2021 Integrated Resource Plan

October 7, 2020

Welcome

2021 El Paso Electric Company Integrated Resource Plan Public Participation Meeting 3

Agenda:

- Transportation Electrification Plan – EPE
- Energy Imbalance Markets – CAISO
- Reliability and Expansion Modeling – E-3
- Reliable Operations – SPP Reliability Coordinator

Safe Harbor

Certain matters discussed in this Integrated Resource Plan ("IRP") public advisory group presentation other than statements of historical information are "forward-looking statements" made pursuant to the safe harbor provisions of the Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended.

Forward-looking statements often include words like we “believe”, “anticipate”, “target”, “project”, “expect”, “predict”, “pro forma”, “estimate”, “intend”, “will”, “is designed to”, “plan” and words of similar meaning, or are indicated by the Company’s discussion of strategies or trends. Forward-looking statements describe the Company’s future plans, objectives, expectations or goals and include, but are not limited to, statements regarding [anticipated future generation costs, resource need, customer growth rates, rate structure, fuel costs, purchased power pricing]. Such statements are subject to a variety of risks, uncertainties and other factors, most of which are beyond El Paso Electric Company's ("EPE" or the "Company") control, and many of which could have a significant impact on the Company's operations, results of operations, and financial condition, and could cause actual results to differ materially from those anticipated. Additional information concerning factors that could cause actual results to differ materially from those expressed in forward-looking statements is contained in EPE's Form 10-K for the fiscal year ended December 31, 2019 and Quarterly Reports filed in 2020. Any such forward-looking statement is qualified by reference to these risks and factors. EPE cautions that these risks and factors are not exclusive.

Although the Company believes that the expectations reflected in such forward-looking statements are reasonable, no assurances can be given that these expectations will prove to be correct. Forward-looking statements by their nature that could substantial risks and uncertainties that could significantly impact expected results, and actual future results could differ materially from those described in such statements. Management cautions against putting undue reliance on forward-looking statements or projecting any future assumptions based on such statements. Forward-looking statements speak only as of the date of this IRP public advisory group presentation, and EPE does not undertake to update any forward-looking statement contained herein, except to the extent the events or circumstances constitute material changes in this IRP that are required to be reported to the New Mexico Public Regulation Commission ("NMPRC" or "Commission") pursuant to its IRP Rule, 17.7.3 New Mexico Administrative Code.

Meeting Format and Guidelines

- **Presentations will be by EPE staff and invited speakers.**
  - Presenters will complete presentation prior to answering questions.
- **Participants may submit questions through the WebEx chat box.**
- **Communications should be respectful, to the point and on topic.**
- **Written questions submitted after the meeting will be responded to in writing within 10 days.**

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Transportation Electrification Plan

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EPE Transportation Electrification Journey

- **2014**
  - Began fleet electrification and installation of charging stations for fleet vehicles
- **2017**
  - Special EV Time of Use (“TOU”) rate in Texas was approved
- **2018**
  - Educational website was created to increase customer awareness and understanding of EVs
- **2019**
  - Launched employee incentive program and organized several “Lunch and Learn” events
  - Developed EPE’s EV Tactical Initiatives

Current Transportation Electrification Efforts

- **Customer education and outreach:**
  - EV training to employees and customer service
  - Ride and Drive events, community presentations
  - Info session with home builders and auto-dealers
  - EV customer survey
  - EV Community customer registration page
- **Purchased over 38 electrified vehicles for EPE fleet**
  - Sedans, SUVs, Forklifts, and e-PTO bucket trucks
- **Installed charging stations for fleet vehicles at 4 facilities**

Legislation - House Bill 521

- **On April 3, 2019, NMPRC passed House Bill 521**
- **House Bill requires utilities to file an application with NM PRC by Jan 1, 2021 with a subsequent filing every two years**
- **House Bill requirements:**
  - Charging infrastructure investments or incentives
  - Rate designs and programs that encourage charging off-peak hours
  - Customer Education and Outreach programs that increase awareness
- **Proposed investments and programs shall focus on:**
  - Improve utility's system efficiency, the integration of variable resources, operational flexibility and utilization during off-peak hours
  - Increase access to low-income users and underserved communities
  - Reduce air pollution and greenhouse gases
  - Support consumer choices in charging and allow for private investment

EPE Transportation Electrification Plan

- **Planning Phase**
  - Benchmarked utilities
  - Assessed our EV adoption rate and barriers
  - Identified charging infrastructure needs
  - Evaluated business models
  - Explored EV TOU rates
- **Development Phase**
  - Developed EPE's EV charging strategic vision and goals
  - Proposed customized customer programs
  - Enhanced customer outreach and education based on identified awareness gaps
  - EV TOU rate for New Mexico customers

EPE Transportation Electrification Plan

- **Proposed Plan**
  - Charging Infrastructure: Pilot Rebate Programs
    - Residential
    - Commercial: Workplace, Multi-Unit Dwellings (MUDs), DC Fast Charging, Fleet Customers
  - Measurement and Verification
  - Program Administration
  - Electrification Grid Impact Study (“EGIS”)
  - EV TOU rate
  - Customer Education and Outreach

Charging Infrastructure Strategic Vision

- **Phase 1- EV data collection and increased adoption (2021-2022):**
  - Increase EV adoption and identify home charging locations
  - Close charging infrastructure gaps
  - Evaluate impact of EV charging on EPE's infrastructure
  - Promote off-peak charging
- **Phase 2 - Customer-Managed EV consumption:**
  - Engage customers to manage time and cost of EV charging through customer-centric online and/or mobile platforms
  - Develop an event-based program to shave load during peak hours
  - Implement a monthly rewards program for consistent charging off-peak hours
  - Measure and verify load reduction/peak shaving
- **Phase 3- Utility-Managed EV consumption:**
  - Enhance Phase 2 by enabling utility-managed charging

Pilot Project: Residential Incentive Program (2021-2022)

- **Residential proposal:**
  - Propose $500 rebate for a purchase of networked level 2 charging station
  - Limited to 550 customers (50% of expected EV customers who charge at home)
- **Low and Moderate Income ("LMI") customers:**
  - Propose up to $1,300 rebate for a purchase and installation of networked level 2 charging station
  - Limited to 120 customers
    - Based on EPE's service territory low-income weighted average

Pilot Project: Commercial Incentive Programs (2021-2022)

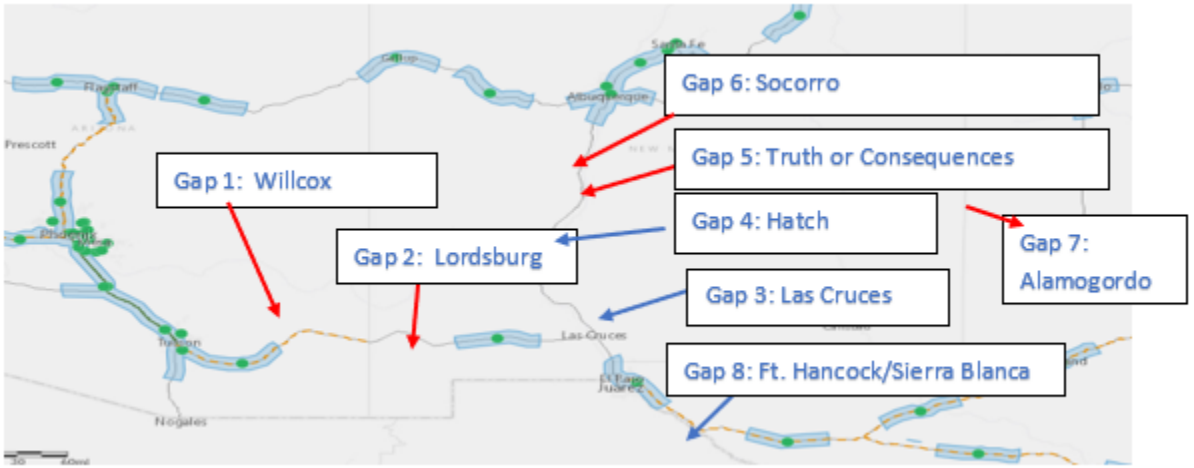
- **Address identified infrastructure gaps:**
  - Limited **workplace** and **Multi-Unit Dwelling** (“MUD”) charging
  - Limited **DC Fast Charging** (“DCFC”) infrastructure available to connect interstate corridors
  - Complexities of charging infrastructure installation for **customer fleets**

- **Commercial Proposal:**
  - Propose up to 60 incentives, 75% for level 2 and 25% for DCFC
    - 12 DCFC
    - 38 MUDs & workplace
    - 10 customer fleet
    - Incentives will cover up to 50% of installation costs

DCFC Incentives

- **Interstate corridor gaps in EPE's service territory (blue) :**
  - Hatch, Las Cruces, and Ft. Hancock/Sierra Blanca
  - Up to $26,000 rebate for purchase and installation of DCFC station
  - Limited to 12 stations

- **Interstate corridor gaps outside EPE's service territory (red):**
  - Requests for designation of alternative fuel corridors
  - Station location requests to Electrify America



*Electric Vehicle Corridor Map**

*DOE, ArcGIS Electric Corridor Map, https://www.arcgis.com/home/webmap/viewer.html?webmap=376dedd75b8347b8936abd70703cdb69&extent=-158.6002,16.7349,-56.1198,56.6162

Pilot Project: Workplace, MUDs and Fleet Initiative

- **Workplace and MUDs:**
  - Up to $3,500 rebate to cover 50% of networked level 2 charging station installation costs
  - Limited to 38 stations*

- **Customer Fleet:**
  - Up to $3,500 rebate to cover 50% of networked level 2 charging station installation costs + make-ready infrastructure
  - Up to $26,000 rebate on DCFC station installation + make-ready infrastructure
  - Limited to 10 stations

- **The number of workplace stations was estimated based on 16% of EV owners with no access to home charging and a recommendation of International Energy Association of 10 EVs to 1 port. The number of MUD stations was estimated based on the estimated number of customers residing in MUDs*

Program Administration, Measurement and Verification

Internal

- Applications review and approval;
- Measurement and Verification of program results
- Customer Service

External

- Payment Disbursement

Electrification Grid Impact Study

- **Project Goal:**
  - Assess the adequacy of existing infrastructure to meet the future demand created by electric vehicles and automated systems in EPE's service territory over the next 10 years
- **Project Scope:**
  - Mapping of EPE substations and compiling initial adoption data
  - Mapping potential load growth to identify the greatest impacts, sensitivities, and potential operational challenges
  - Development of load control strategies that could mitigate issues
  - Estimating the cost of upgrades with uncontrolled load
  - Develop EV near-term and long-term Roadmap
- **Estimated Completion Date:** December 2020

Experimental Electric Vehicle Charging Rate (EEVC)

- **EPE developed a Rate No. 42 – Electric Vehicle Charging Rate for its New Mexico customers that was filed with NMPRC as a part of EPE's Rate Case in May 2020:**
  - Both residential and commercial customers are eligible
  - Only charging operating at 120V or 240V are eligible for this rate
  - Requires an installation of a separate meter for EV charger
  - Customer Charge per meter of $3.80
  - Lower energy rates to incentivize customers to charge during off-peak times:
    - On-peak rate of $0.29426 (from 1 p.m. to 7 p.m., M-F, June-Sep);
    - Super off-peak of $0.00945 (12 a.m. to 8 a.m. for summer and non-summer months)
    - Off-peak of $0.05502 (other hours not covered by On-peak and Super Off-Peak)

Customer Education and Outreach

- **Customer EV survey:**
  - 470 customers participated (74% in TX and 26% in NM)
  - 6.6% own EV or PHEV, or both
- **EV customer demographic is consistent with national demographics**
  - young adults, median to high income, bachelor's or higher, own solar panels
- **Non-owner customer awareness of EVs is low:**
  - > 40% don't know the difference between a hybrid and EV
  - > 20% have never driven an EV
  - > 20% don't know if they can charge using home's electrical outlet
  - Perceived limited availability of EV models and public charging stations
  - Perceived high cost of maintenance and fuel

Enhanced Customer Outreach and Education Programs

- **Residential:**
  - Improve customer awareness of EVs, incentives and EV rates
  - Update EV website and promote EV Community
  - Organize EV virtual events and Ride & Drives
  - Develop a pre-owned vehicle guide
  - Dedicate 20% of marketing budget to LMI customer segment
- **Commercial:**
  - Offer informational presentations
  - Develop employee and tenant surveys for business owners
  - Promote installation of lockable level 1 outlets in parking lots
  - Promote available business incentives
- **Automakers and Dealerships:**
  - Develop an EV-group buy program
  - Conduct informational sessions for dealership staff
  - Distribute EV brochures
- **Home Builders and Apartment Association**
  - Continue promoting EV-ready homes and apartments

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Thank you.

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California ISO

Energy Imbalance Market

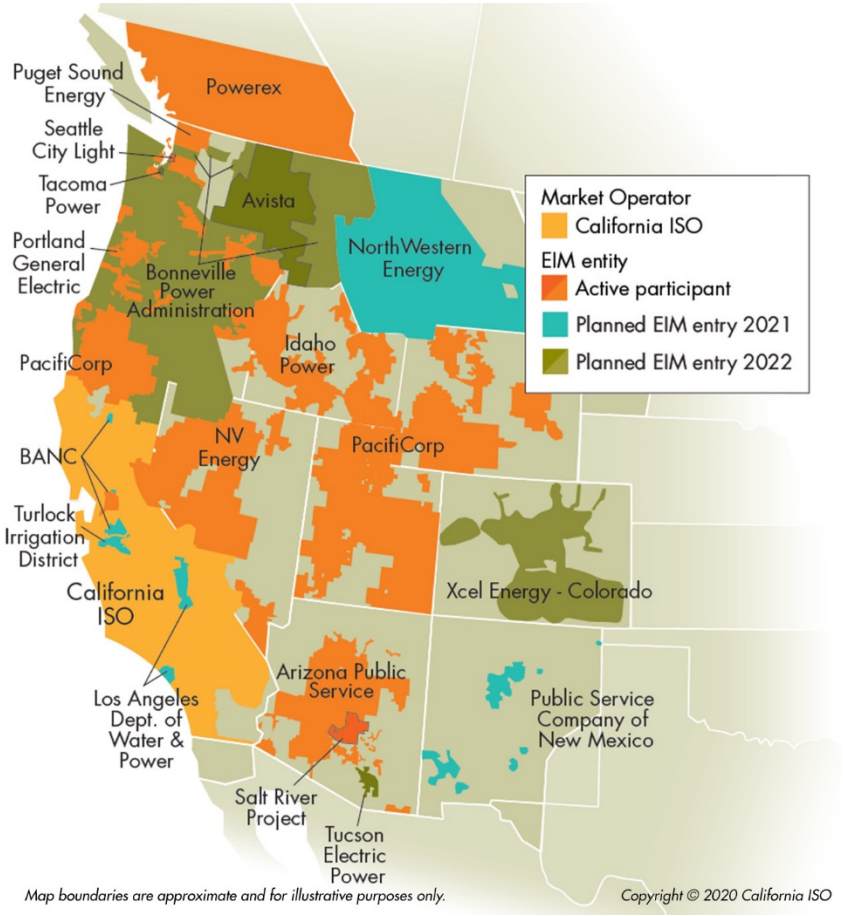
El Paso Electric IRP Meeting

Don Fuller, Director Strategic Alliances

October 7, 2020

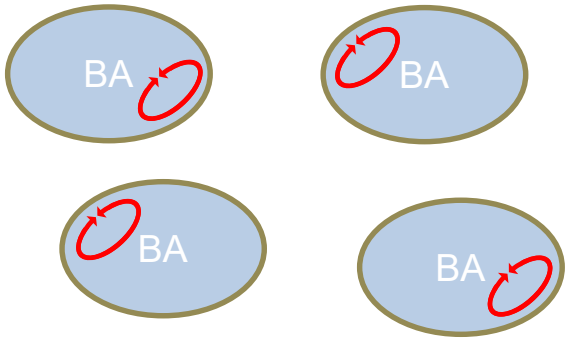
The Western Energy Imbalance Market

- Automated dispatch minimizes cost, facilitates renewables, reduces curtailments, resolves imbalance, avoids congestion
- Situational awareness enhances reliability
- Harmonizes with bilateral trading and reserve sharing groups
- Preserves BAA autonomy, including compliance, balancing and reserve obligations
- Voluntary entry, no exit fees
- Benefits from EIM operation exceeded $1 billion on July 3



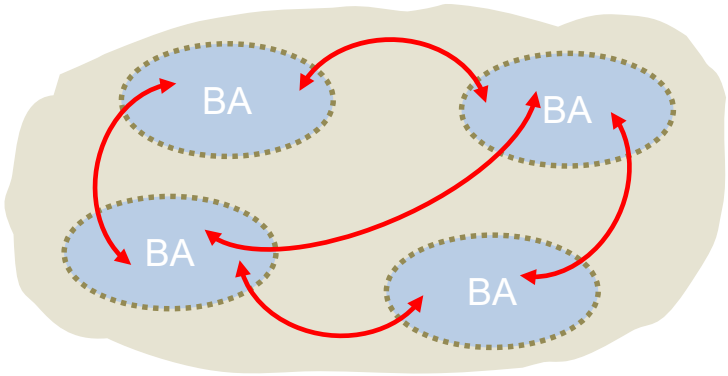
EIM enhances variable resource integration by dispatching energy every five minutes

Today:
Each BA must balance loads and resources within its borders.



