Integrating EE Resources as a Distribution Resource Lessons from BQDM

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Reimagine tomorrow.

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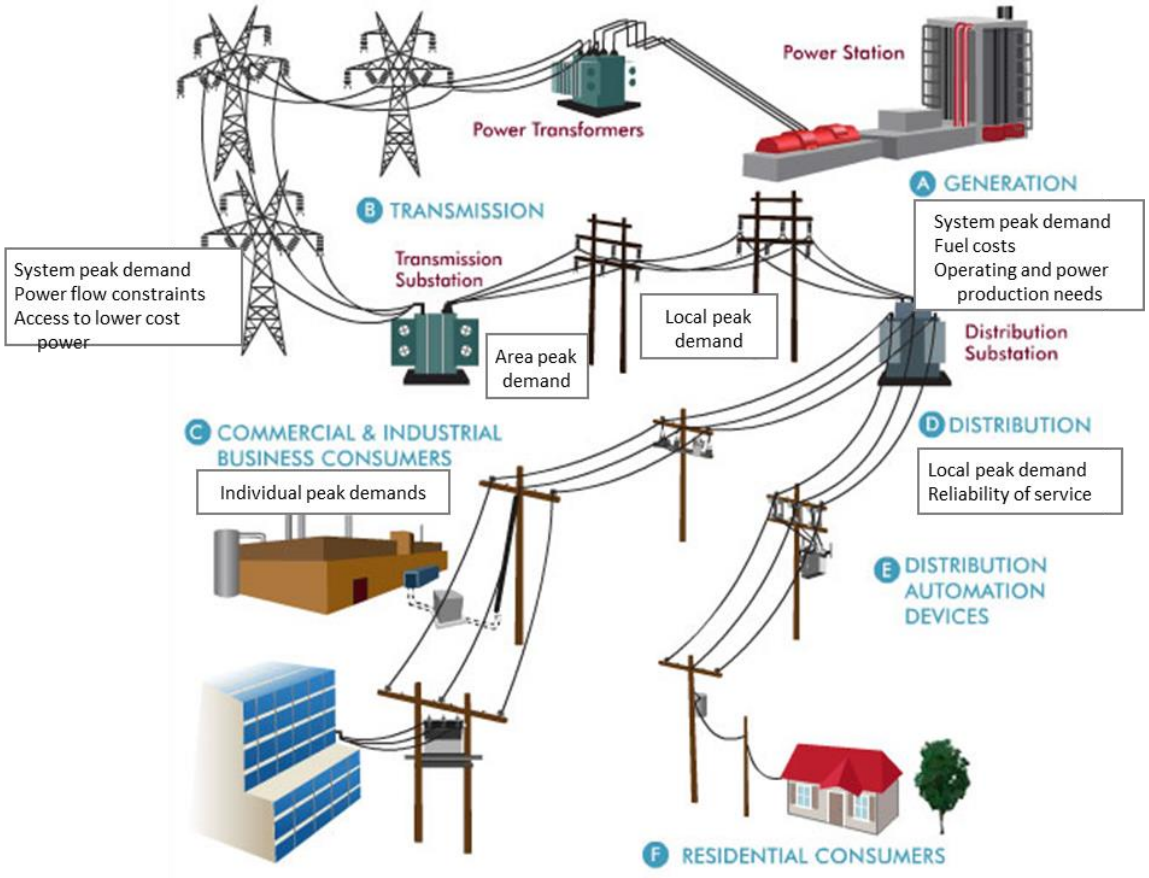
At the core is a debate is the value that distributed energy resources provide to the grid and how they should be integrated



