON-WPP FOOTPRINT

CURRENT WRAP FOOTPRINT



Note: As of March 1, 2023.

Source: Western Power Pool

The first regional reliability planning and compliance program in the history of the West

WRAP will deliver a region-wide approach for assessing and addressing resource adequacy.

- Providing coordination and visibility across participants
- "Encouraging the use of western regional resource diversity compared to the status quo"

Applying New Principles in Modernized Approaches to RA

01 Quantify size, frequency, duration, and timing of shortfalls

02 Model chronological operations across many weather years

03 Accept that there is no such thing as perfect capacity

04 Understand that load participation fundamentally changes RA construct

05 Model neighboring grids and transmission as resources

06 Make reliability criteria transparent, including economic costs

Understanding Capacity Shortfalls	Understanding Capacity and Resource Types	Inclusion of Economic Considerations

Source: Energy Systems Integration Group

Other Actions Under Consideration Affecting RA

System Operator and Regulatory Actions to Update Adequacy Approach

- Texas legislature dispatchable gas plant proposals
- NERC winter preparation alert
- Capacity accreditation/equivalent load-carrying capability for all resources
- Seasonal analysis

Other Actions Potentially Impacting RA

- Permitting reform and potentially increased inter-regional transfer capacity
- EPA proposed emissions rules for fossil-fired generation

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Key Takeaways

Cost and Affordability Short- and Long-Term Drivers

Industry Change

The nature of bulk power resources has changed over the past decade, and significant amounts of proposed solar and wind resources are in interconnection queues.

Extreme Weather

Recent summer and winter weather events have tested power supply availability—both for renewable and gas-fired generation—on several systems.

Need for New Measures

Traditional measures of resource adequacy—availability at peak—are deficient as more energy-limited resources come online and the number of hours of energy insufficiency during non-peak hours and shoulder months increases.

Changing Inputs

Resource adequacy analysis is adapting to account for different supply composition, potential effects of climate change, the needs for energy adequacy through multi-hour and multi-day events, and load flexibility.

Integrated System Planning

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Stephen Haubrich

Director

Stephen Haubrich is a director at ScottMadden with experience in a broad range of functional areas within the energy industry, specializing in electric transmission and distribution, capital project planning, operational process improvement, and project management. He joined ScottMadden in June of 2011 after receiving an M.B.A. from Emory University's Goizueta Business School. Prior to business school, he was acting vice president of Professional Interiors Inc., a custom millwork manufacturing company. Stephen also holds a B.S., with honors, in psychology and a minor in German from the University of Florida.

Why Is the Industry Talking About Integrated System Planning?

- The energy transition is creating additional complexity in operating and planning for utility systems.
- Complexity is introduced as utilities focus on new goals, such as:
  - Greenhouse gas emission reductions
  - Integration of DERs
  - Accommodation of two-way power flows
  - Increasing renewable resources
- These complexities are driving changes within each of the electric system planning processes.

Generation

- Resource Intermittency
- Ramping
- Gas Availability
- Electrification
- Load Profiles
- Resource Adequacy
- Forecasting

Transmission

- Shoulder Months
- Load Intermittency
- Common Mode Failures
- Interconnections
- Extreme Weather
- Demand-Side Resources
- Forecasting

Distribution

- DERs
- Electrification
- Granularity
- Data
- Stakeholders
- Forecasting

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Why Is the Industry Talking About Integrated System Planning? (Cont.)

These same complexities are also driving change between system planning processes.

DRIVERS FOR PLANNING INTEGRATION
Generation and Transmission

- Common mode failure analysis
- Interconnection queue challenges
- FERC Notice of Proposed Rulemaking on regional planning
- Resources that span functions (energy storage)

DRIVERS FOR PLANNING INTEGRATION
Transmission and Distribution

- Wholesale demand response management
- FERC Order 2222
- Distributed energy resources located at sub-transmission
- Interconnection cost allocation
- Real time operations
- Optimized solutions across T&D

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What Is Integrated System Planning?

As utilities are re-exploring the concept of integrated planning, there's not a lot of alignment at this time on exactly what it looks like or even what it's called.

- Approach varies based on utility operating environment and objectives.
- At its core, Integrated System Planning involves increasing coordination between, or re-integrating, planning processes that have been largely siloed.

What Are Utilities Trying to Achieve Through Integrated System Planning?