- Limited pool of balancing resources
- Inflexibility
- Economic inefficiencies
- Increased costs to integrate wind/solar

In an EIM:
The market dispatches resources across BAs to balance energy



- Diversity of balancing resources
- Increased flexibility
- Decreased amount of balancing capability needed
- More economically efficient
- Decreased integration costs
- Easily scalable

Western EIM Benefits

millions $

EIM Participants	2014	2015	2016	2017	2018	2019	2020 Q1	2020 Q2	Total
Arizona Public Service			5.98	34.56	45.30	54.48	11.26	6.40	157.98
BANC						15.86	7.07	9.17	32.10
California ISO	1.24	12.66	28.34	36.96	67.94	44.74	9.57	21.25	222.70
Idaho Power Company					26.88	28.23	5.15	6.08	66.34
NV Energy		0.84	15.57	24.20	25.55	22.87	5.36	4.73	99.12
PacifiCorp	4.73	26.23	45.47	37.41	61.68	59.77	7.80	8.46	251.55
Portland General Elec.				2.83	27.57	42.87	6.93	9.15	89.35
Powerex					7.84	11.94	1.09	2.84	23.71
Puget Sound Energy			1.56	9.86	13.68	16.15	3.67	1.15	46.07
Seattle City Light								1.63	1.63
Salt River Project								8.14	8.14
TOTAL	**5.97**	**39.73**	**96.92**	**145.82**	**276.44**	**296.91**	**57.90**	**79.00**	**998.69**

Western EIM governance structure

EIM Governing Body (GB)	• 5 independent, non-stakeholder members • Delegated authority over EIM-related market rules • Selected by stakeholder nominating committee, confirmed by EIM Governing Body • Provides western entities a decision-making voice
EIM Body of State Regulators (BOSR)	• Advises the EIM Governing Body and ISO Board of Governors on matters of interest • Currently eight state officials from EIM states • Provides a state regulatory perspective
Regional Issues Forum (RIF)	• Public vehicle for discussion of EIM-related issues, including impacts to neighboring balancing authority areas • Organized by ten self-selected sector liaisons • May produce opinions for EIM governing body or ISO Board of Governors

EIM Governing Body Members

John Prescott,
Chair

Anita J.
Decker
Vice Chair

Valerie Fong

Rob
Kondziolka

Carl Linvill,

Extended Day-Ahead Market (EDAM) initiative

- Extend EIM to include DA market
- Same foundational concepts as EIM, BAA autonomy, voluntary entry, no exit fees.
- EIM will be maintained as a stand-alone service
- Stakeholder process underway, running through 2021
- Major topics
  - Transmission availability and pricing
  - Resource sufficiency
  - Greenhouse gas
  - Governance

Resources

- EIM Computer-based training at: https://www.westerneim.com/Slides/Resources.aspx
- EIM Quarterly benefits reports at: https://www.westerneim.com/Slides/About/QuarterlyBenefits.aspx
- EIM Fact Sheet at: https://www.westerneim.com/Documents/WesternEIMFactSheet.pdf
- What the EIM executives are saying:
- https://www.westerneim.com/Documents/WesternEIMWhatTheyreSaying.pdf

Energy+Environmental Economics

Overview of Reliability and Capacity Expansion Modeling

El Paso Electric stakeholder webinar

10/07/20

Arne Olson, Senior Partner
Jack Moore, Director
Joe Hooker, Managing Consultant
Jimmy Nelson, Managing Consultant
Huai Jiang, Consultant
Manu Mogadali, Consultant
Adrian Au, Consultant
Chen Zhang, Consultant

Agenda

- Background on E3
- Modeling framework
- Reliability modeling
- Capacity expansion modeling

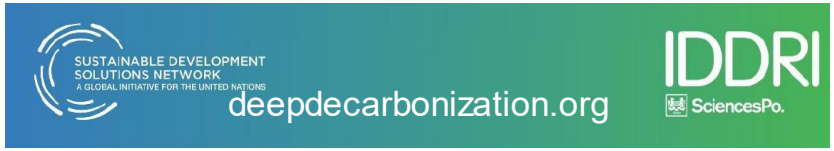
Energy+Environmental Economics

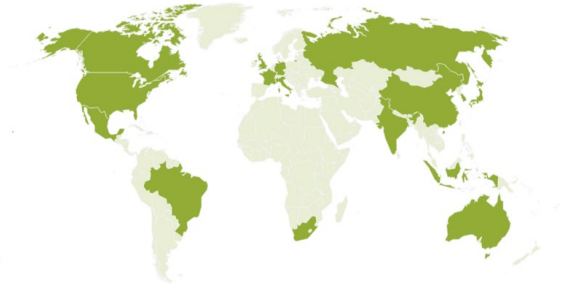
Background on E3

About E3

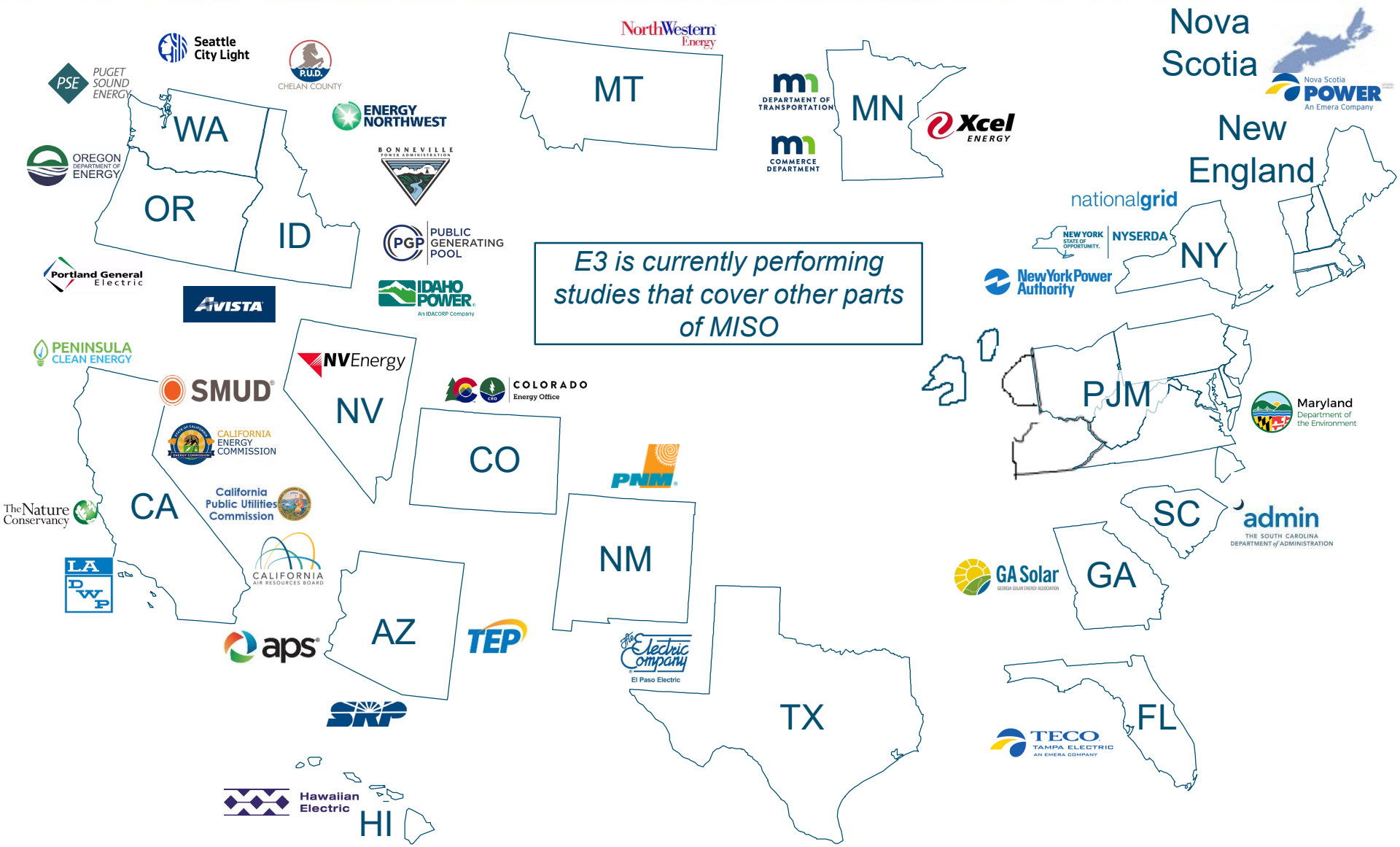
- **E3 is a consultancy specializing in energy economics with ~70 staff. E3 has offices in San Francisco, New York, Boston, and Calgary**
- **E3 consults extensively for utilities, government agencies, developers, and environmental groups on clean energy issues**
- **Deep carbon reduction and 100% zero-carbon planning for:**

  - **United Nations:** Deep Decarbonization Pathways Project
  - **California:** CPUC, LADWP, SMUD, Calpine
  - **Hawaii:** HECO
  - **Pacific Northwest:** numerous utilities
  - **Southwest:** APS, NV Energy
  - **Colorado:** Governor's Energy Office
  - **Upper Midwest:** Xcel Energy
  - **Canada:** Nova Scotia Power





E3 has worked with many clients to study clean energy and decarbonization targets



E3 is currently performing studies that cover other parts of MISO

Key E3 resource planning studies

+ **E3's resource planning studies focus on questions of how to meet aggressive carbon reduction and clean energy goals in the electric sector while maintaining reliability and managing costs:**

Sponsor	Study	Date
Arizona Public Service	2020 IRP Support	2019-'20
California Energy Commission	Deep Decarbonization in a High Renewables Future	2018
California Energy Commission	Supporting Analysis for SB100 Joint Agency Report	2020
California Public Utilities Commission	Ongoing IRP Support	2016-'20
Calpine Corp	Resource Adequacy under Deep Decarbonization	2019
Colorado Energy Office	Development of Colorado GHG Roadmap	2020
El Paso Electric	Support for RFP Bid Evaluation	2018-'20
Hawaiian Electric Co	2016 Power Supply Improvement Plan	2016
Nova Scotia Power	IRP Support	2018-'20
NV Energy	2020 IRP Support	2020
Public Generating Pool	Pacific Northwest Low Carbon Scenario Analysis	2017
Sacramento Municipal Utilities District	2018 IRP Support	2018
Xcel Energy	Upper Midwest 2019 IRP Support	2018-'19
Various Northwest Utilities	Resource Adequacy in the Pacific Northwest	2019

+ **In addition, E3 is currently working on studies of a decarbonized electricity supply in the Mid-Atlantic, New York, and New England**

Energy+Environmental Economics

Modeling framework

Overview of key questions

- **Calculate the planning reserve margin (PRM) for the system and the effective load carrying capability (ELCC) values for resources**

  Key Questions:

  - What is the total effective capacity the system needs to meet El Paso Electric's reliability standard?
  - How can solar, energy storage, wind, and other dispatch-limited resources contribute to the total capacity requirement? How does this change with penetration?

- **Develop least-cost resource portfolios that achieve clean energy targets while maintaining reliability**

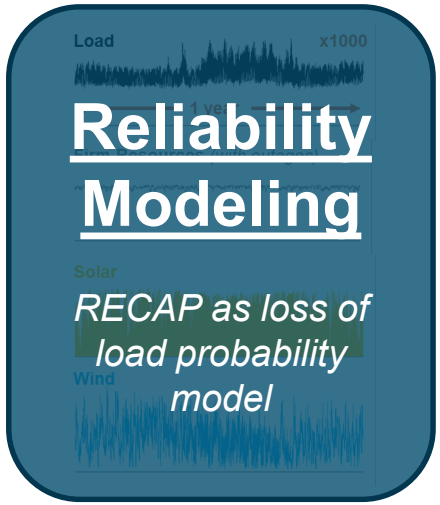
  Key Questions:

  - Which resources are economic to add to the system over the planning horizon?
  - How can El Paso Electric meet the New Mexico Energy Transition Act requirements most cost effectively?
  - What is the role of firm generating capacity in ensuring resource adequacy?