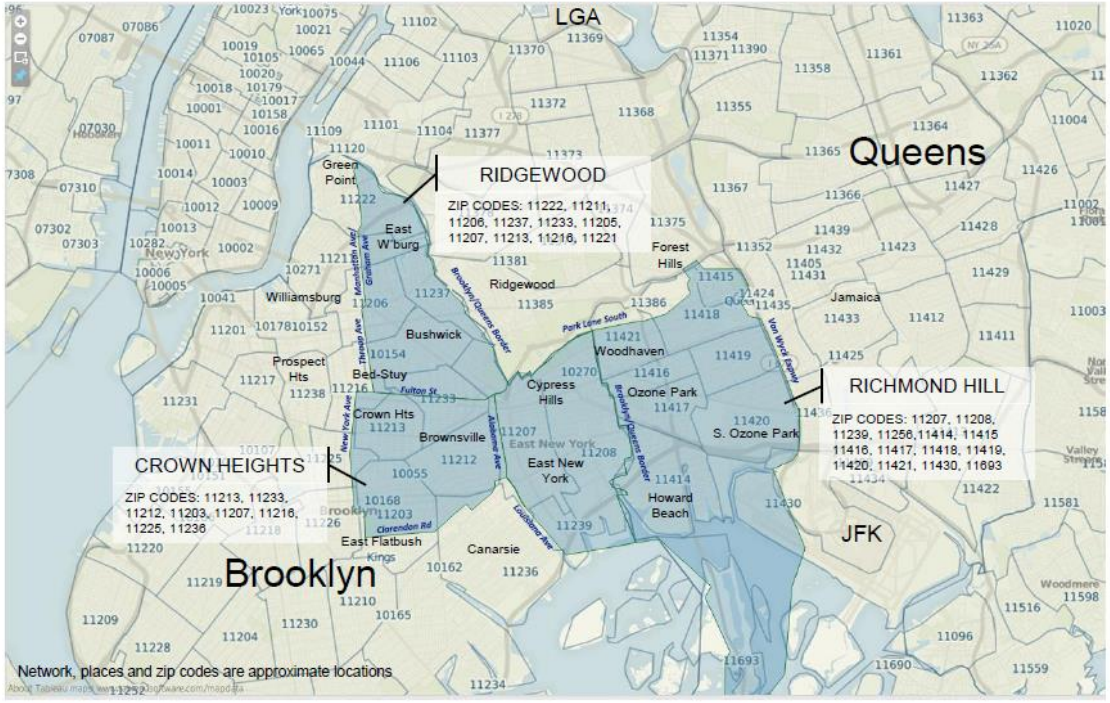
- One of the most unique aspects of DERs, including EE, is that they can touch all aspects of the grid
- Will EE be allowed to compete side-by-side with distribution alternatives and other distributed energy resources?
- How is EE being compared to other alternatives?

The ability of EE to provide operational relief or T&D deferral value depends on several factors

- The design of the distribution system
- The distribution component in question
- The magnitude of the resources
- The characteristics of the resource and how well they align with the local peak
- The location of the resources and the amount of excess T&D capacity
- How well resources coincide with the local need
- How soon the investments are needed
- The value of the deferred or avoided investment

