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QUALIFYING CAPACITY METHODOLOGY HYBRID IDEAS

OCTOBER 5, 2021

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HIGH LEVEL OBSERVATIONS – WE HAVE BEEN TALKING ABOUT FOUR DISTINCT, BUT RELATED TOPICS

1) How do we measure how DR performed?

- Load impact protocols (ex-post)
- Baseline methods
- Control groups
- Specific methodologies such as Recurve’s

2) How do we determine the DR capability under different conditions (hour of day, month, weekday/weekend, temperature, etc.?)

- Load impact protocols (ex-ante)
- Historical bids
- Forward bids (PJM model)

3) How do we account for the availability and use limited nature of DR in planning?

- E3 ELCC (Delta Method)
- Modified LIP + E3 ELCC (PG&E)

4) How to we improve the process for Qualifying Capacity?

- Shorten timeframe
- Make it easier and cheaper
- Use open models
- Lower report writing requirements
- Lots of other ideas

HOW MUCH A RESOURCE CONTRIBUTES TO RELIABILITY DEPENDS ON ITS CHARACTERISTICS

KEY QUESTION	CONSTRAINT	DEFINITION
Is the DER tied to a specific load shape?	Load profile	Structural shape of load reductions deliverable by a resource. For example, energy efficiency will deliver loads aligned with underlying consumption patterns (e.g., lighting or HVAC); solar PV will deliver loads varying by time of day, peaking in early afternoon; batteries of fuel based generation have no such limits.
	Seasonal availability	Availability year round versus summer only.
Is the resource flexible?	Availability window (start and end hours)	Hours of the day during which the resource is available. May be longer than the duration category. If duration category is shorter than the availability window, optimal window is used (e.g., the window with the most peak load).
	Ramp speed	Length of time it takes for resource to achieve maximum load reduction.
	Dispatch delay	Advance notice which must be given for resource to be dispatched.
Are there specific operating constraints?	Dispatch duration	Maximum number of consecutive hours during which a resource is able to deliver load reduction. May be limited by technology constraints (battery discharge time) or program limits (demand response event window).
	Max dispatch hours per year	Limit to total number of dispatchable hours in a year.
	Max events per year	Limit to total number of dispatch events (days) in a year.
	Max consecutive	Limit to total number of consecutive dispatch events (days) in a year.
	Events per year	(Days) in a year.

Source: Bode, Lemarchand and Schellenberg (2015). Addressing the Locational Valuation Challenge for Distributed Energy Resources. Available at: https://sepapower.org/resource/beyond-the-meter-addressing-the-locational-valuation-challenge-for-distributed-energy-resources/

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HYBRID #1: NET LOADS ELCC

THE BASICS

- ELCC is simply a calculation to factor in characteristics of resources and convert the MW output capability into values used for planning
- Planning is driven by net loads, since solar and wind are effectively intermittent base loads
- In the near term (1-2 years) the mix of resources is relatively well known.
- Battery storage and DR are assessed jointly because they both are availability and energy limited and target the high-value hours (they compete and complement each other)
- The model would be open source and rely on open data (Excel + Python)
- Requires clear definition of DR resources

PROS

- Open data
- Can be an open sourced model housed on a common website accessible to all
- Easy to update DR resources
- Transparency on how DR is modeled from inputs to calculations to results

CONS

- Does not work for modeling ELCC 10 years out
- Is a good approximation but may not exactly match E3 resource planning model (RECAP)

HYBRID #1: CALCULATIONS STEP BY STEP

1. Calculate net loads over multiple years, scaling for solar and wind current capacity
2. Layer in all DR and all battery resources and optimize their dispatch to shave the duration curve
3. Assess by how much of the net load peak is shaved across all hours when all DR and battery storage is dispatched optimally
4. Remove a resource, re-optimize, and assess by how much the net load peak is shaved without the resource
5. The delta (between 3 and 4) equals the unadjusted ELCC MW for the resource.
6. Calibrate all resources so the sum of the individual parts adds up to the portfolio ELCC

HYBRID #2A: E3 MODELS + OPEN SOURCE MODEL FOR DR CALCULATIONS

THE BASICS

- Resource planning model produce estimates of expected unserved energy (EUE) for each hour of year (8760) and simulation run
- Only a small fraction of simulated days and hours have unserved energy
- The granular output of the planning models can be paired with a transparent, open-sourced model to quantify each resource's contribution to reliability
- CAISO would produce an estimate of the resource needs that are not met, absent existing DR and battery storage resources.
- The unserved energy outputs would be used as inputs into the open sourced model