Overview of modeling approach

+ **The IRP modeling approach pairs detailed loss-of-load-probability modeling (RECAP) with capacity expansion models (RESOLVE and PLEXOS LT) to provide a robust perspective on system reliability, operations, and cost under aggressive clean energy targets**

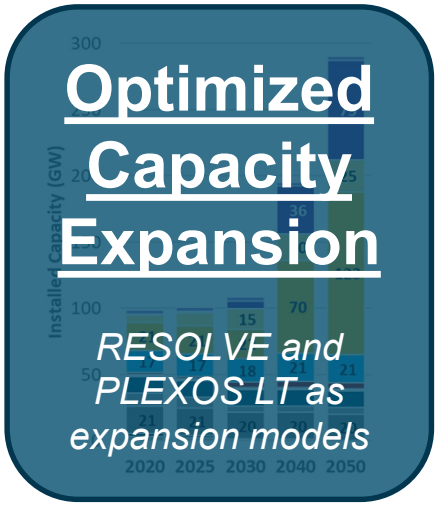
1 Conduct detailed reliability modeling to quantify the capability of variable & dispatch-limited resources to contribute to resource adequacy requirements



Planning reserve margin

Technology ELCC curves

Optimized portfolios



2 Optimize future resource portfolios to meet reliability and clean energy targets while minimizing cost to customers

3 Perform detailed reliability modeling to check that the optimized system meets the reliability target

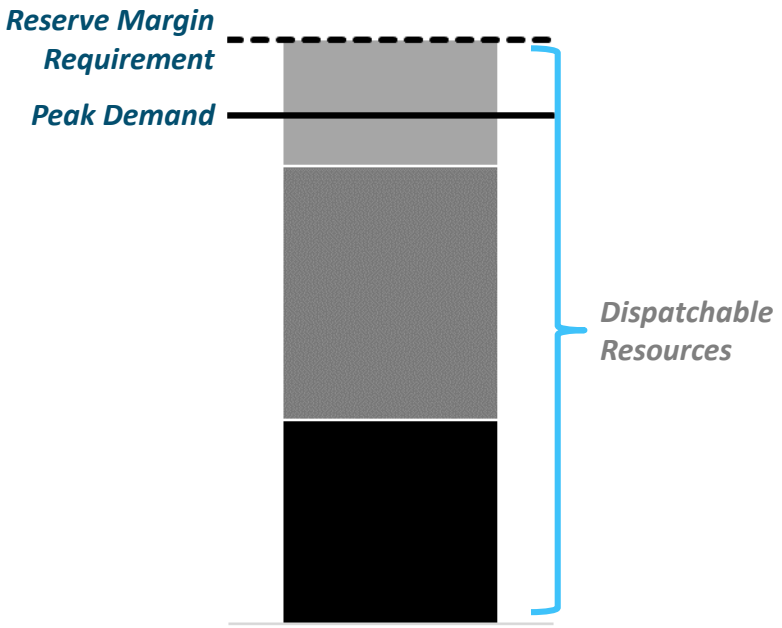
Energy+Environmental Economics

Reliability modeling

Evolving considerations: system reliability

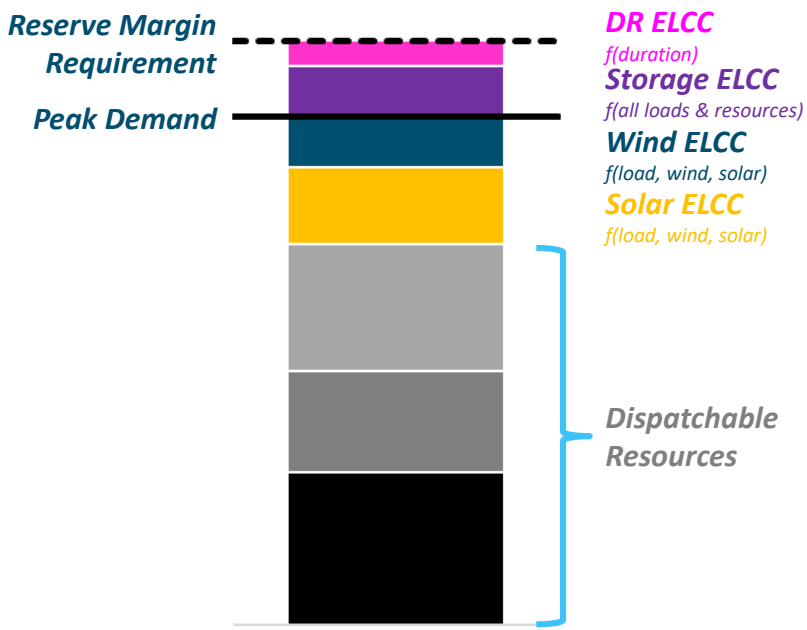
Old Paradigm (Illustrative)

+ **Resource adequacy focused on ensuring enough dispatchable resources to meet peak demand**
  - A system planned to meet peak demand would implicitly be capable of meeting lower demands throughout the year as well



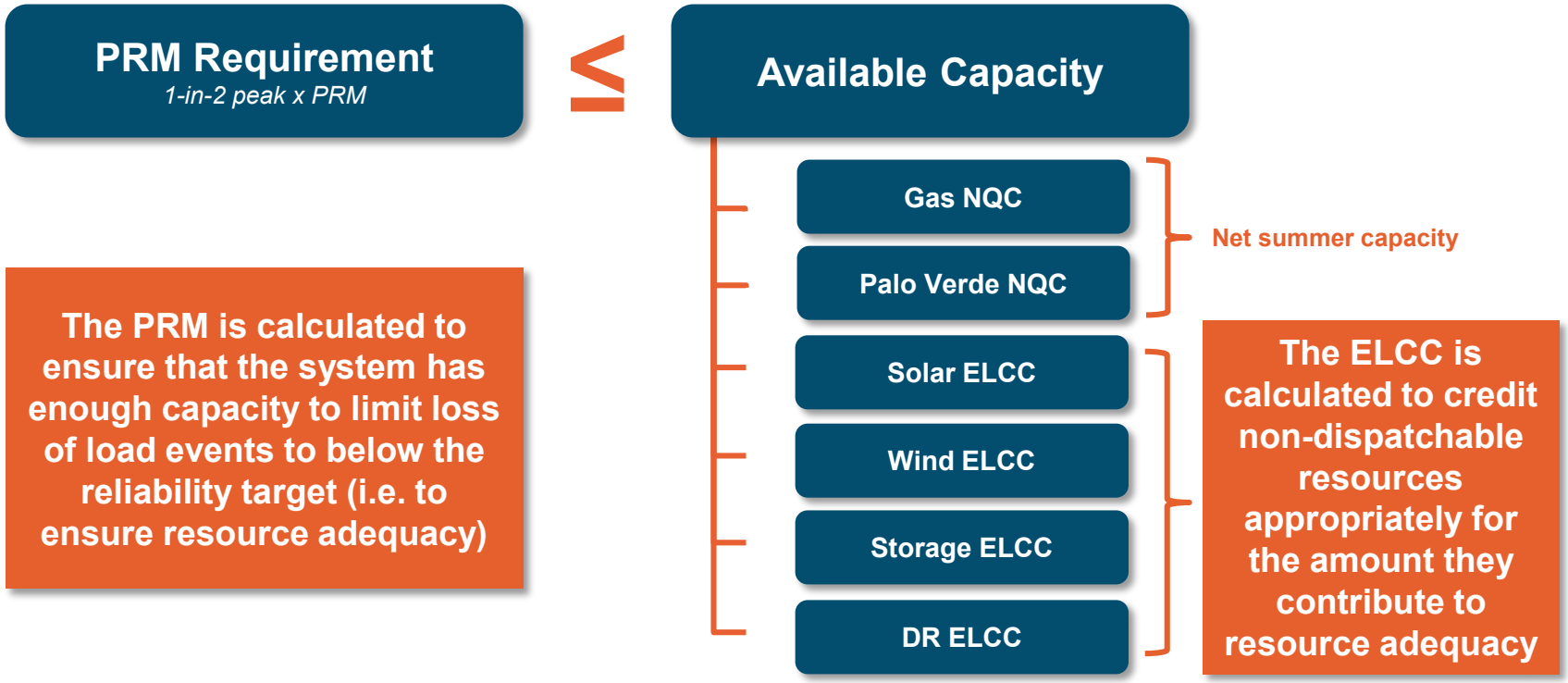
New Paradigm (Illustrative)

+ **New types of resources add complexity to reliability planning**
  - Variable resources and storage may not dispatch at full capacity when needed
  - Due to interactive effects, most challenging period for reliability may not be the peak hour



The planning reserve margin constraint ensures resource adequacy

- The planning reserve margin (PRM) constraint in capacity expansion models ensures that there is enough capacity to ensure resource adequacy
- The contribution of each resource towards the PRM requirement depends on the characteristics of each individual resource



NQC = Net Qualifying Capacity; ELCC = Effective Load Carrying Capability

Overview of RECAP

- RECAP is a time-sequential, Monte Carlo-based model that evaluates hourly resource availability over thousands of simulated years
- RECAP uses historical weather, load, solar, and wind correlations as the foundation of simulating the system over many potential conditions

Inputs

Load
- *Hourly load for many weather years*

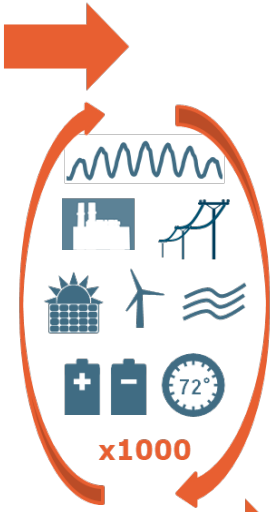
Dispatchable Generation
- *Capacity*
- *FOR*
- *Maintenance*

Renewables
- *Capacity*
- *Hourly generation profiles for many weather years*

Hydro
- *Hydro availability for many hydro years*
- *Max/min constraints*

Storage
- *Capacity*
- *Duration*
- *Roundtrip efficiency*
- *FOR*

Demand Response
- *Capacity*
- *Max # of calls*
- *Duration of each call*



Outputs

LOLE
- *Loss of load expectation*
- *Days/yr of total expected lost load per year*

LOLH
- *Loss of load hours*
- *Hours/yr of total expected lost load per year*

EUE
- *Expected unserved energy*
- *MWh/yr of energy that cannot be served*

ELCC
- *Effective load carrying capability*
- *Equivalent quantity of 'perfect capacity' for a variable or energy-limited resource*

TPRM
- *Target planning reserve margin*
- *PRM required to achieve a specified reliability threshold (i.e. LOLE, ALOLP, or EUE)*

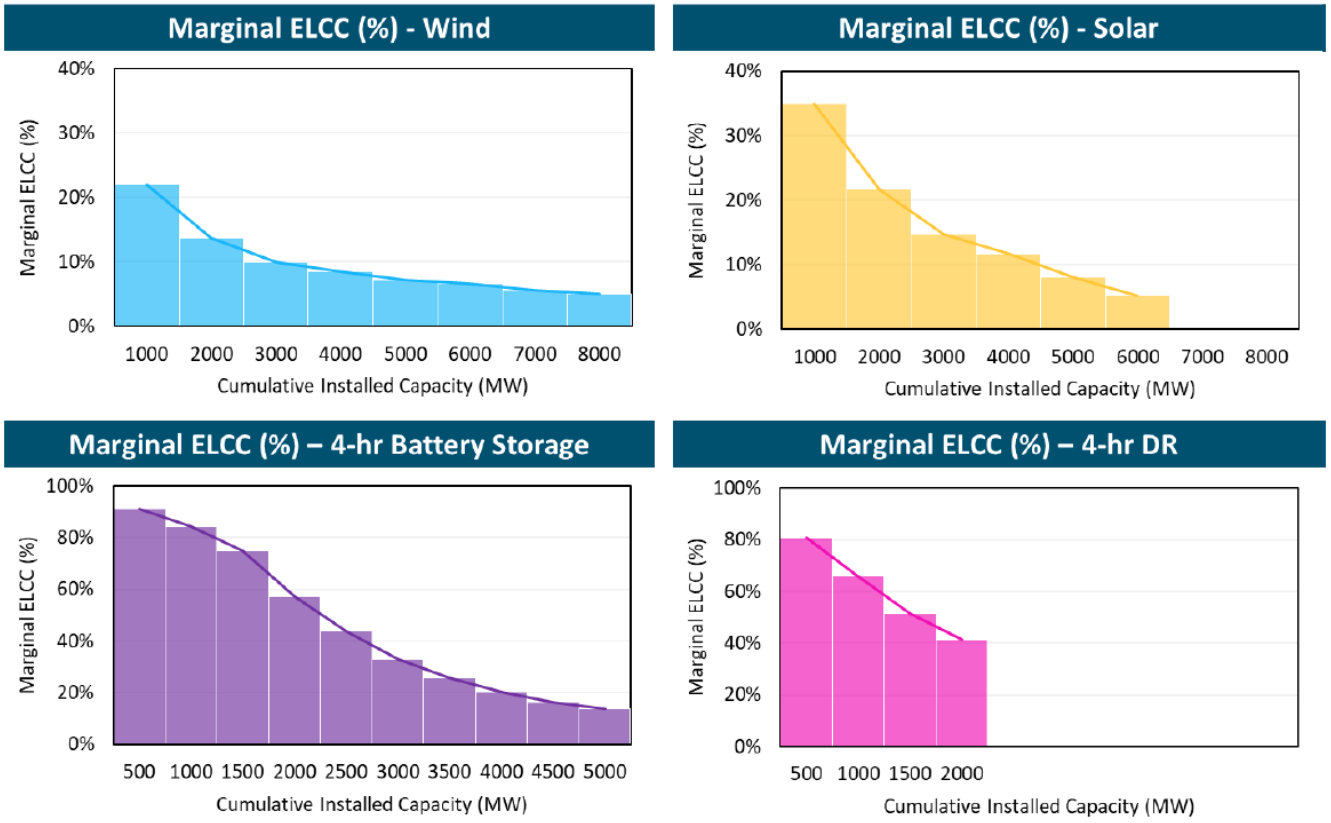
Does a resource portfolio meet the reliability target?

What is the capacity credit of dispatch-limited resources?

What reserve margin is needed to ensure reliability?

