Forecasting Resource Adequacy in Southwest Power Pool Through 2035

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OBJECTIVE: Model Resource Adequacy & Cost For Three Scenarios

1. Develop Reasonable Accreditation Values for Wind & Solar

- 2018-2022 hourly dataset.
- Peak load availability.
- Net peak load availability.

2. Reference Scenario

- SPP/EIA planned additions (2.9 GW Gas, 1.4 GW Wind, 740 MW Solar, 60 MW Battery Storage) and retirements (2.9 GW Coal, 2.4 GW Gas, 40 MW Other) by 2035.
- Replace rest with modeled wind (15.7 GW), solar (23.2 GW), and four-hour storage (9.8 GW)
- Peak load and net load.

3. Ozone Transport Rule (OTR) & Coal Combustion Residual (CCR) Scenario

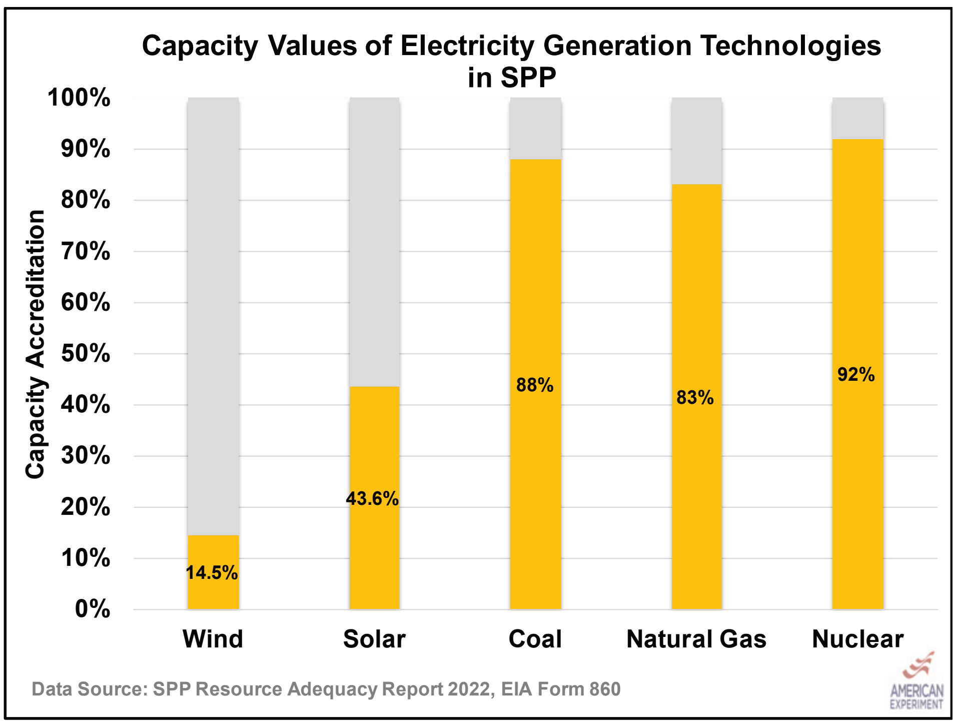
- Loss of 22 GW of coal and 6.3 GW of gas by 2035.
- Replace with natural gas (2.9 GW), wind (69.7 GW), solar (101.7 GW), and four-hour storage (29.9 GW).
- Peak load and net load.

Wind and Solar ELCC Methodology Reversed At FERC

- SPP had planned to base wind and solar accreditation on their effective load carrying capacities (ELCC)
- After initially being approved by FERC, the Commission reversed its decision arguing all generators should be required to undergo an ELCC analysis, not just wind and solar.
- FERC Commissioners also disagreed on whether SPP had failed to define seasonal net peak load.
- This leaves the accreditation of wind and solar in limbo as SPP continues to go through the FERC rehearing process.

SPP's 2022 Capacity Accreditation by Resource

- Technologies are given different accreditation values based on their reliability during times of peak electricity demand.
- Nuclear, coal, and natural gas get the highest accreditation values.
- Wind and solar get much lower accreditation values.



We need a standard that treats each resource type as an independent variable to model resources adequacy as more thermal plants retire and the grid becomes increasingly reliant upon wind, solar, and battery storage.

- SPP may be moving toward seasonal ELCC accreditation to more accurately accredit wind and solar, but this may or may not solve the problem because ELCC is based on the marginal ability to serve load with an existing thermal fleet.
- Wind was assumed to produce 14.5 percent of potential output during peak hours and new solar was expected to produce 43.6 causing "Phantom Firm" resources to potentially be counted as accredited capacity.

