A Review of the Latest Developments in ISO/RTOs Across the Country

NARUC Bulk Power System Learning Module

April 2, 2024

Zach Ming, Sr. Director
When all reliability risk was concentrated in peak periods, simplifications such as “availability during peak” made perfect sense.
As penetrations of renewables and energy storage resources have increased, accreditation methods have needed to evolve.
The Three Broad Categories of Resource Accreditation

Texas Performance Credit Mechanism (PCM)

California Slice-of-Day

... but, they both look a lot like Marginal ELCC ...
Resource accreditation is based on availability during highest reliability risk hours.

Total Reliability Requirement = average load + operating reserve requirements – allowable loss of load during reliability risk hours

Renewable Resource Accreditation = average renewable availability during reliability risk hours

Storage Resource Accreditation = average storage availability during reliability risk hours

Thermal Resource Accreditation = average thermal availability during reliability risk hours
Capacity Requirements are *Lower Than The Gross Peak*

**Gross peak and Marginal Reliability Need**

<table>
<thead>
<tr>
<th>Gross Peak</th>
<th>Margin Reliability Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>93,000</td>
<td>66,940</td>
</tr>
</tbody>
</table>

72% of Gross Peak

**ERCOT Source**

**Gross peak and Marginal Reliability Need**

<table>
<thead>
<tr>
<th>Gross Peak</th>
<th>Margin Reliability Need</th>
</tr>
</thead>
<tbody>
<tr>
<td>150,640</td>
<td>131,820</td>
</tr>
</tbody>
</table>

88% of Gross Peak

Marginal Reliability Need lower due to the difference between the Gross and Net Peak

**PJM Source**
What’s Happening in Capacity Right Now?

<table>
<thead>
<tr>
<th>ISO</th>
<th>Past</th>
<th>Present</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYISO</td>
<td>Availability During Peak</td>
<td>Marginal ELCC</td>
<td>Marginal ELCC</td>
</tr>
<tr>
<td>PJM</td>
<td>Average ELCC</td>
<td>Marginal ELCC</td>
<td>Marginal ELCC</td>
</tr>
<tr>
<td>MISO</td>
<td>Average ELCC (filed)</td>
<td>Marginal ELCC</td>
<td>Marginal ELCC</td>
</tr>
<tr>
<td>SPP</td>
<td>Availability During Peak</td>
<td>Average ELCC (filed)</td>
<td>?</td>
</tr>
<tr>
<td>ISONE</td>
<td>Availability During Peak</td>
<td>Availability During Peak</td>
<td>Marginal ELCC?</td>
</tr>
<tr>
<td>ERCOT</td>
<td>N/A</td>
<td>N/A</td>
<td>Performance Credit Mechanism</td>
</tr>
<tr>
<td>CAISO</td>
<td>Availability During Peak</td>
<td>Average ELCC</td>
<td>Slice of Day?</td>
</tr>
</tbody>
</table>
The Early Movers to Marginal ELCC

1. FERC approved NYISO move to marginal capacity accreditation in late 2022

2. PJM filed to FERC for marginal capacity accreditation Oct 2023 and received approval in 2024

3. MISO filed a marginal capacity framework with FERC last week (March 2024) and now awaits approval
Step 1: Calculate Resource Class Marginal ELCC Values

Step 2: Calculate Individual Resource Performance Adjustment Factors

Naming conventions vary by ISO

Illustrative ELCC Values Across Technologies

- Wind
- Solar
- Storage (4 hr)
- Storage (8 hr)
- Hydro
- Demand Response
  - Natural Gas Intermittible Service
  - Natural Gas Firm Pipeline Service
  - Natural Gas On-Site Fuel Storage

Marginal Reliability Improvement (MRI)
Marginal Effective Load Carrying Capability (Marginal ELCC)
Direct Loss of Load (DLOL)
SPP filed to FERC a proposed update to capacity accreditation in March 2024 for an average ELCC for renewables/storage and average forced outage for thermal.

ISONE has previously indicated it is moving toward a marginal framework.

An ongoing proceeding is underway regarding capacity accreditation with developments expected in 2024.

The process has been hampered by technical modeling issues as well as unique challenges geographic challenges around fuel deliverability constraints.
Each load-serving entity must procure sufficient capacity with each month/hour “slice”
- 12 months x 24 hours = 288 different compliance periods

Renewables are accredited using a percentile method “e.g. 80% worst day” that is overall calibrated to achieve 1-in-10 system reliability

Issues
- (Unnecessarily) complex
- Compliance is achieved based on matching one’s own load as opposed to providing system value
- Compliance values almost ensure misalignment (i.e. “worst” load days almost definitionally do not occur on the “worst” solar days)

Benefits
- But … value will be concentrated in the same hours as marginal ELCC (e.g. net peak hours) yielding similar economic outcomes

Next Steps
- At the same time as the California Public Utilities Commission (CPUC) is writing detailed rules for the implementation of slice-of-day, the Commission is actively exploring moving beyond this framework through the implementation of marginal ELCC
Texas Performance Credit Mechanism

+ Functions similarly to a marginal ELCC framework with all compensation occurring based on actual availability during tight hours (as opposed to ex-ante modeled availability)