ELCC curves for Xcel Energy's Upper Midwest service area

- **The ELCC for dispatch-limited resources exhibits diminishing returns**
  - Adding renewables shifts reliability events to periods of lower renewable output
  - Adding storage clips the peak, so additional tranches require longer durations

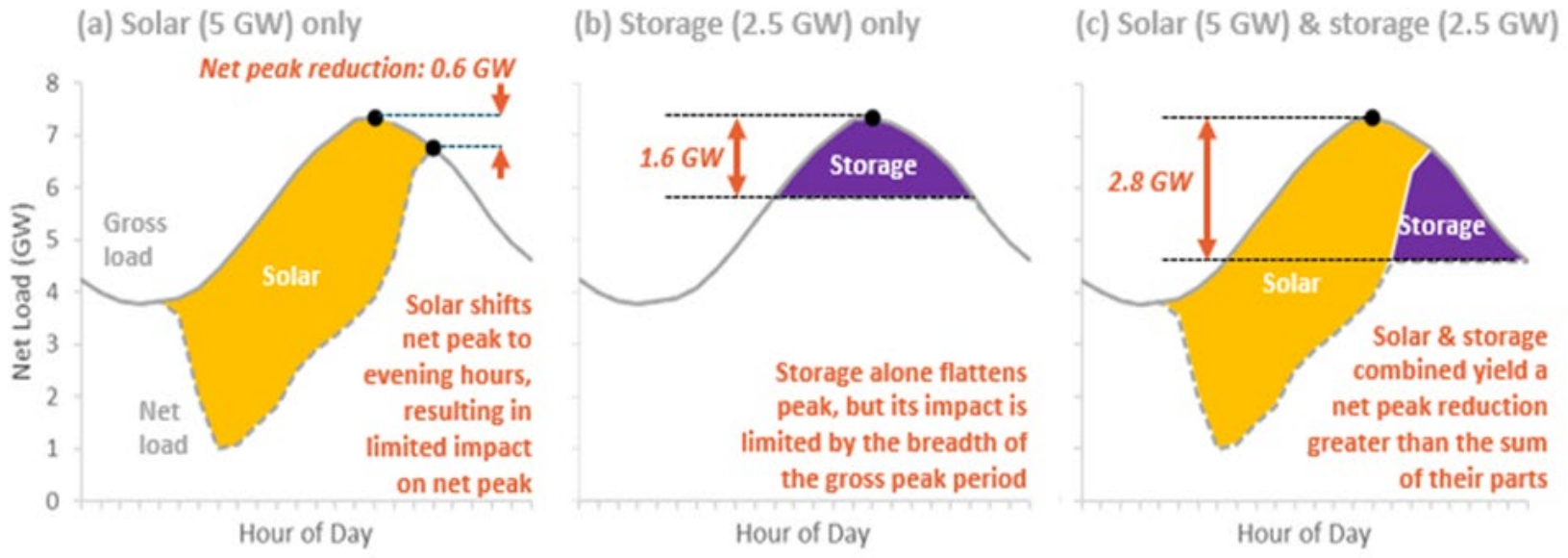


Results from 2019 IRP Support for Xcel Energy's Upper Midwest Service Area

ELCC dynamics for solar and storage

- Solar shifts the net load peak to the evening, resulting in a diminishing ELCC. Net load is gross load less renewable output
- Storage clips the peak, requiring longer durations and resulting in a diminishing ELCC
- Solar and storage together have complementary characteristics and can produce a combined ELCC that exceeds the sum of individual resources' ELCCs

Hypothetical solar and storage operations on peak day of NV Energy system

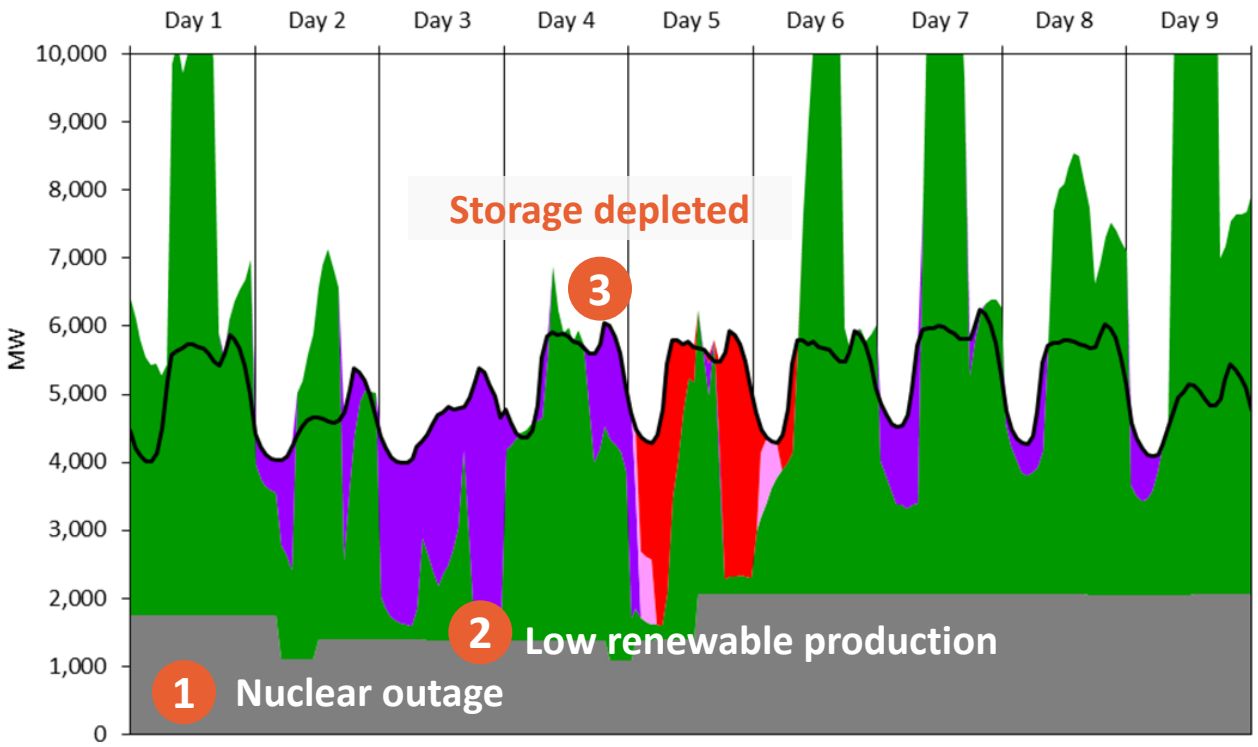


Results from 2020 IRP Support for NV Energy

Anatomy of a reliability event in a 100% zero-carbon portfolio

+ On a system that relies predominantly on variable renewables and storage to meet reliability needs, reliability events result from sustained energy shortages, which may not occur during peak demand periods

Nine-day snapshot* of resource availability, 100% zero-carbon scenario



Multi-day low wind/solar output results in an outage during this week

* Nine-day snapshot chosen from a simulation of loads and resources on >23,000 operating days

Results from 2019 IRP Support for Xcel Energy's Upper Midwest Service Area

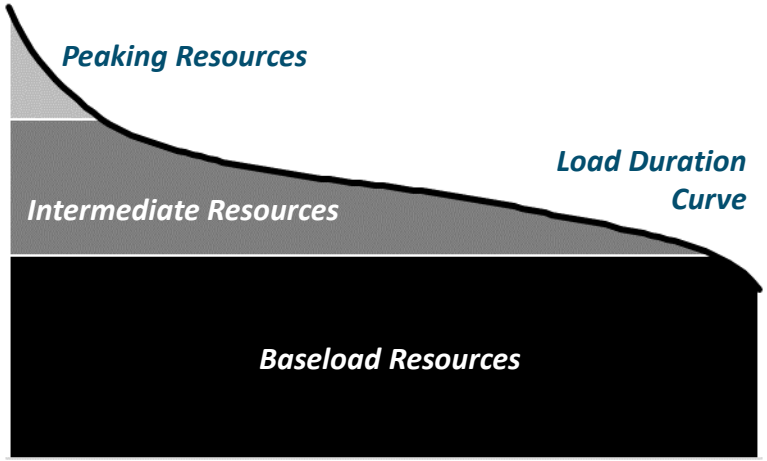
Energy+Environmental Economics

Capacity expansion modeling

Evolving planning paradigm: operations

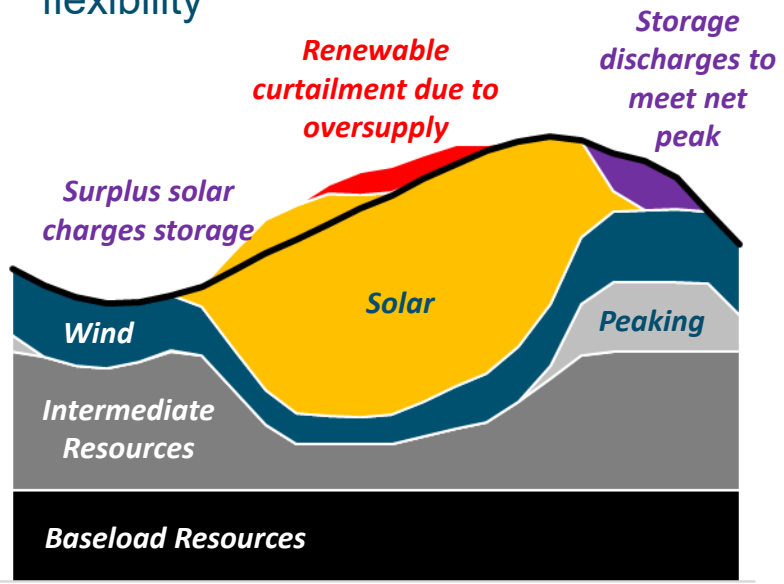
Old Paradigm (Illustrative)

- Heuristic approaches provide a reasonable means of evaluating resource needs and investment options
- Tradeoff between capital-intensive resources with low operating costs and low capital resources with high operating costs



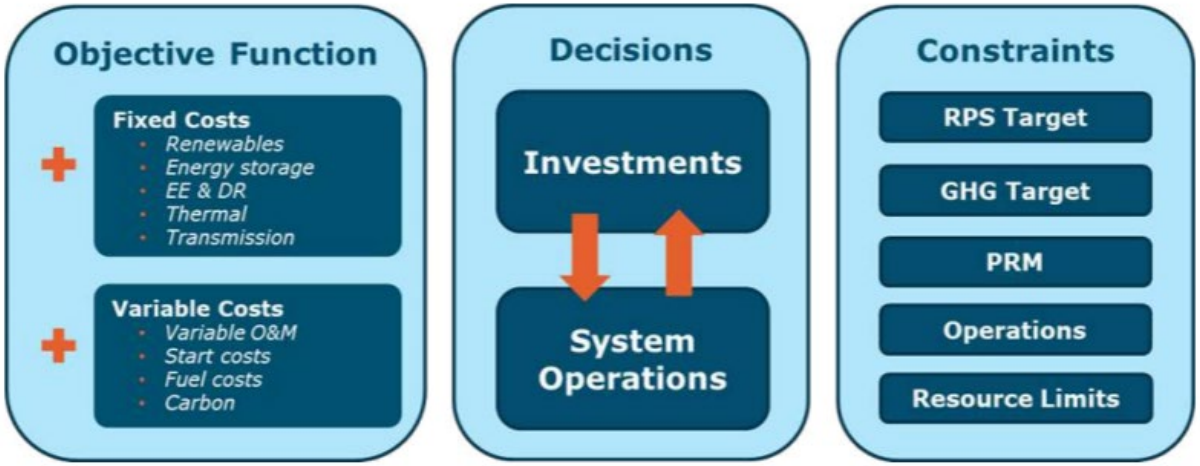
New Paradigm (Illustrative)

- Understanding system dispatch at hourly & subhourly timescales becomes necessary to evaluate investments
- Chronological simulation needed to capture constraints on operational flexibility



Overview of capacity expansion models

- **E3's RESOLVE model is a long-term planning tool created to support utilities, regulators, environmental advocates, and market participants**
- **RESOLVE analyzes the complex operational considerations and economic tradeoffs of a highly renewable grid**
  - Seasonal and weather-based correlations between load and renewable output
  - Interactive resource adequacy contributions of different renewable resources
  - Increasing cost of renewable integration and carbon reductions at high levels



- **PLEXOS LT will also be used to perform capacity expansion modeling**

Resource options for the 2021 IRP

Preliminary listing of resources to be considered in 2021 IRP

- Solar
- Wind
- Biomass
- Geothermal
- LM/DR – EE[1]
- Battery Li-Ion
- Other Energy Storage
- Other Renewables
- Imports
- Gas Fired Reciprocating
- Gas Fired CT[2]
- Gas Fired CC[3]

Other resources & technology to be explored

- Energy Storage– pumped hydro, flow batteries, underground compressed air, hydrogen, flywheels
- Nuclear - modular nuclear possible option upon Palo Verde retirement but not prior to 2045
- Gas Turbine– conversion to hydrogen fuel
- EV and customer sited batteries

1. LM/DR-EE: Load Management/Demand Response- Energy Efficiency
2. Combustion Turbine
3. Combined Cycle

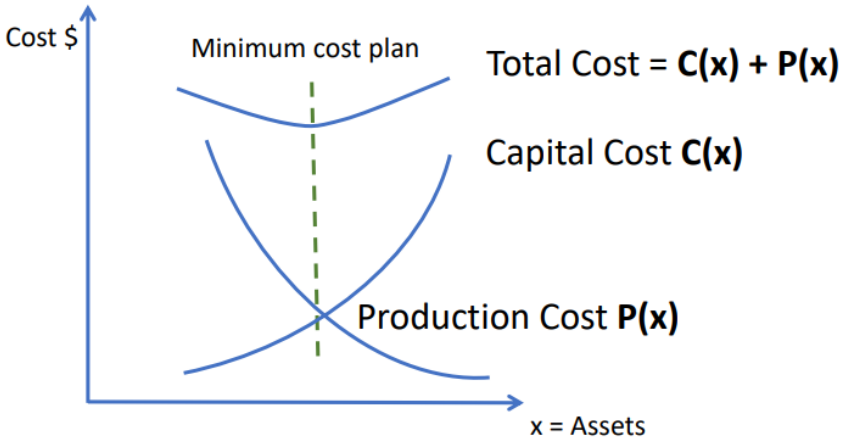
Presented at the 8/14/20 Public Advisory Meeting

RESOLVE and PLEXOS LT can model a wide range of resource options to meet reliability and clean energy targets at least cost

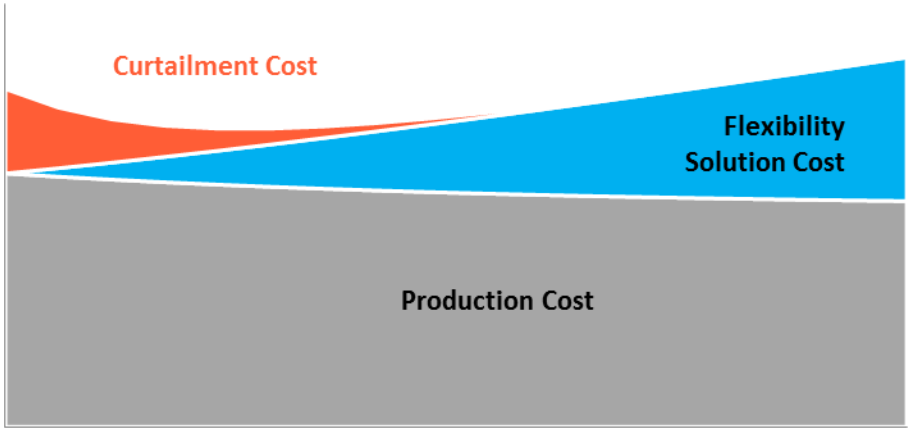
Cost minimization in capacity expansion model

- **The capacity expansion model minimizes cost subject to constraints by choosing resource additions**
  - The total cost is the sum of production costs and fixed costs
  - Constraints include clean energy targets, reliability targets, plant capabilities, transmission limitations, etc.
- **Production costs**
  - Fuel and variable O&M
  - PPA and contract costs
- **Fixed costs**
  - Capital cost
  - Fixed O&M
  - Transmission cost

Objective function = total cost



Balancing the cost of renewables and integration solutions

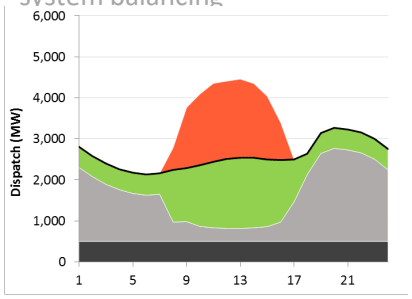


Curtailment and flexibility solutions are part of the least-cost portfolio

System Flexibility

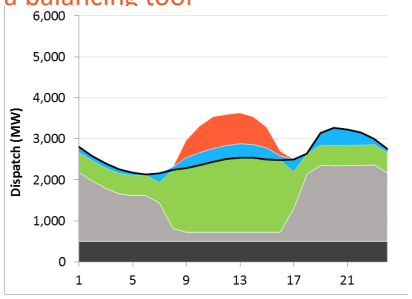
Highly Inflexible System

- **No investments** made in flexibility solutions
- **Curtailment is frequent** and occurs in large quantities, is needed for system balancing



