WRAP ELCC Process and Example

WRAP ELCC Methodology

Seasonal ELCC Simulations (Last-In Approach)

- Pure capacity (Pure Capacity #2) is added to the system until the 1-in-10 LOLE metric is achieved.
  - Either by adding pure negative or pure positive capacity

- The VER class under study is then removed from the benchmark system. The system is then adjusted back to 1-in-10 LOLE by adding pure capacity (Pure Capacity #1).

- **ELCC of VER (under study) = Pure Capacity 1 – Pure Capacity 2**

WRAP ELCC Example

Results from Seasonal ELCC Simulations (Step 1)

- An example subregion is used with one wind VER zone, one solar VER zone, and ESRs.
- The seasonal ELCC values are determined in the ELCC study using the last-in approach (values determined using SERVM software)

VER Type		Seasonal ELCC (MW)
Wind VER Zone	Nameplate	400
	ELCC	102
Solar VER Zone	Nameplate	700
	ELCC	515
ESR	Nameplate	300
	ELCC	290

Determination of Total of Last-in ELCC (Step 2)

- The ELCC is calculated for each VER and ESR zone.
- The zones are summed and totaled.

	Subregion		Season
(A)	Wind VER Zone	Last-in ELCC (Step 1)	102
(B)	Solar VER Zone	Last-in ELCC (Step 1)	515
(C)	ESR	Last-in ELCC (Step 1)	290
(D)	Total of Zones	Total Adjusted Monthly ELCC [(A) + (B) + (C)]	907

Determination of System ELCC Ratio (Step 3)

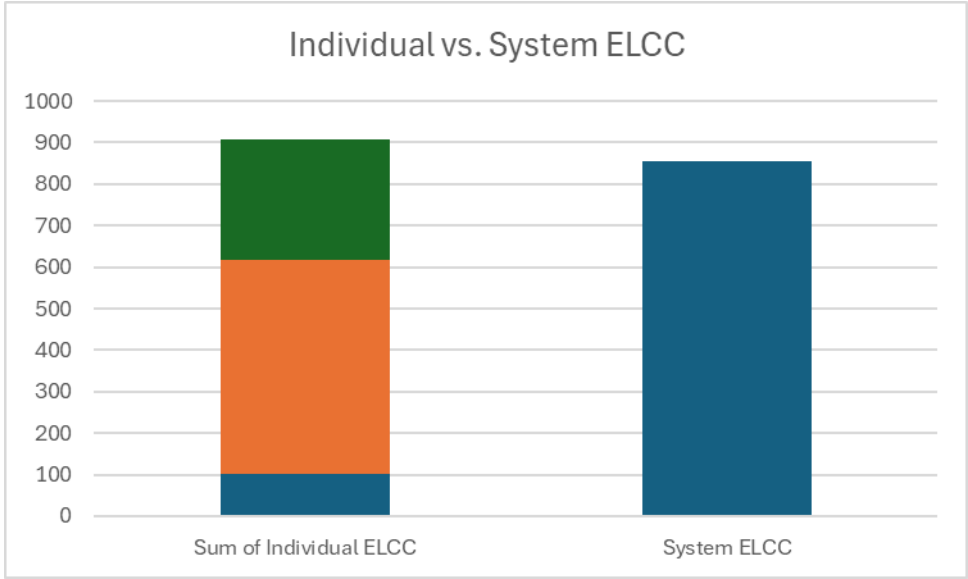
- System ELCC determination
  - System ELCC is the total combined ELCC value of all wind, solar, and ESR resources. System ELCC for each month is determined by performing a last-in study with all wind, solar, and ESRs removed together and is shown as value (A) below.
  - Calculated using SERVM software

	Subregion	Season
(A)	System ELCC (Combined ELCC value of wind, solar, ESR) [Calculated in SERVM]	856

Determination of System ELCC Ratio (Step 4)

- A ratio of monthly System ELCC to the combined VER and ESR monthly ELCCs is calculated using the System ELCC values and the Combined VER and ESR ELCC values.

