ELCC – IMM Comments

Markets & Reliability Committee
September 19, 2020
ELCC Issues

• ELCC values
  • Source/basis/logic
  • Single value or a set of interdependent values (surface)

• Guaranteed ELCC
  • Class or unit
  • Impact

• ELCC in the capacity market clearing
  • Static, predefined, ex ante
  • Dynamic, internally consistent
  • Marginal or average value
PJM Logic for ELCC Values

- With all thermal units, increase load to get to 1 in 10 LOLE
- Add PJM forecasted intermittent generation (temporal shape of output based on historical data).
- LOLE improves to over 1 in 10 (e.g. to 1 in 15).
  - Load Method: Increase load until LOLE is equal to 1 in 10. Added load divided by intermittent ICAP is the ELCC.
  - Gen Method: Remove base capacity until LOLE is equal to 1 in 10. Removed capacity divided by intermittent ICAP is the ELCC.
Ex Ante ELCC

- Ex ante approach
  - ELCC values by class define the resource UCAP for offers into capacity auction
  - ELCC values for each resource are determined prior to the auction based on modeling
  - A single value for each class of intermittent resources
  - The ex ante ELCC resource mix is not a function of capacity market clearing.
    - No interactions;
    - No simultaneous determination.
  - Ex ante ELCC is always wrong; accurate prediction not possible.
Proposed Ten Year Lock In

• Lock in / floor values to be based on 10 year forecast of class ELCC values
  • A 10 year ELCC forecast will necessarily be based on many unknown inputs (inputs would include thermal capacity levels, intermittent capacity levels, intermittent generation levels and shape)
  • There is no means or structure for understanding the ELCC forecast error
  • ELCC should reflect the capacity resource mix and can only be accurately determined when incorporated into the auction clearing engine
Proposed Ten Year Lock In

- Lock in / floor values to be based on 10 year forecast of class ELCC values. Ignores key variables.
  - No analysis of coal retirements;
  - No analysis of nuclear retirements;
  - No analysis of impact of significant rule changes;
  - No analysis of significant technology changes.
- Imposes risks on customers?
  - Who pays in the event of significant change?
- The goal of markets is to shift risk to investors.
- Ten year lock in shifts risks to other investors and to customers. Inefficient result.
Proposed Ten Year Lock In

• Proposal calls for a hierarchy of “support” to compensate for locked in ELCC floors in excess of realized ELCC values
  • Resources within a related ELCC class or group of classes will be penalized by using required ELCC values that are less than their realized ELCC
  • If ELCC class cannot cover shortfall, an allocation across all ELCC classes will be required
  • It is not clear from the proposal what happens in the event there are not enough renewable resources to make up the shortfall resulting from the lock in.
    o PJM clears additional thermal resources?
Proposed Ten Year Lock In

- Old units will be over valued and overpaid.
- New units will be under valued and underpaid.
- Underpayment can affect unrelated asset types.
- No analysis of expected impact of lock in over 10 years.
  - Payments to resources.
  - Payments by customers.
Lock In Example

- The ELCC value for 20,000 MW nameplate of solar is 50 percent which results in 10,000 MW UCAP
  - 5,000 MW has a guaranteed floor at 60 percent (Group A)
  - 7,000 MW has a guaranteed floor at 50 percent (Group B)
  - 8,000 MW has a guaranteed floor at 40 percent (Group C)
  - Group A is credited with 3,000 MW UCAP (60 percent)
  - Group B is credited with 3,500 MW UCAP (50 percent)
  - Group C is credited with 3,500 MW UCAP (43.75 percent)
- Group C penalized. Lower floor value.
- What happens if Group C is guaranteed 45 percent floor value?
Lock In Example

- The ELCC value for 20,000 MW nameplate of solar is 50 percent which results in 10,000 MW UCAP
  - 5,000 MW has a guaranteed floor at 60 percent (Group A)
  - 7,000 MW has a guaranteed floor at 50 percent (Group B)
  - 8,000 MW has a guaranteed floor at 45 percent (Group C)
  - Group A is credited with 3,000 MW UCAP (60 percent)
  - Group B is credited with 3,500 MW UCAP (50 percent)
  - Group C is credited with 3,600 MW UCAP (45 percent)
- Credited UCAP exceeds 10,000 MW
- 100 MW must come from a different class, or PJM must clear an additional 100 MW of thermal.
Simultaneous ELCC

- Inputs to the ELCC study are the actual capacity resources that intend to offer into the capacity auction.
- The level of thermal resources and the levels of intermittent classes are varied to produce different ELCC values for different resource mixes (the ELCC surface).
- Contrast to PJM method which results in a single ELCC point, based on forecasts rather than actual offers.
- ELCC values for each resource class are determined as part of the clearing of the capacity market, based on the optimal, least cost combination of resources.
Average vs Marginal ELCC

- **Average ELCC** – the ELCC for a class of resources is equal to the ELCC value for the class divided by the total maximum net capability of the class.
- **Marginal ELCC** – the ELCC for a class of resources is equal to the ELCC value associated with the last MW in the class.
- Both average and marginal results are the result of the same ELCC study.
Simultaneous ELCC: Average vs Marginal

Class ELCC is the area under the Marginal ELCC curve (___) which is equal to the Avg ELCC Value x MW (___)
Simultaneous Marginal ELCC

- Use of marginal ELCC results in correct measurement of total resource value.
  - Area under the curve
- Use of marginal ELCC results in correct measurement of resource performance obligation.
- Use of marginal ELCC results in correct payment to resources.
Prices and Revenues with Marginal ELCC

- If a 100 MW solar resource clears, the obligation is to provide 100 MW of solar when conditions allow.
  - Regardless of marginal ELCC.
- If a 100 MW solar resource clears with a marginal ELCC of 1.0, effective MW = 100 MW:
  - $100 \text{ MW} \times 1.0 = 100 \text{ MW}$
- If a 100 MW solar resource clears with a marginal ELCC of 0.5, effective MW = 50 MW:
  - $100 \text{ MW} \times 0.5 = 50 \text{ MW}$
Prices and Revenues with Marginal ELCC

• If a 100 MW solar resource clears at $1.00 per MW-day, with a marginal ELCC of 1.0, revenue is:
  • $100 MW * 1.0 * $1 = $100 per day

• If a 100 MW solar resource clears at $1.00 per MW-day, with a marginal ELCC of 0.5, revenue is:
  • $100 MW * 0.5 * $1/0.5 = $100 per day
  • = 50 MW * $2 = $100 per day
Prices and Revenues with Marginal ELCC

• The price per effective MW will vary with the ELCC.

• The total payment to the resource is always equal to or greater than the offer, regardless of the marginal ELCC.
Marginal ELCC Payment Example

• Intermittent resource with 100 MW maximum capability offers at $15 per MW-day
  • Payment: ($15 x 100 x 365) = $547,550 per DY
  • If unit is marginal. Payment greater if inframarginal.

• If resource clears and marginal ELCC is 10 percent:
  • Effective capacity is (100 MW x 0.10) = 10 MW
  • Offer per effective MW is ($15 / 0.10) = $150.00 per MW-day
  • Offer for delivery year is $150 x 10 x 365 = $547,500 per DY
## Marginal ELCC and Effective Offers

<table>
<thead>
<tr>
<th>Marginal ELCC Percent</th>
<th>Effective Offer ($ per MW-day)</th>
<th>Effective Offer ($ per DY)</th>
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<tr>
<td>100%</td>
<td>$15.00</td>
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