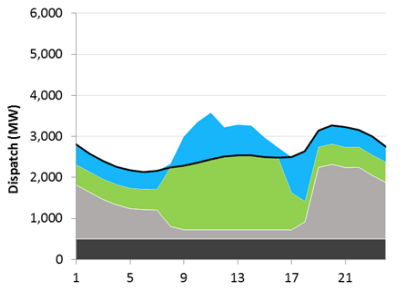
Optimal System

- **Some investments** made in flexibility solutions to limit curtailment
- **Curtailment still occurs routinely** as a balancing tool



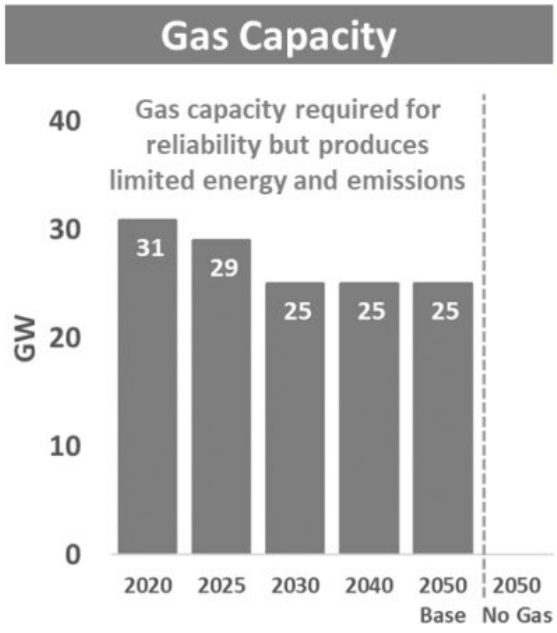
Highly Flexible System

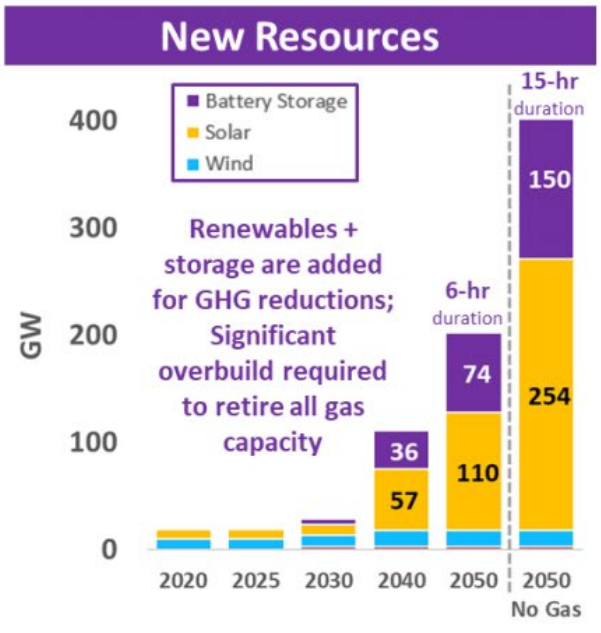
- **Significant investments** made in flexibility solutions
- **Curtailment does not occur** due to large amounts of flexibility



Case study: decarbonization and resource adequacy in California

- The least-cost portfolio to reduce economy-wide carbon emissions by 80% by 2050 includes very large quantities of solar and storage while retaining 17–25 GW of natural gas capacity for reliability
- Retiring gas and providing resource adequacy with only renewables and storage is technically feasible but prohibitively expensive



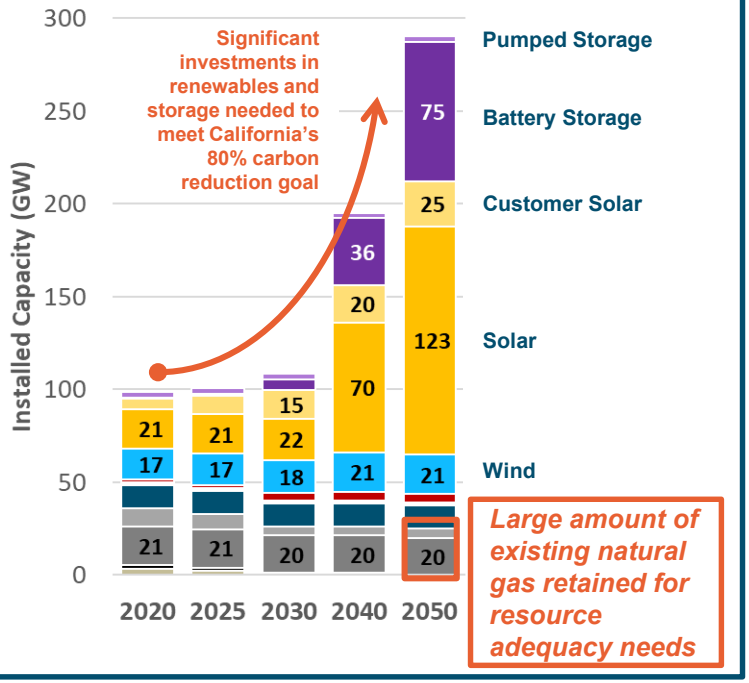


Results from Long Run Resource Adequacy Under Deep Decarbonization Pathways for California study for Calpine Corp

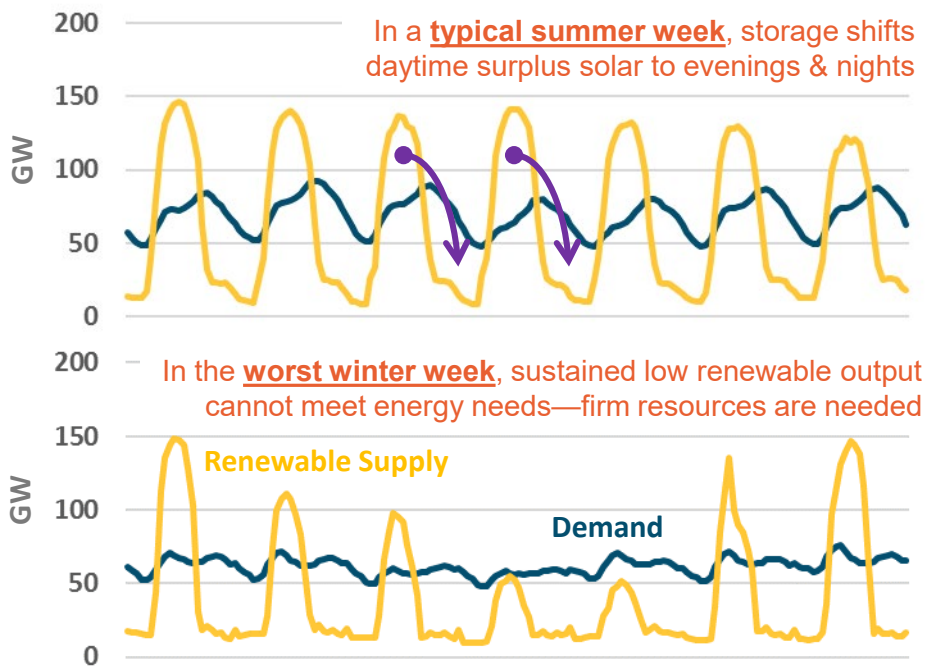
Case study: decarbonization and resource adequacy in California

+ **Key study finding: Meeting California's greenhouse gas goals will require investment in >100 GW of solar and significant quantities of energy storage—but a significant amount of gas generation capacity is still needed for reliability when solar is not available**

Investment needs to meet California goals



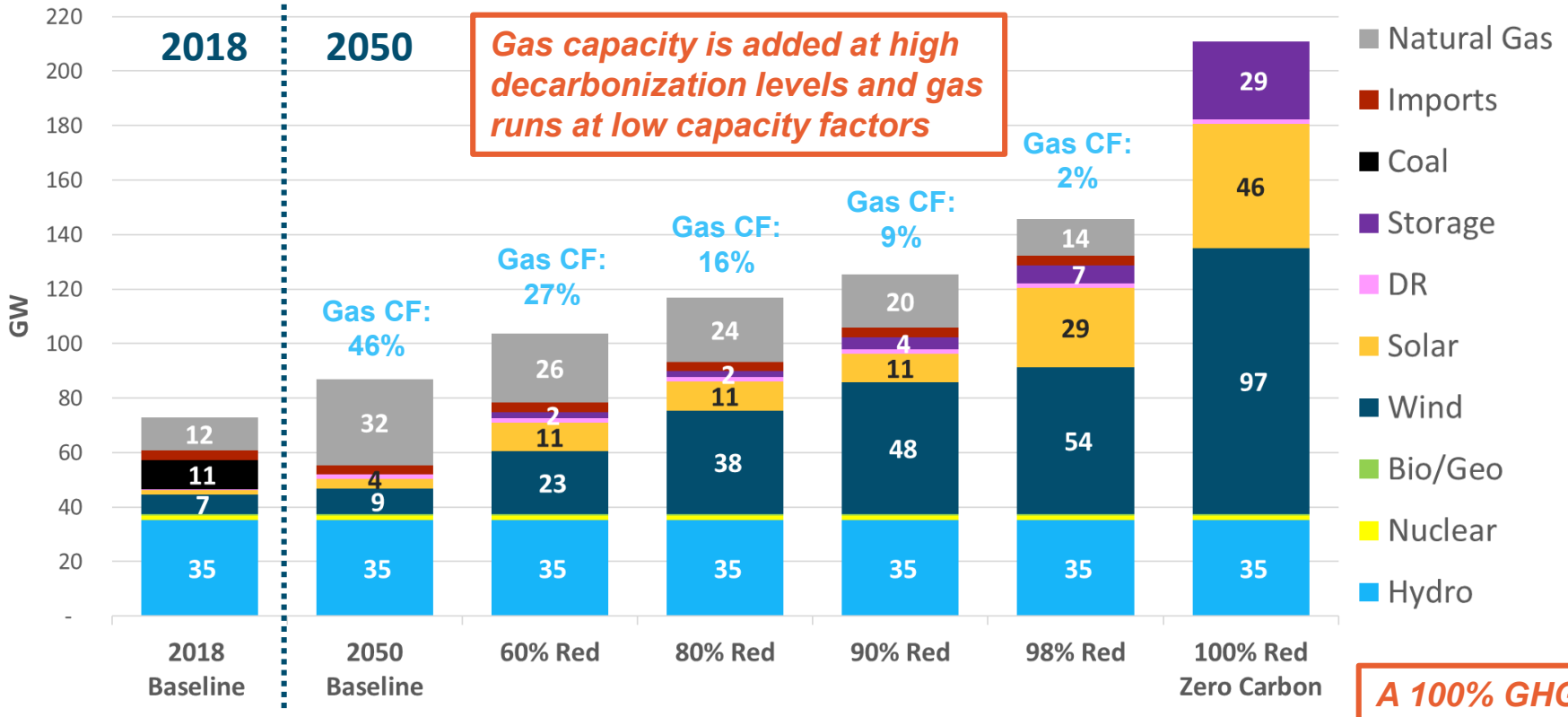
Diurnal balancing of solar becomes main challenge



Results from Long Run Resource Adequacy Under Deep Decarbonization Pathways for California study for Calpine Corp

Case study: decarbonization and resource adequacy in the Northwest

Total Installed Capacity by Scenario (MW)



GHG Reduction vs. 1990	16%	60%	80%	90%	98%	100%
Clean Energy Share (%)	63%	86%	100%	108%	117%	123%
Additional Cost ($/MWh)	Base	$0 - $7	$3 - $14	$5 - $18	$10 - $28	$52 - $89

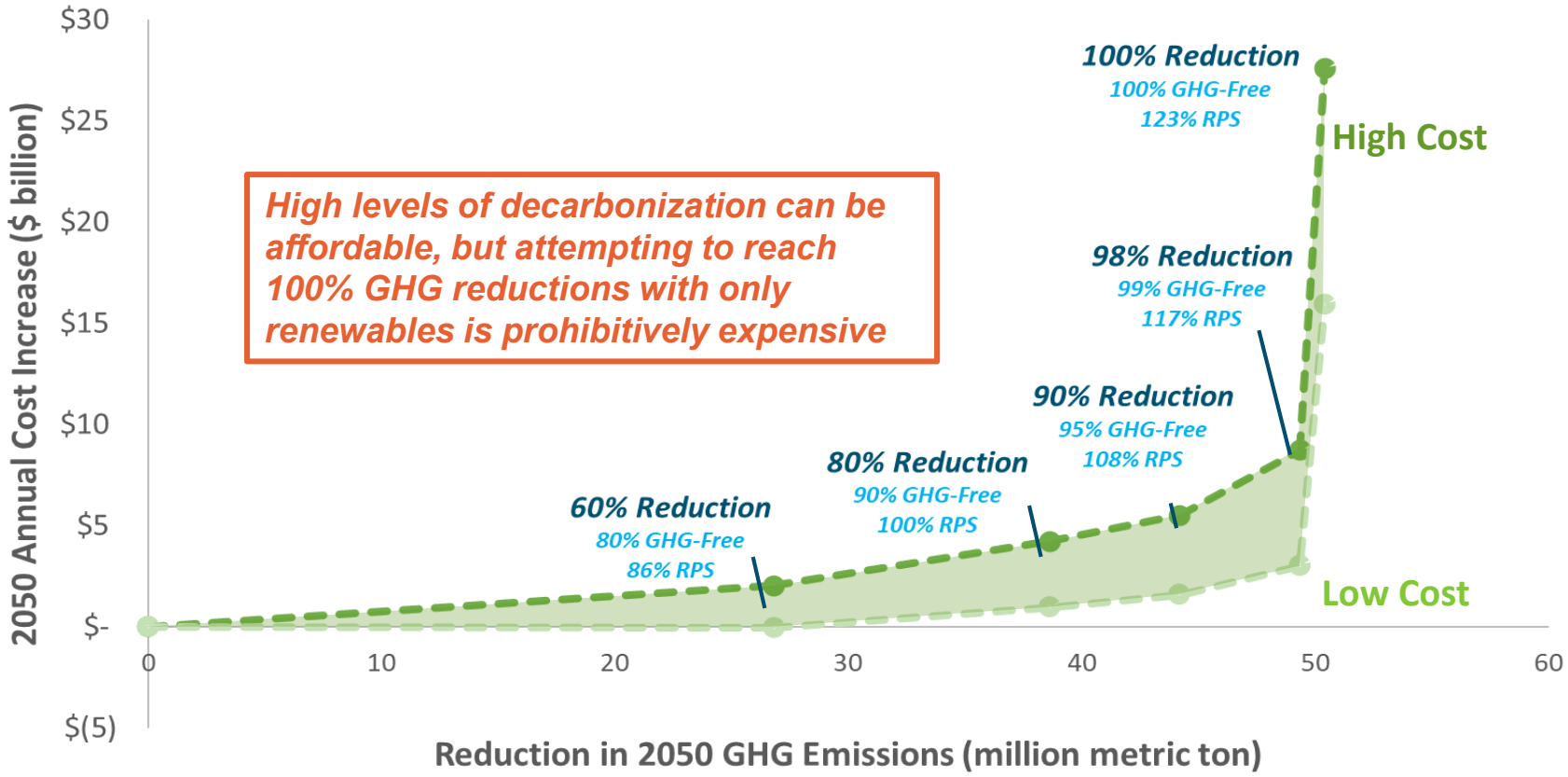
A 100% GHG reduction scenario results in high incremental costs