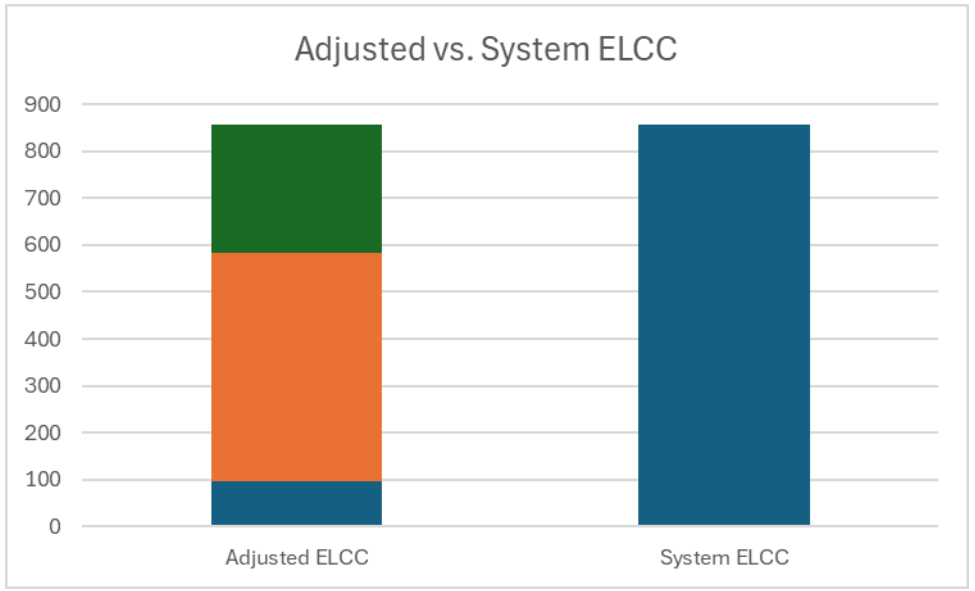
	Subregion	Season
(A)	System ELCC (Combined ELCC value of wind, solar, ESR) (Step 3)	856
(B)	Combined VER and ESR ELCCs (Step 2)	907
(C)	Ratio for Final QCCs [(A) / (B)]	94.4%



Application of Zonal Ratios (Step 5)

- The ratio is applied to the adjusted ELCC of each VER and ESR zone of the subregion.
- Final QCC of the zone cannot exceed total nameplate of resources in the zone (*).

	Subregion		Season
(A)	Wind VER Zone	Final QCC (Values from Step 2 * Ratio from Step 4	96
(B)	Solar VER Zone	Final QCC (Values from Step 2 * Ratio from Step 4	486
(C)	ESR	Final QCC (Values from Step 2 * Ratio from Step 4	274
(D)	Total of Zones	Total Subregion QCC (Same as Previous Slide or (A)+(B)+(C))	856



Adjustment of Over-Allocation (if necessary) (Step 6)

- If applying the ratio of zonal ratio to the combined VER and ESR values causes the ELCC to be greater than the total nameplate, then the QCC above the nameplate is distributed to the other VER types.
- Step not needed in this example. All value less than nameplate.

Subregion	Nameplate		Season
Wind VER Zone	400	Final QCC	96
Solar VER Zone	700	Final QCC	486
ESR	300	Final QCC	274
Total of Zones		Total Subregion QCC (Same as Previous Slide)	856

Determination of QCC % by Zone (Step 7)

- The QCC% is found by ratioing the final QCC of the VER zone with the nameplate of the VER zone.

	Wind VER Zone	Season
(A)	Final QCCs (Step 6)	**96**
(B)	Nameplate (Step 1)	400
(C)	Monthly QCC% [(A)/(B)]	**24%**

Determination of Individual Resource QCCs (Step 8)

- The QCC of each resource in a VER zone is calculated by multiplying total VER Zone QCC by the ratio of the average output during CCHs of the month for the individual resource by the sum of the average output during CCHs of all resources in the VER Zone
- The sum of every resource's QCCs in a VER zone equals the final monthly QCC of the zone in Step 6.

	Resource	July
(A)	VER Zone Total QCC (Step 6)	96
(B)	Average resource output during CCHs (Unique to the individual resource – based on historical or synthesized data)	32
(C)	Average output of all resources in the zone during CCHs (based on historical or synthesized data)	110
(D)	Resource QCC [(A)*((B)/(C))]	**28**