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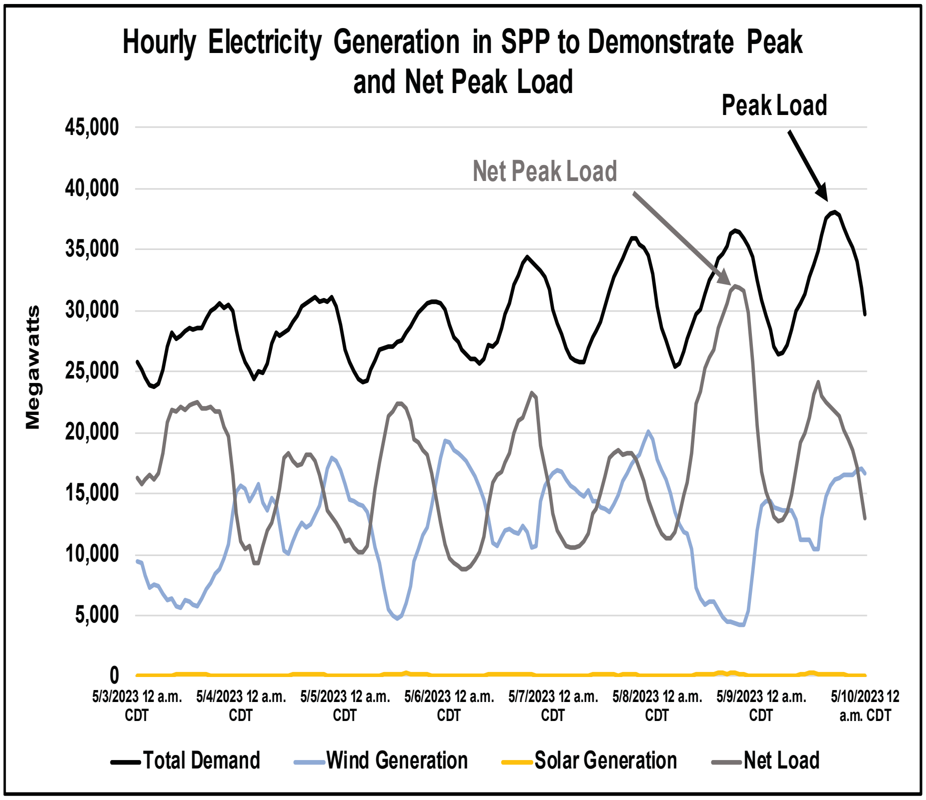
Methodology—Developing a Standardized Capacity Accreditation for Renewable Resources



Assess wind and solar variability during peak load and net peak load hours

- **Peak Load:** The hours with the highest electricity demand.
- **Net peak load:** Gross demand minus wind and solar generation, which allows us to assess the highest demand hours where wind and solar output is the lowest. This is the standard new wind and solar resources should be judged by going forward.
- Used the last 4 years of data from EIA Hourly Grid Monitor and Form 923. Peak and net peak occurred on July 19, 2022, and August 6, 2019, respectively.
- Highest Certainty Deliverability (HCD) to assess wind and solar accreditation.
- Sample size of 2,000 hours for wind & solar of the highest peak & net peak hours across 4 years.
- Took the mean of the lowest 25 percent of wind and solar output during those hours to come up with our accredited capacity values for peak and net peak.
- Using this methodology, we developed peak capacity and net peak capacity values for wind and solar.

	Peak Accreditation	Net Peak Accreditation
Wind	11.8%	7.5%
Solar	16.4%	20.4%

How does the ND Study's HCD Approach Differ from SPP's Proposed New Seasonal ELCC Approach?

- HCD peak accreditation values for wind and solar are consistent with SPP's ELCC values (summer and winter for wind, winter for solar).
- HCD net peak accreditation values for wind and solar are lower than SPP's ELCC values.

HCD approach is valuable for a few reasons:

- As more wind & solar are added to the grid, net peak will become more challenging than peak load demand.
- HCD manages the downside of wind & solar at net peak compared to the ELCC methods currently under consideration by SPP.

SPP APPROACH

Table 1. Summer Wind ELCC Tier Result

2022 Allocated ELCC Summer Wind by Tier (MW)			
	TIER 1	TIER 2	TIER 3
Tier ELCC (MW)	2,952	404	1,978
Tier Nameplate (MW)	13,211	2,808	16,448
Tier ELCC (%)	22%	14%	12%

Table 2. Winter Wind ELCC Tier Result

2022 Allocated ELCC Winter Wind by Tier (MW)			
	TIER 1	TIER 2	TIER 3
Tier ELCC (MW)	2,949	654	2,083
Tier Nameplate (MW)	11,745	4,274	16,448
Tier ELCC (%)	25%	15%	13%

Table 3. Summer Solar ELCC Tier Result

2022 Summer ELCC Solar			
	TIER 1	TIER 2	TIER 3
Tier ELCC (MW)	181	0	202
Tier Nameplate (MW)	235	0	327
Tier ELCC (%)	77%	0%	62%

Table 4. Winter Solar ELCC Tier Result

2022 ELCC Winter Solar			
	TIER 1	TIER 2	TIER 3
Tier ELCC (MW)	87	0	86
Tier Nameplate (MW)	235	0	327
Tier ELCC (%)	37%	0%	26%

HCD ALTERNATOVE APPROACH

Highest Certainty Deliverability	Peak Accreditation	Net Peak Accreditation
Wind	11.8%	7.5%
Solar	16.4%	20.4%
Reserve Margin	12.0%	12.0%

Conclusions

1. Our findings represent a best-case scenario for reliability due to our HCD accreditation

2. Different standards, such as seasonal accreditation ELCC being explored by SPP, will produce varying levels of reliability that must be examined in light of these results.

3. Costs were relatively modest due to the large amount of thermal capacity remaining on the SPP system through 2035, but costs increase **substantially** as more thermal retirements occur and Load Responsible Entities (LREs) attempt to replace this lost generation with wind, solar, and battery storage.

4. Policymakers must understand the challenges regarding reliability, resiliency and affordability that are growing every year.