Results from Resource Adequacy in the Pacific Northwest study for a consortium of utilities

Case study: decarbonization and resource adequacy in the Northwest

+ Scenario analysis in the Northwest highlights low-cost opportunities to achieve significant GHG reductions with investment in renewables and coal retirements

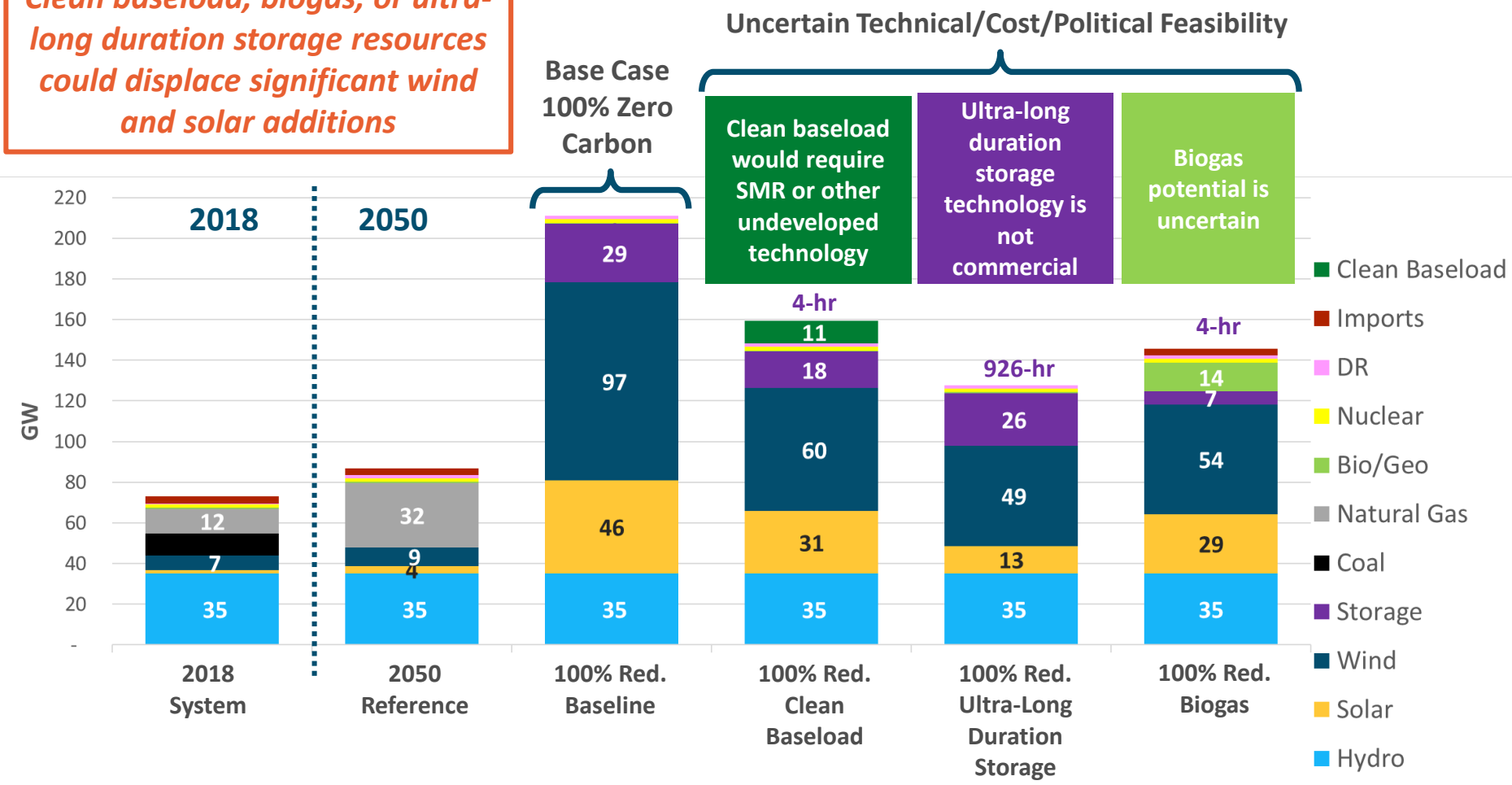
Annual Cost of Carbon Reductions in the Pacific Northwest



Results from Resource Adequacy in the Pacific Northwest study for a consortium of utilities

Case study: decarbonization and resource adequacy in the Northwest

Clean baseload, biogas, or ultra-long duration storage resources could displace significant wind and solar additions



Carbon (MMT CO2)	50	0	0	0	0
Annual Cost Delta ($B)	Base	$16- $28	$14-$21	$550-$990	$4 - $9
Additional Cost ($/MWh)	Base	$52-$89	$46-$69	$1,800-$3,200	$14 - $30

Summary

- **Reliability modeling ensures that the system has enough resources to ensure reliable system operations**
  - The PRM is calculated to ensure that the system has enough capacity to limit loss of load events to below the reliability target (i.e. to ensure resource adequacy)
  - The ELCC is calculated to credit non-dispatchable resources appropriately for the amount they contribute to resource adequacy
  - Past studies show that firm capacity is still needed in deeply decarbonized systems
- **Capacity expansion modeling informs future resource decisions**
  - Optimal portfolios minimize cost while achieving clean energy targets and maintaining reliability
  - Past studies show that renewables can be integrated cost effectively to achieve deep decarbonization
- **Every electricity system is different, so the results from the 2021 EPE IRP will differ from past studies**
  - Load and resource characteristics vary from system to system

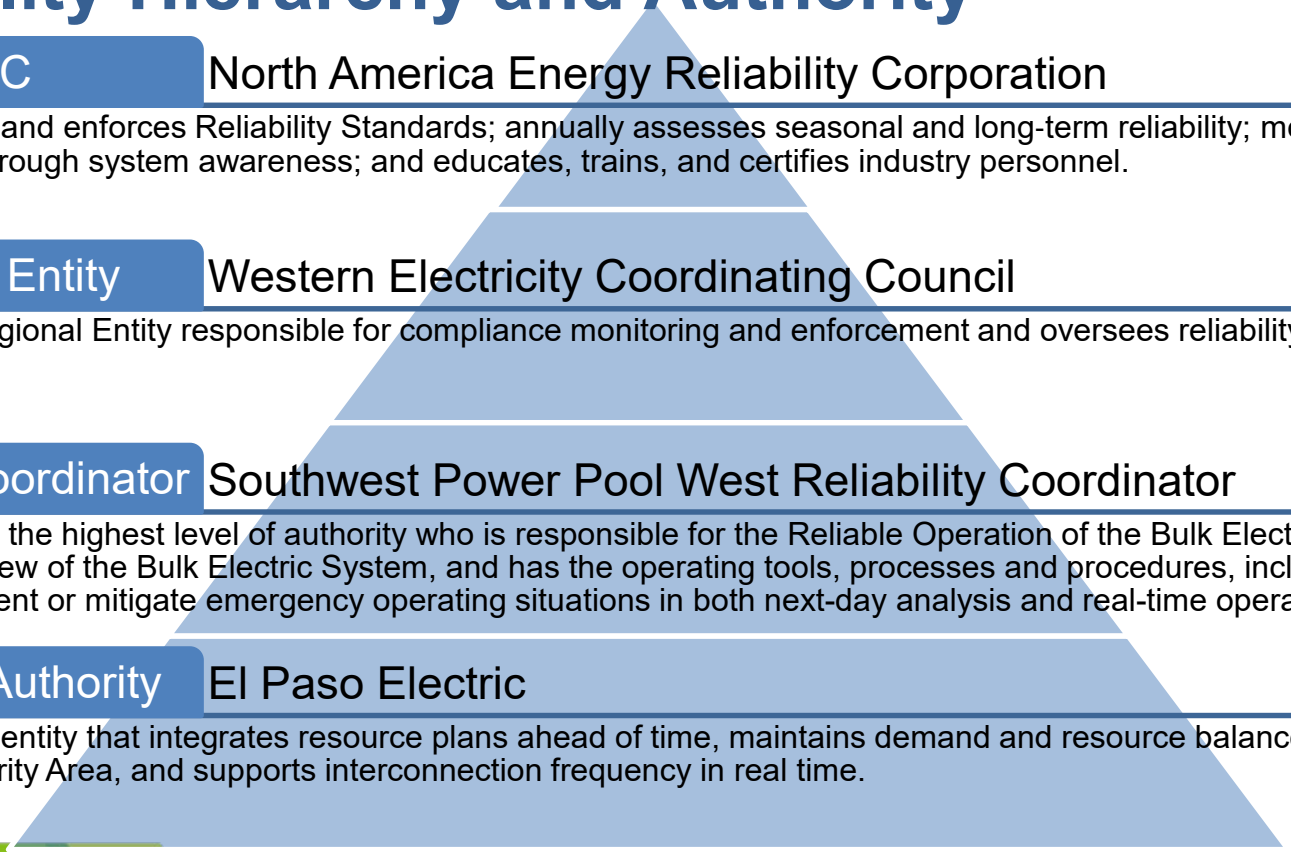
Energy+Environmental Economics

Thank You

SPP Reliability Coordinator for EPE

The Electric Company
El Paso Electric

Reliability Hierarchy and Authority



NERC — North America Energy Reliability Corporation

- NERC develops and enforces Reliability Standards; annually assesses seasonal and long-term reliability; monitors the bulk power system through system awareness; and educates, trains, and certifies industry personnel.

Regional Entity — Western Electricity Coordinating Council

- WECC is the Regional Entity responsible for compliance monitoring and enforcement and oversees reliability planning and assessments.

Reliability Coordinator — Southwest Power Pool West Reliability Coordinator

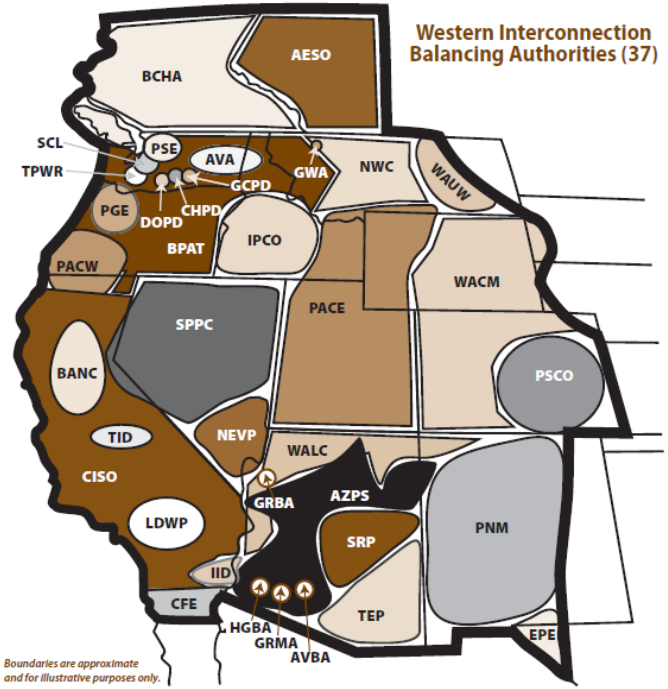
- The entity that is the highest level of authority who is responsible for the Reliable Operation of the Bulk Electric System, has the Wide Area view of the Bulk Electric System, and has the operating tools, processes and procedures, including the authority to prevent or mitigate emergency operating situations in both next-day analysis and real-time operations.

Balancing Authority — El Paso Electric

- The responsible entity that integrates resource plans ahead of time, maintains demand and resource balance within a Balancing Authority Area, and supports interconnection frequency in real time.

Western Interconnection Reliability Coordinators

- **Through 2019 WECC had one Reliability Coordinator for all WECC entities**
  - PEAK RC ceased operations as the Reliability Coordinator
- **Now the WECC has five Reliability Coordinators**
  - CAISO RC
  - Southwest Power Pool (West)
  - British Columbia Hydro and Power Authority
  - Grid Force
  - Alberta



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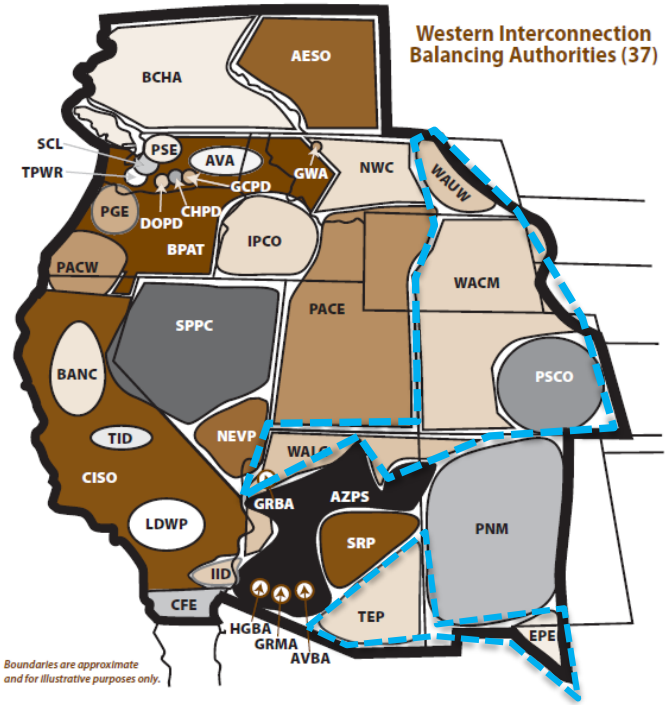
Western Interconnection Reliability Coordinators

- **SPP West RC provides operational and real-time oversight for compliance to reliability standards**
- **SPP West RC Members (blue dashed boundary)**
  - El Paso Electric (EPE)
  - Arizona Electric Cooperative
  - City of Farmington, NM
  - Tucson Electric Power (TEP)
  - Public Service Co. of Colorado (PSCO – Xcel Energy)
  - Tri-State G&T Association
  - Colorado Springs Utilities
  - Black Hills Energy (three utilities)
  - WAPA, WACM, WAUW
  - Platte River Power Authority
  - Intermountain Rural Electric Association