PROS

- Can be an open sourced model housed on a common website accessible to all
- Easy to update DR resources
- Transparency on how DR is modeled and characterized

CONS

- Does not work for modeling ELCC 10 years out
- Is a good approximation since the magnitude of DR and battery resources does not change overnight but it may not exactly match E3 resource planning model (RECAP)

HYBRID #2A: NET LOADS ELCC STEP BY STEP

1. CAISO produces EUE without DR and battery storage resources
2. Layer in all DR and all battery resources and optimize their dispatch to server unmet needs
3. Assess by how much of the much the MW shortfall is reduced when DR and battery storage are dispatched optimally
4. Remove a resource, reoptimize, and assess by how much the MW shortfall is reduced without it
5. The delta equals the unadjusted ELCC MW for the resource.
6. Calibrate so the sum of the individual parts adds up to the portfolio ELCC

HYBRID #2B: ALL WORK IS IN EXCEL MODEL AND DOES NOT REQUIRE AS DETAILED OF OUTPUTS FROM THE RESOURCE PLANNING MODEL

1. CAISO produces EUE without DR and battery storage resources
2. Normalize the Expected Unserved Energy (EUE) so it adds up to 100%
3. Allocate to agreed upon granularity (e.g., by month, hour, and weekday/ weekend)
4. Produce DR load reduction capability at the same granularity
5. Incorporate limits on availability, event duration, and other attributes such as post-event effects

The weighted average of #3 and #4 is the ELCC for the resource

HYBRID #2B: CALCULATION EXAMPLE

Start	End	Expected Unserved Energy (MWh) A	EUE % B	Reduction Capability (MW) C	Column C + 12:00 to 10:00 PM availability constraint (MW) D	Column D + 4 hour Max Duration Constraint (MW) E	Column E + Snapback or Post-event persistance (MW) F
0:00	1:00	0.0	0.0%	86.4	0.0	0.0	0.0
1:00	2:00	0.0	0.0%	81.0	0.0	0.0	0.0
2:00	3:00	0.0	0.0%	74.0	0.0	0.0	0.0
3:00	4:00	0.0	0.0%	61.2	0.0	0.0	0.0
4:00	5:00	0.0	0.0%	45.6	0.0	0.0	0.0
5:00	6:00	0.0	0.0%	36.0	0.0	0.0	0.0
6:00	7:00	0.0	0.0%	30.0	0.0	0.0	0.0
7:00	8:00	0.0	0.0%	30.0	0.0	0.0	0.0
8:00	9:00	0.0	0.0%	1.2	0.0	0.0	0.0
9:00	10:00	0.0	0.0%	3.6	0.0	0.0	0.0
10:00	11:00	0.0	0.0%	6.0	0.0	0.0	0.0
11:00	12:00	0.0	0.0%	52.8	0.0	0.0	0.0
12:00	13:00	0.0	0.0%	84.0	84.0	0.0	0.0
13:00	14:00	0.0	0.0%	127.2	127.2	0.0	0.0
14:00	15:00	0.0	0.0%	178.8	178.8	0.0	0.0
15:00	16:00	100.0	5.9%	228.0	228.0	0.0	0.0
16:00	17:00	150.0	8.8%	268.8	268.8	0.0	0.0
17:00	18:00	200.0	11.8%	300.0	300.0	300.0	300.0
18:00	19:00	300.0	17.6%	289.2	289.2	289.2	289.2
19:00	20:00	350.0	20.6%	266.4	266.4	266.4	266.4
20:00	21:00	300.0	17.6%	223.2	223.2	223.2	223.2
21:00	22:00	200.0	11.8%	157.2	157.2	0.0	-133.9
22:00	23:00	100.0	5.9%	98.4	0.0	0.0	-67.0
23:00	0:00	0.0	0.0%	98.4	0.0	0.0	-33.5
TOTAL		**1700.0**	**100.0%**	**2827.4**	**2122.8**	**1078.8**	**844.4**
MAX		**350.0**	**20.6%**	**300.0**	**300.0**	**300.0**	**300.0**
Spark Line							

ELCC **160.9** <-- SUMPRODUCT(Column_B,Column_F)

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QUESTIONS?

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