Considerations in Capacity Accreditation Using ELCC

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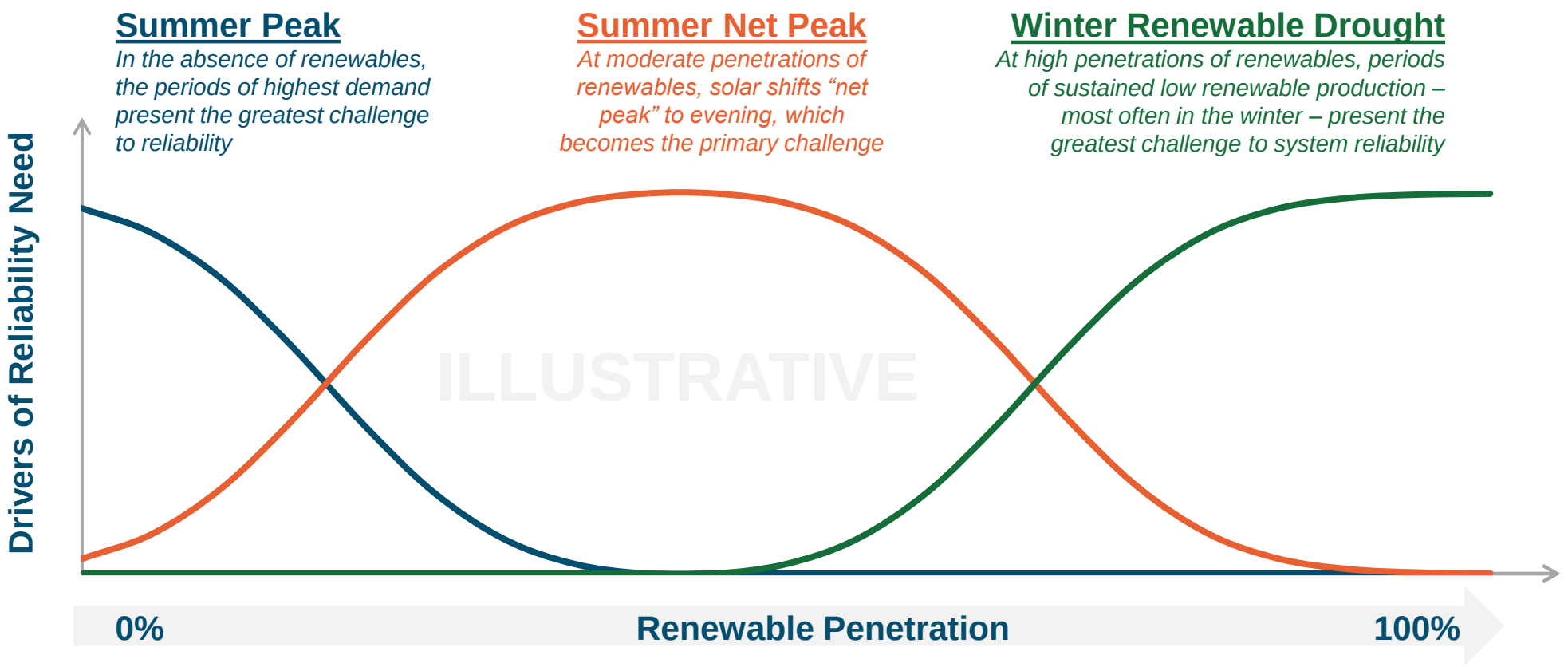
Energy+Environmental Economics

Nick Schlag, Partner

Consider a power plant that exists apart from an electricity system

Does it have any reliability value?

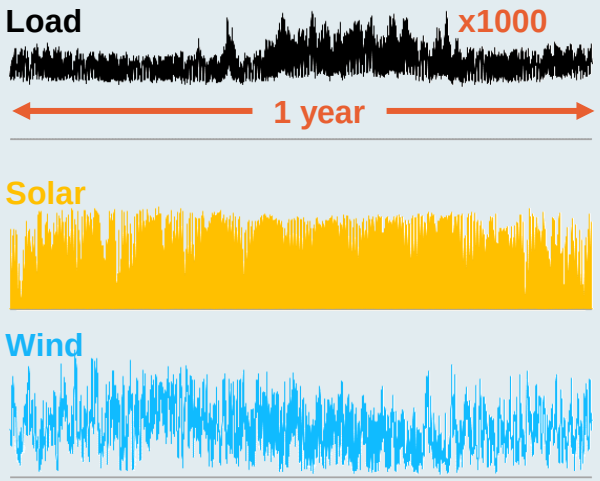
The transition to a deeply decarbonized electricity system will change the nature of reliability planning



Resource accreditation must be linked explicitly to need determination – ideally using LOLP modeling