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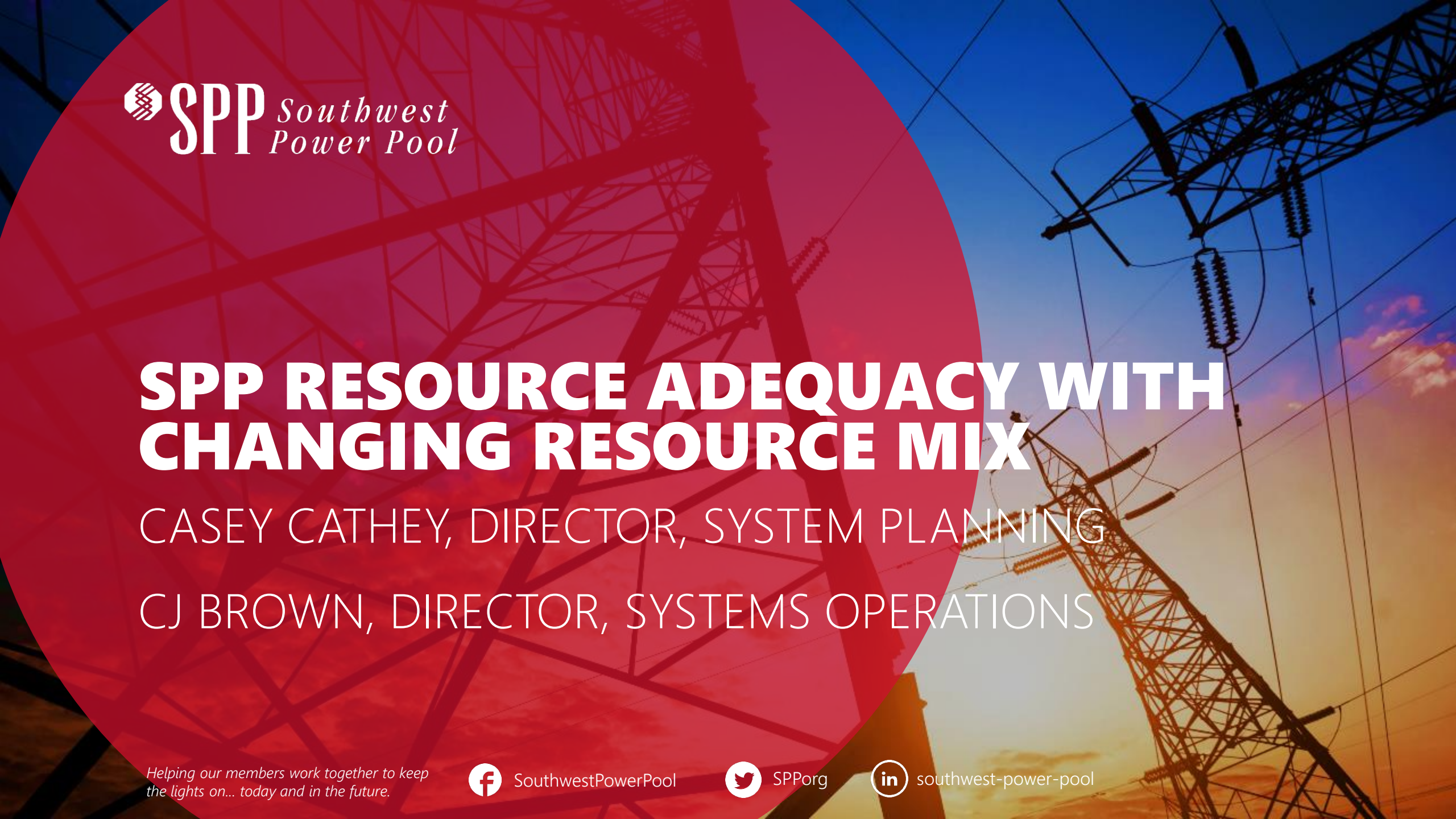
Southwest Power Pool

- SPP West RC is providing solely reliability coordination services for members from the WECC
- SPP in the Eastern Interconnect is a Regional Transmission Organization ensuring reliable supplies of power and adequate transmission infrastructure in addition to reliability coordination
- SPP invited to provide a reliability coordinator perspective on integrated resource planning



SPP Southwest Power Pool

SPP RESOURCE ADEQUACY WITH CHANGING RESOURCE MIX

CASEY CATHEY, DIRECTOR, SYSTEM PLANNING

CJ BROWN, DIRECTOR, SYSTEMS OPERATIONS

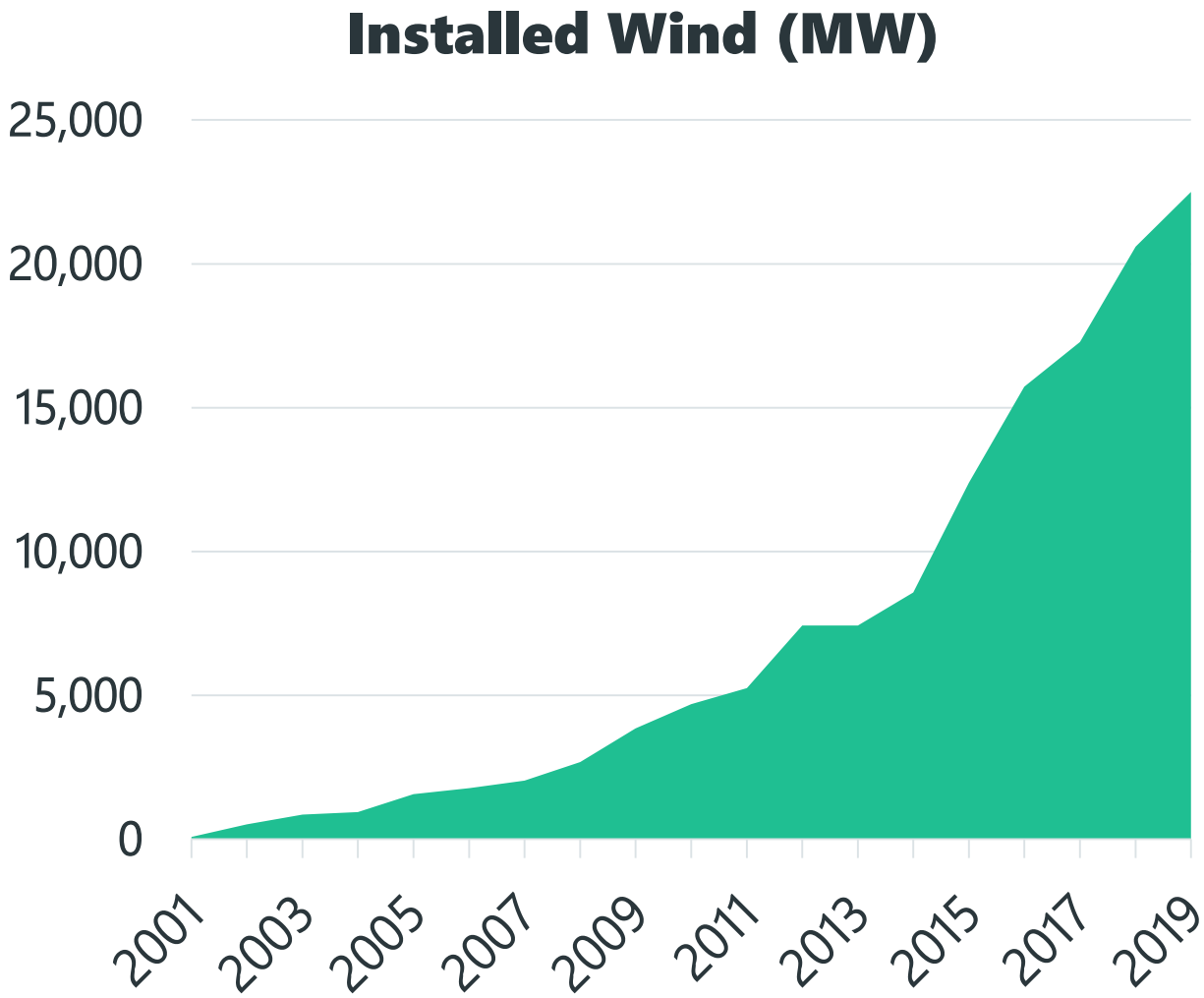
Helping our members work together to keep the lights on... today and in the future.

SouthwestPowerPool SPPorg southwest-power-pool

CURRENT CRITERIA AND ELCC DIRECTION

HISTORY OF CURRENT SPP CRITERIA

- Criteria was originally adopted in 2004, measuring wind resource performance during peak load hours
  - Modified in 2014 with similar method
- Since 2014, the SPP footprint has expanded geographically and wind on the system has increased to over 23,000 MW
- Current methodology does not take into consideration the effects of incremental wind or solar facilities added to the system
  - Results in overstating the capacity accreditation of these resources



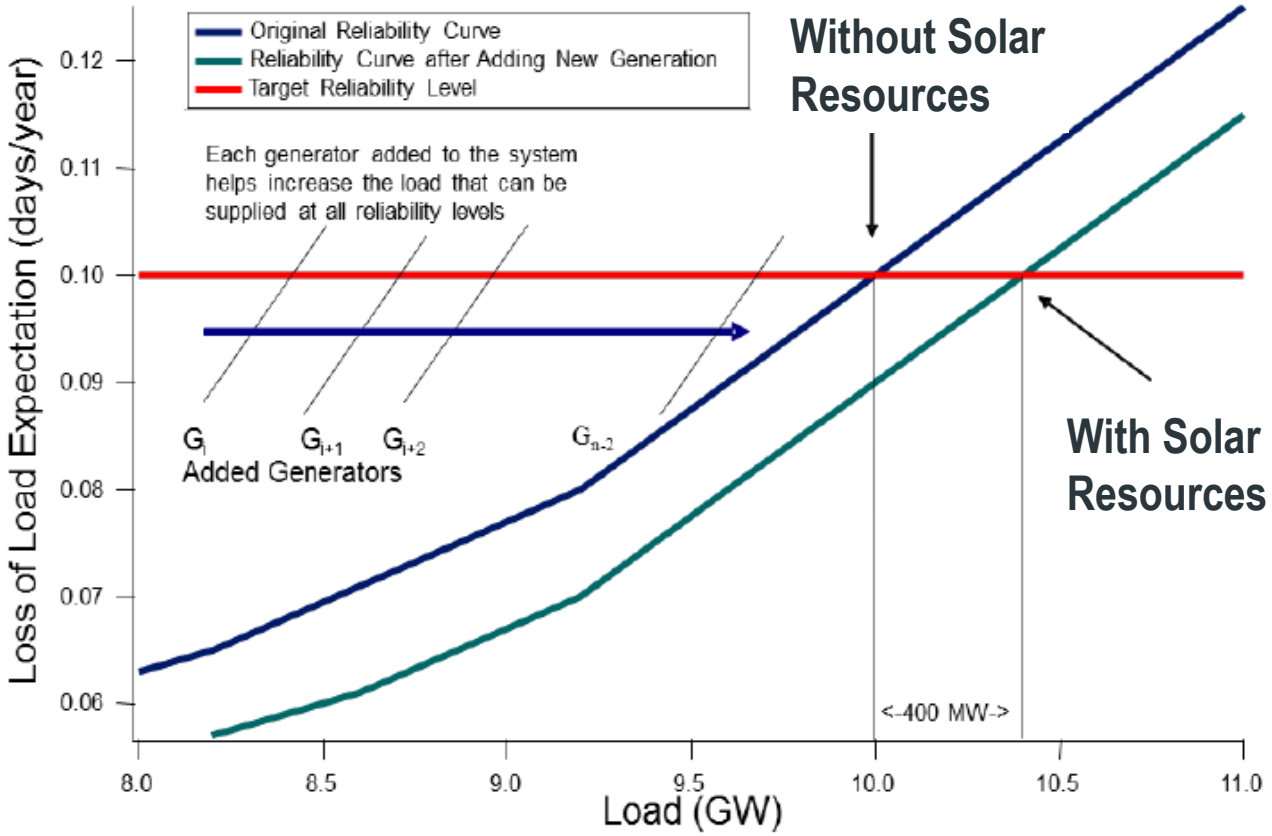
SUPPLY ADEQUACY WORKING GROUP (SAWG) EVALUATION OF WIND AND SOLAR ACCREDITATION

- In early 2018, SAWG directed SPP staff to explore ELCC as a method for accrediting wind and solar resources
- SAWG Goals
  - Review and research industry use of effective load carrying capability (ELCC methodology)
    - Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs), including MISO, NYISO, PacifiCorp, CAISO and PJM, utilize ELCC practices to determine capacity value of variable resources
  - Determine the reliability need for establishing ELCC methodology in SPP
  - Determine the amount of accredited capacity for wind in the SPP footprint, based on ELCC-based methodology
  - Compare ELCC results to SPP Planning Criteria methodology

ELCC OVERVIEW

- Effective load carrying capability (ELCC) is the amount of incremental load a resource can dependably and reliably serve during peak hours

- To effectively measure the ELCC of a resource, its ability to serve load reliably has to be determined
  - This is accomplished by calculating the loss of load expectation (LOLE) of the system with and without the studied resource
  - SPP utilizes the reliability metric of 1 day in 10 years (or 0.1 day/year), which is also used in the SPP LOLE analysis