2022: Public Utility Commission of Texas unanimously adopts PCM
2024: ERCOT working to write detailed rules of PCM implementation
2026+: Implementation

Performance credit hours

Availability during performance credit hours generates performance credits for resources

Demand during performance credit hours generates performance credit obligation for loads
<table>
<thead>
<tr>
<th>ISO</th>
<th>Past</th>
<th>Present</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYISO</td>
<td>Availability During Peak</td>
<td>Marginal ELCC</td>
<td>Marginal ELCC</td>
</tr>
<tr>
<td>PJM</td>
<td>Average ELCC</td>
<td>Marginal ELCC</td>
<td>Marginal ELCC</td>
</tr>
<tr>
<td>MISO</td>
<td>Average ELCC</td>
<td>Marginal ELCC</td>
<td>Marginal ELCC</td>
</tr>
<tr>
<td>SPP</td>
<td>Availability During Peak</td>
<td>Average ELCC</td>
<td>?</td>
</tr>
<tr>
<td>ISONE</td>
<td>Availability During Peak</td>
<td>Availability During Peak</td>
<td>Marginal ELCC?</td>
</tr>
<tr>
<td>ERCOT</td>
<td>N/A</td>
<td>N/A</td>
<td>Performance Credit Mechanism</td>
</tr>
<tr>
<td>CAISO</td>
<td>Availability During Peak</td>
<td>Average ELCC</td>
<td>Slice of Day?</td>
</tr>
</tbody>
</table>
+ **Installed Capacity (ICAP)**
  - Imperfections of thermal were not recognized through a de-rating of these resources but rather through an increase in the total requirement of resources (i.e. planning reserve margin)
  - Created relatively little distortion until de-rating renewables led to an apples-to-oranges contribution toward planning reserve margin

+ **Unforced Capacity (UCAP)**
  - De-rate thermal plants based on uncorrelated forced outages
  - Inconsistent with how renewables are treated (i.e. windless periods affect all wind resources at the same time)

+ **Marginal ELCC**
  - Simulate thermal resources identically to renewable and storage resources
What Do Marginal ELCCs Look Like?

Illustrative Marginal ELCC Values for California

PJM 2025/2026 Marginal ELCC Class Ratings

<table>
<thead>
<tr>
<th>ELCC Class</th>
<th>Final Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore Wind</td>
<td>35%</td>
</tr>
<tr>
<td>Offshore Wind</td>
<td>60%</td>
</tr>
<tr>
<td>Solar Fixed Panel</td>
<td>9%</td>
</tr>
<tr>
<td>Solar Tracking Panel</td>
<td>14%</td>
</tr>
<tr>
<td>Landfill Gas Intermittent</td>
<td>54%</td>
</tr>
<tr>
<td>Hydro Intermittent</td>
<td>37%</td>
</tr>
<tr>
<td>4-hr Storage</td>
<td>59%</td>
</tr>
<tr>
<td>6-hr Storage</td>
<td>67%</td>
</tr>
<tr>
<td>8-hr Storage</td>
<td>68%</td>
</tr>
<tr>
<td>10-hr Storage</td>
<td>78%</td>
</tr>
<tr>
<td>DR</td>
<td>76%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>95%</td>
</tr>
<tr>
<td>Coal</td>
<td>84%</td>
</tr>
<tr>
<td>Gas CC</td>
<td>79%</td>
</tr>
<tr>
<td>Gas CT</td>
<td>62%</td>
</tr>
<tr>
<td>Gas CT Dual Fuel</td>
<td>79%</td>
</tr>
<tr>
<td>Diesel</td>
<td>92%</td>
</tr>
<tr>
<td>Steam</td>
<td>75%</td>
</tr>
</tbody>
</table>
Strong and consistent penalties ensure that resources perform as they are accredited, mitigating the incentive to sell capacity above actual capability which has the double impact of creating phantom capacity and depressing prices, pushing actual capacity out of the market.

**The Role of Performance Penalties**

- **Must-offer Obligation Only**
  - No bonuses and/or penalties for lack of performance
  - [MISO](https://www.misoenergy.org)

- **Performance bonus/penalties during scarcity events only**
  - Bonus and/or penalties for performance during scarcity events, evaluated after events
  - [SPP](https://www.spp.org)

- **Performance bonus/penalties during tightest hours each period**
  - Guaranteed bonus and/or penalties for performance during a set of hours each season/year, evaluated after each period
  - [ISO New England](https://www.iso-ne.com)
  - [PJM](https://www.pjm.com)

**Weaker**

**Stronger**

Adapted from [source](https://www.eecon.com), *Capacity market design and renewable energy: Performance incentives, qualifying capacity, and demand curves*.
Capacity market design has been an area of ongoing refinements in the two+ decades of their history.

Active issues that ISOs are currently exploring include:

- Setting capacity requirements and accrediting resources on an annual or seasonal basis.
- Running capacity market auctions on a multi-year forward or prompt basis.
- Accredit the capacity of resources differently based on their geographic location (including transmission deliverability).
- Allocating capacity requirements to loads based on pro-rata usage during the gross peak or highest reliability risk hours.
Thank You!

Zach Ming, Sr. Director
44 Montgomery St. Suite 1500
San Francisco, CA 94104
zachary.ming@ethree.com