Brooklyn-Queens Demand Management Project

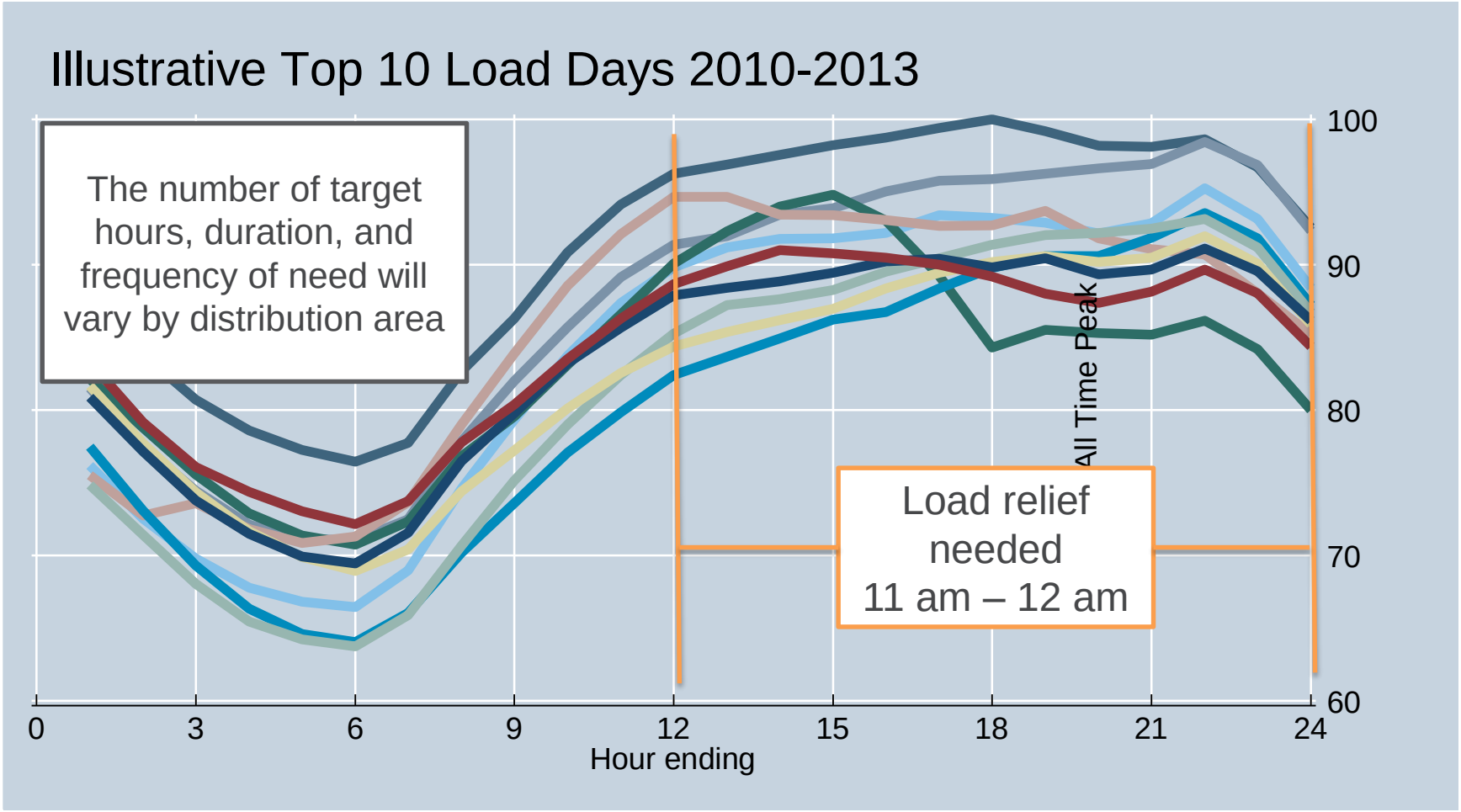
Targeted Brooklyn-Queens Networks



- $1 billion transmission substation upgrade
- 2013 Peak load ~750 MW
- Projected DER solutions by 2018:
  - 41 MW customer side
  - 11MW utility side
- 80+ responses to RFI
  - All types of resources
  - Most responses provided partial solutions