Some Objectives of Integrated System Planning:

- **Better management of increasing penetrations of DERs and associated complexities**
- **Achievement of aggressive net-zero/carbon-emission reduction targets**
- **Optimization of investments at the system level (for effectiveness and lowest cost)**
- **Fairly and accurately accounting for the full value of non-wires alternatives**
- **Sharing data required to transition from deterministic to probabilistic forecasting**
- **Better supporting system scenario planning**

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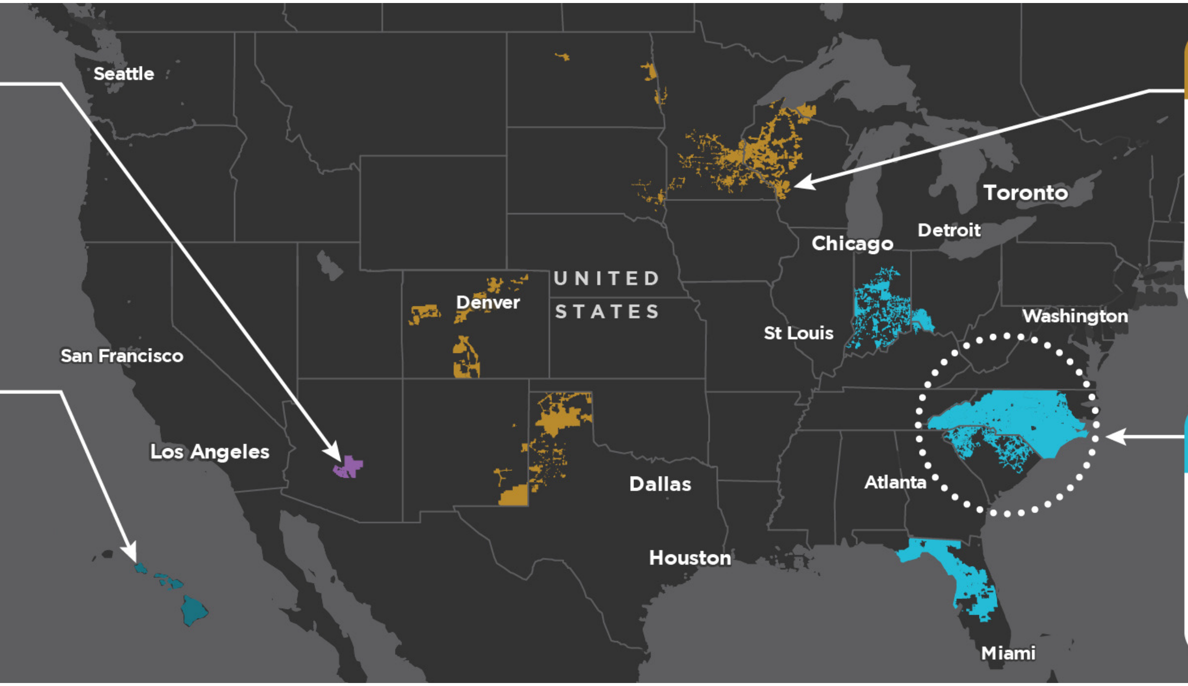
Who's Looking at Integrated System Planning?

Many utilities are at least thinking about Integrated System Planning, but where they are in the process of evaluation or implementation varies widely.



Salt River Project

- Integrated electric and water cooperative utility
- Serves Phoenix metropolitan area (shared territory with APS)
- Outside of organized market, grid part of the Western Interconnection

Hawaiian Electric Co.

- Vertically integrated regulated electricity utility
- Operating companies serve approximately 95% of the state's population
- Outside an organized market and not connected to the U.S. mainland grid

Xcel Energy

- Vertically integrated gas and electric utility
- Operating companies serve diverse customer base across CO, MI, MN, NM, ND, SD, TX, and WI
- Member of MISO

Duke Energy Carolinas/Progress

- Vertically integrated gas and electric utility
- Carolinas and Progress serve the majority of North and South Carolina
- Not operating in RTO and ISO

Source: S&P Capital IQ Pro

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Is Gas Planning Part of the Discussion?

Gas planning is also undergoing its own set of changes.

- Public policy
- Regulatory
- Electrification
- Forecasting
  - Granularity
  - Methodology
- Gas/electric coordination

Key Takeaways

Utility Systems Are Growing More Complex and Interconnected

Impacts of the energy transition necessitate planning that accounts for numerous and rapid changes. As planning processes evolve, they must ensure goals are aligned within different segments of the utility, as well as with the policy that is driving the change.

Utilities Are Exploring Comprehensive Planning Approaches

Utilities are at various stages of the exploration process. Some utilities have been driven by policy or regulatory requirements, while others have enacted changes of their own volition, in many cases doing so with the expectation that it will help them reach aggressive net-zero targets.

Gas Utilities Are Also Facing a Turning Point

Uncertain market conditions and changes in regulatory approaches on the future role of natural gas are driving early conversations on updating long-standing planning practices.

YOUR WEBINAR PRESENTERS




Cristin Lyons
Partner and
Energy Practice Leader

Kevin Hernandez
Partner

Preston Fowler
Director

Stephen Haubrich
Director

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