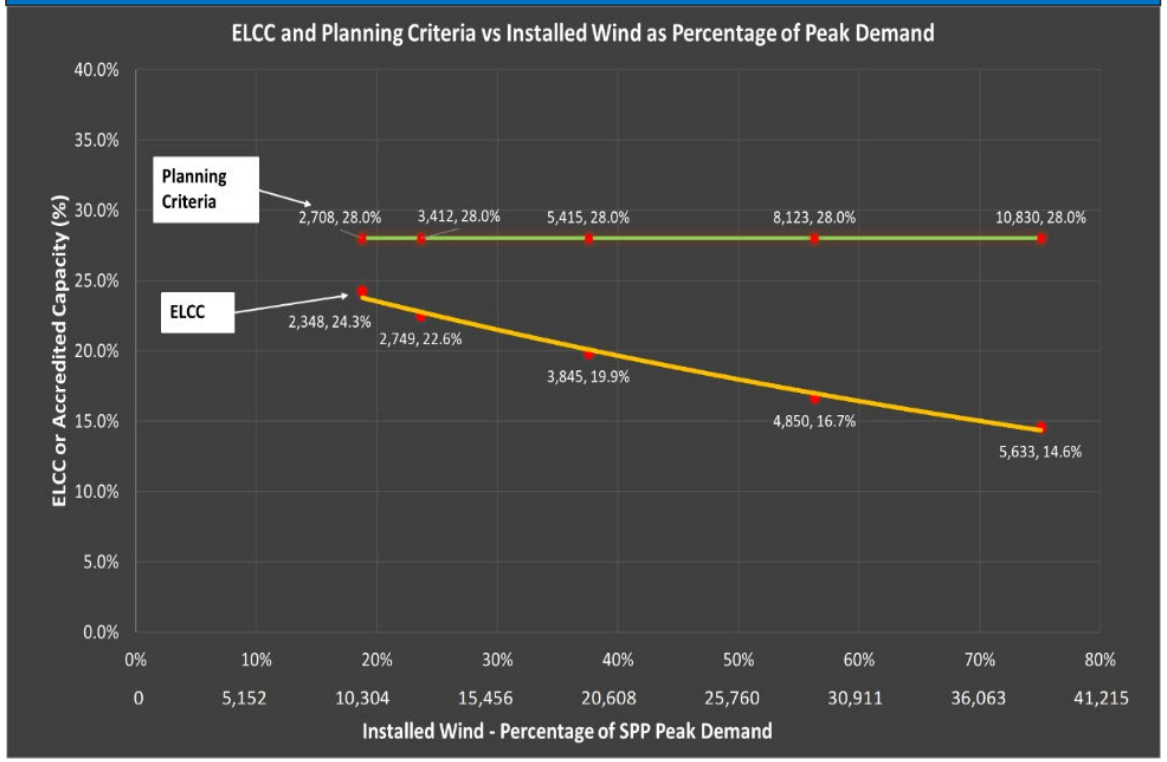


SAWG DIRECTION

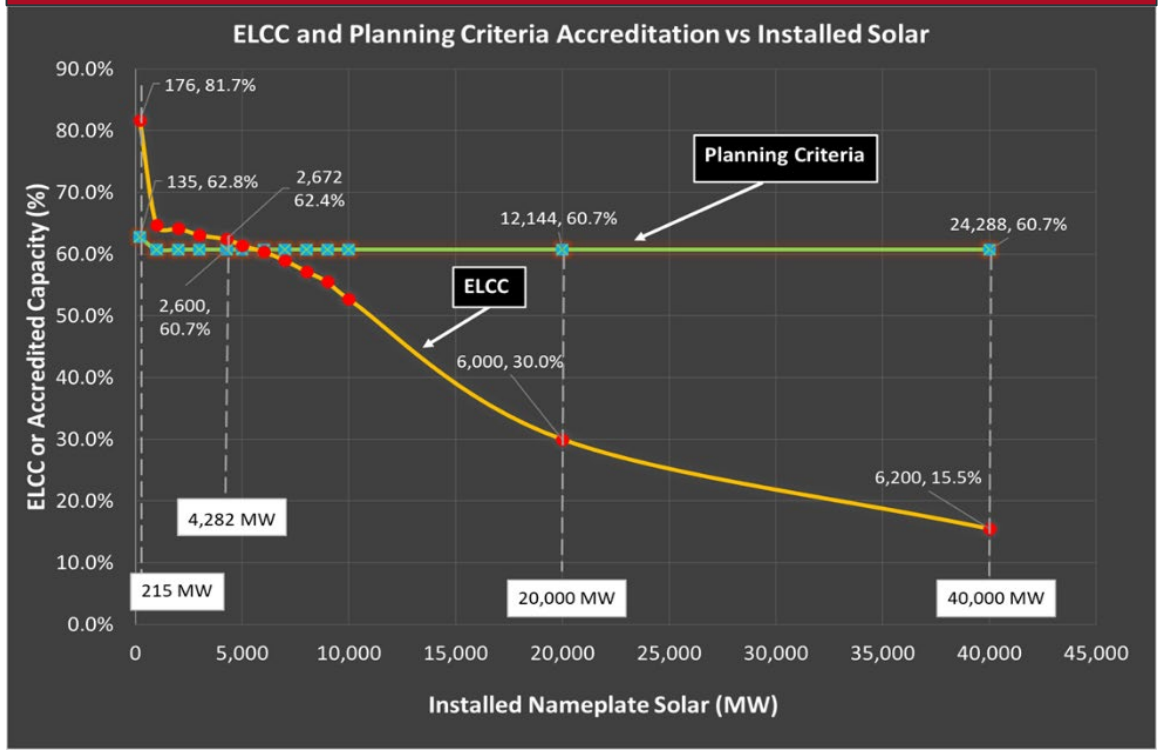
- March 2019 - SAWG approved the use of ELCC as the guiding principle for the accreditation of solar, wind and storage resources in the SPP Balancing Authority, replacing the current accreditation methodology found in section 7.1.5.3 (7) of the SPP Planning Criteria once new criteria language is approved
- Develop ELCC whitepaper based on SAWG direction using ELCC wind and solar ELCC study results as guidance.
  - Multiple straw polls to develop policy whitepaper
- ELCC educational sessions in 2019 and 2020
  - MOPC, RSC, CAWG, ORWG, ESWG, TWG, CWG, NEDTF

RESULTS OF WIND AND SOLAR ELCC STUDY

Wind



Solar



IMPLEMENTATION TIMELINE AND NEW FACILITIES

- ELCC will be performed annually, beginning in 2020, for both the summer and winter seasons.
  - Results will be used as informational only
- Starting with the 2023 summer season, all wind and solar resources will be accredited using the ELCC methodology.
- For facilities that come into service between the annual ELCC studies, the facility would receive a 10% accreditation for wind and a 50% accreditation for solar for the upcoming summer peak season or the average of the lowest tier (tier three), whichever is lower

REAL TIME OPERATION PREPARATION FOR WIND

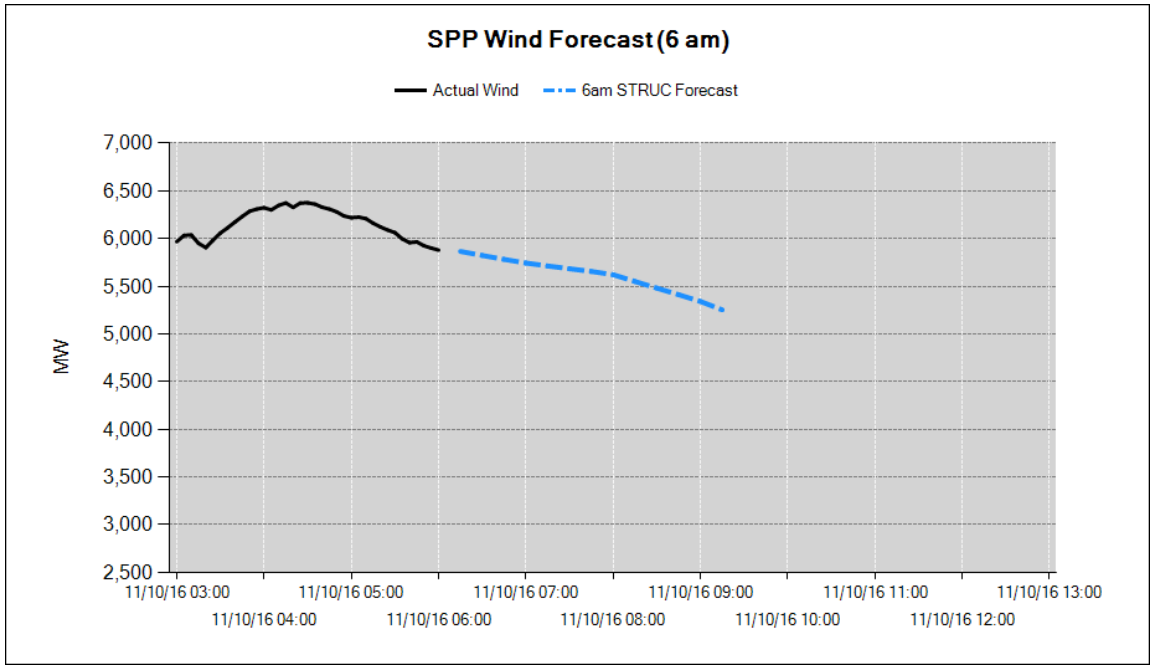
REAL TIME OPERATIONS PREPARATION FOR THE WIND

- SPP Operations personnel begin analyzing high wind Operating Days at least 7 days in advance, even longer in some cases
- All starts with Multi-Day Reliability Assessment (MDRA) and subsequent Reliability Unit Commitment (RUC) studies
  - Analyzes capacity needs, while maintaining thermal loading
  - Various sensitivities/studies performed to account for:
    - Wind forecast errors
    - Load forecast errors
    - Topology changes
- Offline Voltage Stability Assessment (VSA) performed days in advance
  - Ensures the loss of critical facilities does not violate voltage criteria

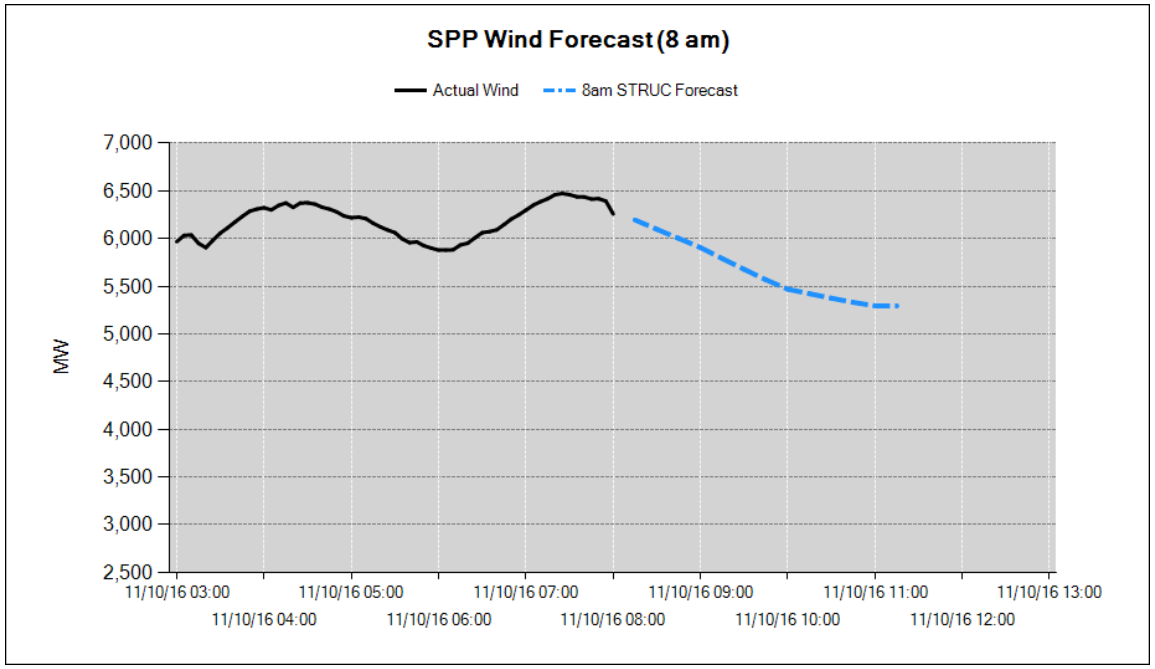
REAL TIME OPERATIONS PREPARATION FOR THE WIND

- Uncertainty Response Team – commonly referred to as URT
  - On a daily basis work with the RUC and Balancing operators to ensure SPP BA has sufficient capacity available to mitigate maximum historical error levels with wind and load forecast over the next seven days. Evaluates the possible need to commit long lead resources that would be unavailable from Day Ahead Market and Day Ahead Reliability Unit Commitment studies.

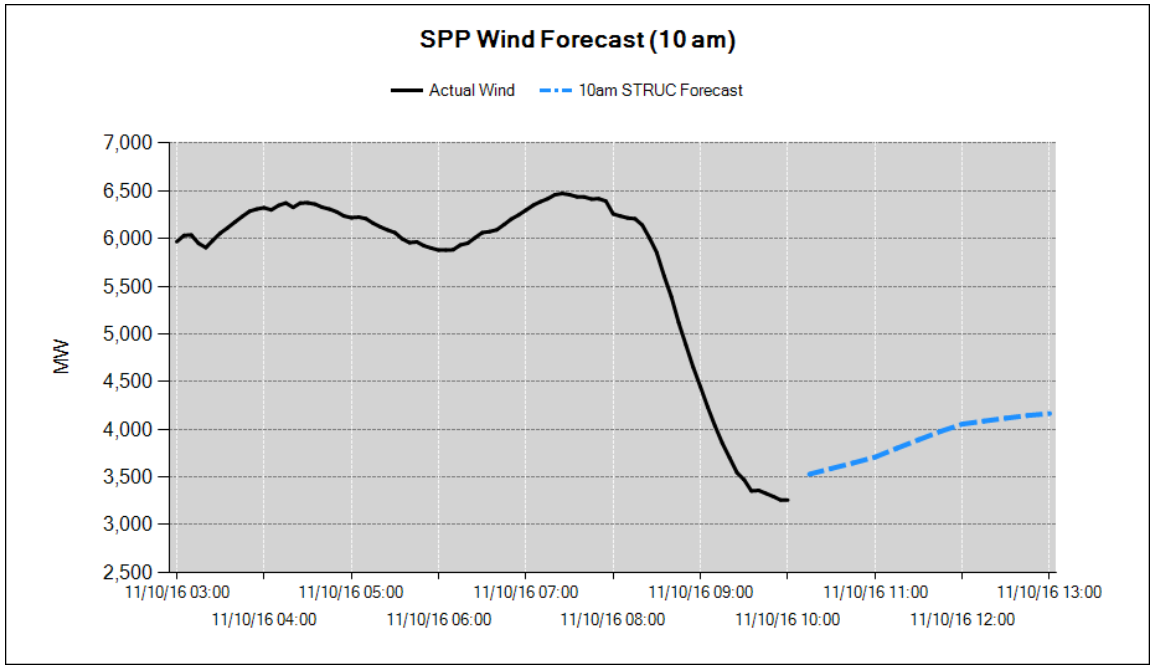
WIND FORECAST (6 AM)



WIND FORECAST (8 AM)



WIND FORECAST (10 AM)



ELCC ALLOCATION PROCESS

ELCC DATA CONSIDERATIONS

- The accreditation for tier one and two is based on peak hours corresponding to individual LRE load shapes, which the capacity is dedicated to serve
- The accreditation for tier three is based on SPP BA load shape
- The available accredited capacity from the ELCC study will be allocated by selecting the average hourly net power output values occurring during the top 3% of load hours for the peak season being analyzed
  - Top 3% of LRE load (tier one and two resources)
  - Top 3% of SPP BA load (tier three resources)

CONSIDERATION OF COMMERCIAL OPERATION DATES

- A new wind or solar facility that has been in-service for less than 3 years, on-site weather data and facility attributes may be used to create power production estimates by the facility owner or operator and provide to SPP
- Facilities greater than 3 years will include no more than the most recent 10 years of metered hourly net power output data at the point of interconnection
- If a wind or solar facility in commercial operation greater than three years undergoes a technology change, SPP will continue to use the previous 10 years MW output unless the LRE/GO designates to treat the existing facility as new facility
  - If designated as a new facility it will be considered a wind or solar facility that has been in commercial operation three years or less.

NEXT STEPS

- SPP staff and the stakeholder driven Supply Adequacy Working Group are currently reviewing and revising the Revision Request (RR418) that will implement the approved white paper policies.

Schedule and Future Meetings

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Meeting Schedule

Date	Meeting	Day	Time
7/10/2020	**First Meeting - Present 2018 IRP, Load Forecast, and L&R**	**Fri**	**2:00 PM**
	Overview of EPE's 2018 IRP, 2020 L&R, Discuss 2025 ETA		
	Economic Research Analysis		
8/14/2020	**Second Meeting - Discuss Resource Options**	**Fri**	**2:00 PM**
	EPE Resource Options		
	Load Management/Demand Response Programs		
	Request for Public Input of Resources		
10/7/2020	**Third Meeting - Present Expansion Modeling**	**Wed**	**2:00 PM**
	Introduce Transportation Electrification		
	Energy Imbalance Markets		
	Reserve Margin Requirements		
	Expansion Modeling		
5/14/2021	**Fourth Meeting - Present Preliminary Resource Portfolio (Draft I**	**Fri**	**2:00 PM**
	EPE Resource Planning and E3 - Draft IRP		
6/15/2021	**Fifth Meeting - Present Final Resource Portfolio (Final IRP)**	**Tue**	**2:00 PM**
	EPE Resource Planning and E3 - Final IRP		
7/1/2021	**Final Meeting - Receive feedback on Final IRP**	**Thu**	**2:00 PM**
	EPE Resource Planning - Feedback		
7/15/2021	**File at NMPRC**	**Thu**	**2:00 PM**

Next Meeting May 14, 2020

- **EPE Resource Planning and E3 – DRAFT IRP**

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Thank you!

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