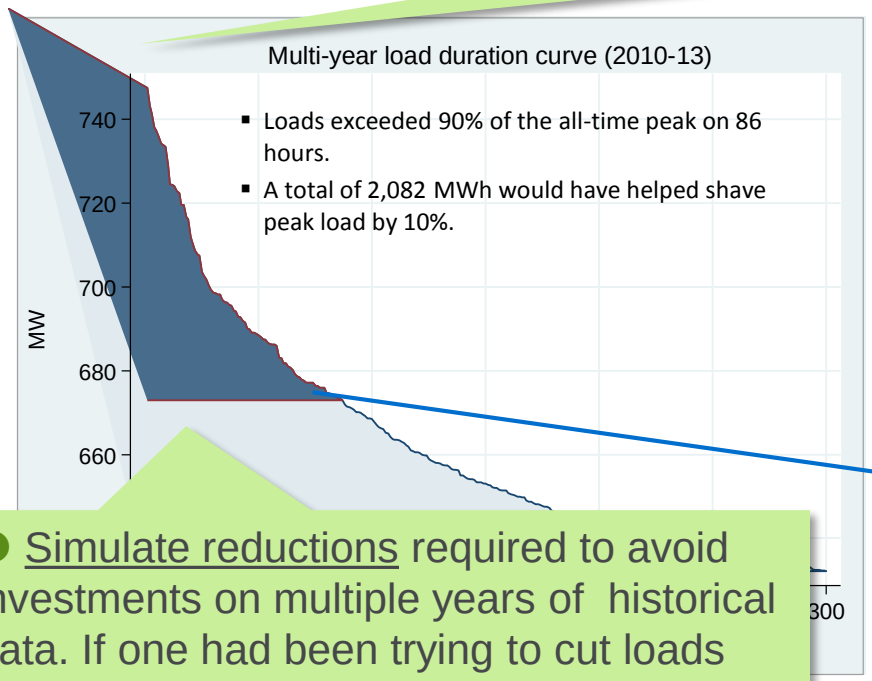
Resource options have widely varying characteristics and value – how do we compare inherently different resources?

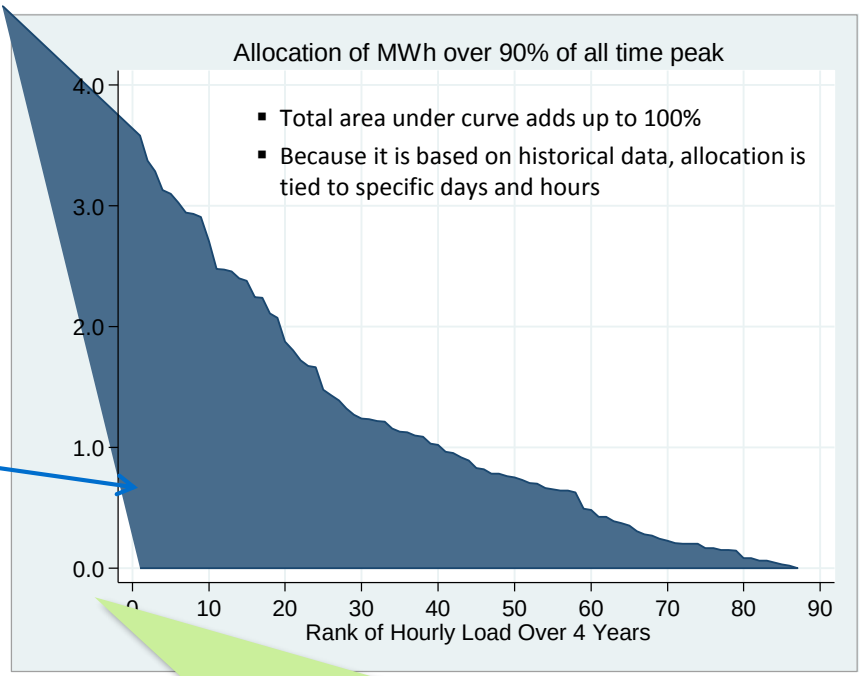
The loads for the area in question has an unusual peaking pattern



Historical loads were used to define when peaking risk is concentrated

❷ Develop risk allocation (dark blue area), the total MWH that would have been needed to shave load duration curve over some threshold

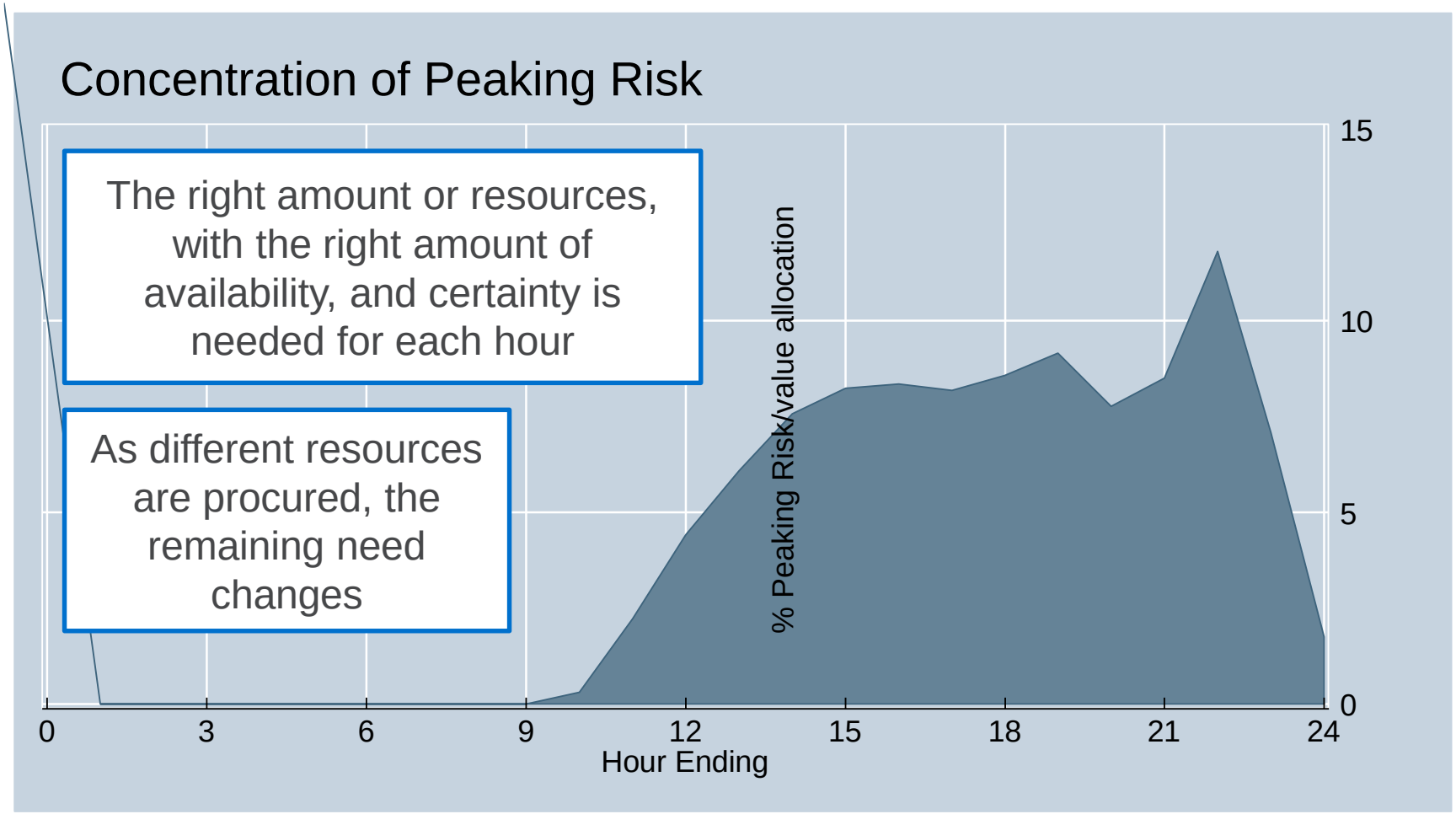




❶ Simulate reductions required to avoid investments on multiple years of historical data. If one had been trying to cut loads by, say, 10%, how much DERs would have been needed? When, how often, and for how long would DERs have been needed?

❸ Allocate risk (needed reductions) across specific days / hours, total risk sums to 100%

Concentration of risk and value for BQDM

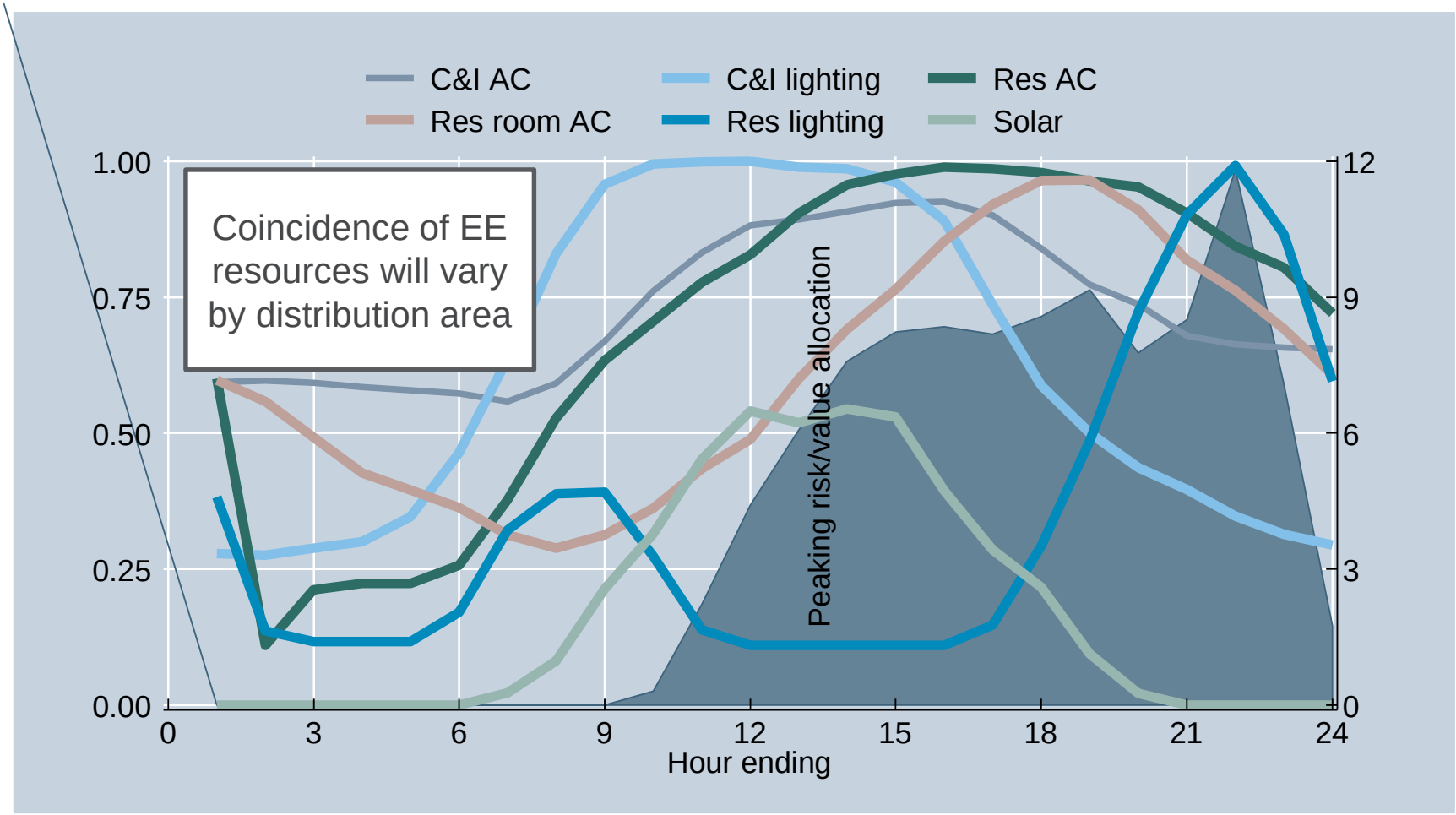


Assessed if specific characteristics affected the ability to meet the load relief need

1. Is the resourced tied to a specific load shape?
   - How well does the resources shape align with local peaking risk?
   - Does it provide negative value for some hours (e.g., load shifting, snapback)
2. Is the resource flexible?
   - Can it be dispatched with different start and end hours?
   - Can the magnitude of output be controlled (ramping)?
   - How far ahead must it be scheduled?
3. Are there specific operating constraints?
   - When is it available?
   - For how long can the resource be sustained?
   - Are there limits on how often or when it can be dispatched?
   - What is the realization rate (e.g., percent of projected load relief that is actually delivered)?

Most relevant questions for EE

How well do different EE resources coincide with the need?



*Load shapes and are illustrative and used for planning purposes, actual loads may vary

The focus in on MW - adjusted for coincidence with local peaks

Hour ending	Residentia Lighting			C&I Lighting		
	Peaking risk Allocation	Demand Reduction (normalized)	Interim Calculation	Peaking risk Allocation	Demand Reduction (normalized)	Interim Calculation
7:00	0.0%	0.32	0.00	0.0%	0.64	0.00
8:00	0.0%	0.39	0.00	0.0%	0.83	0.00
9:00	0.0%	0.39	0.00	0.0%	0.96	0.00
10:00	0.3%	0.27	0.00	0.3%	0.99	0.00
11:00	2.2%	0.14	0.00	2.2%	1.00	0.02
12:00	4.4%	0.11	0.00	4.4%	1.00	0.04
13:00	6.1%	0.11	0.01	6.1%	0.99	0.06
14:00	7.6%	0.11	0.01	7.6%	0.99	0.07
15:00	8.2%	0.11	0.01	8.2%	0.96	0.08
16:00	8.3%	0.11	0.01	8.3%	0.89	0.07
17:00	8.2%	0.15	0.01	8.2%	0.74	0.06
18:00	8.6%	0.29	0.03	8.6%	0.59	0.05
19:00	9.2%	0.49	0.04	9.2%	0.50	0.05
20:00	7.8%	0.72	0.06	7.8%	0.44	0.03
21:00	8.5%	0.90	0.08	8.5%	0.40	0.03
22:00	11.8%	0.99	0.12	11.8%	0.35	0.04
23:00	7.1%	0.87	0.06	7.1%	0.31	0.02
0:00	1.7%	0.60	0.01	1.7%	0.29	0.01

Max Reduction **0.99**

ELCC adjusted **0.45**

$$\sum^{24}(A_h \times B_h)$$

Max Reduction **1.00**

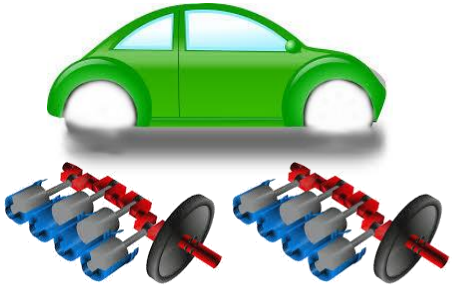
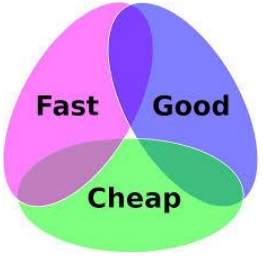
ELCC adjusted **0.65**

$$\sum^{24}(A_h \times B_h)$$

- The values weighted by the risk allocation are lower than non-coincident peaks
- Neither residential nor C&I lighting provide a full solution
- However, they complement each other

*Calculations are illustrative

DERs are complements, not substitutes: maximizing value is a portfolio optimization problem, like building the optimal car

The optimal car…	needs the right parts…	with the best value
▪ The "optimal" car is the one that provides the right balance of cost, reliability, speed, size, etc. for the available budget	▪ A car without wheels is not useful for operation and it is superfluous to purchase two engines	▪ Purchasing only the cheapest parts or parts all from the same vendor may not provide the best value
What kind of car is being built?	***Are there functional quantities of each part?***	***What delivers the best value for the price?***
		

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