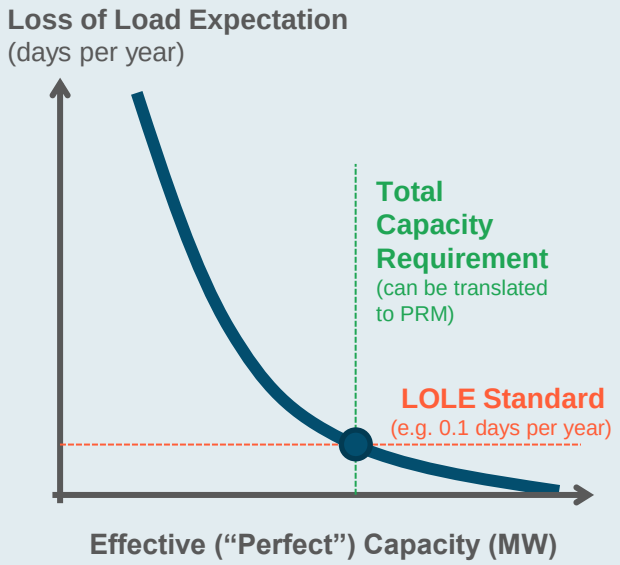
Develop a representation of the loads and resources of an electric system in a loss of load probability model

LOLP modeling allows a utility to evaluate resource adequacy across all hours of the year under a broad range of weather conditions, producing statistical measures of the risk of loss of load



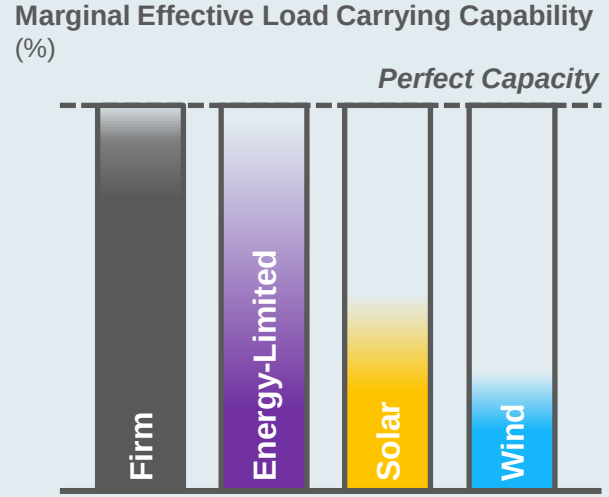
Identify the amount of perfect capacity needed to achieve the desired level of reliability

Factors that impact the amount of perfect capacity needed include load & weather variability, operating reserve needs



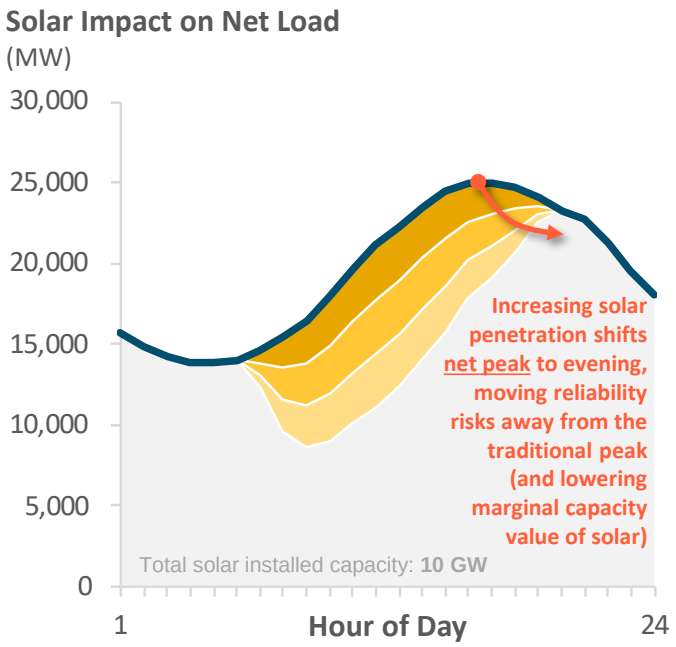
Calculate capacity contributions of different resources using effective load carrying capability

ELCC measures a resource's contribution to the system's needs relative to perfect capacity, accounting for its limitations and constraints

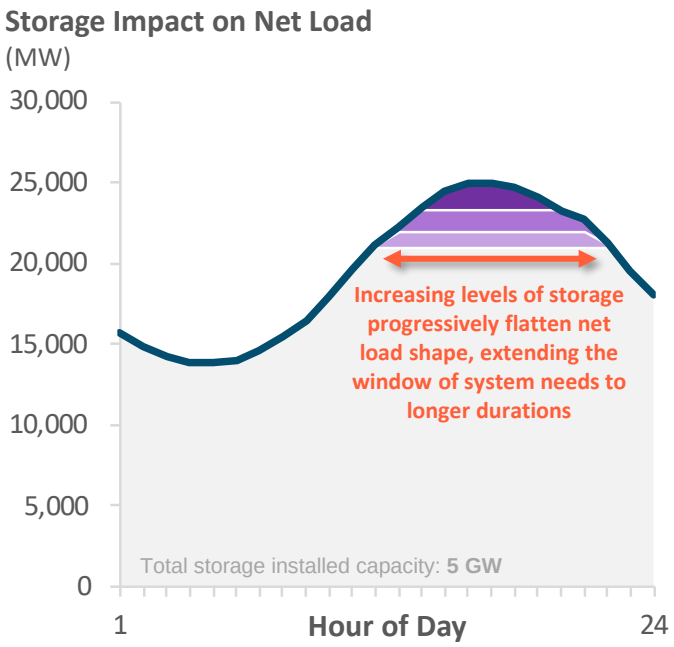


ELCC captures complex dynamics resulting from increasing penetrations of variable & energy limited resources

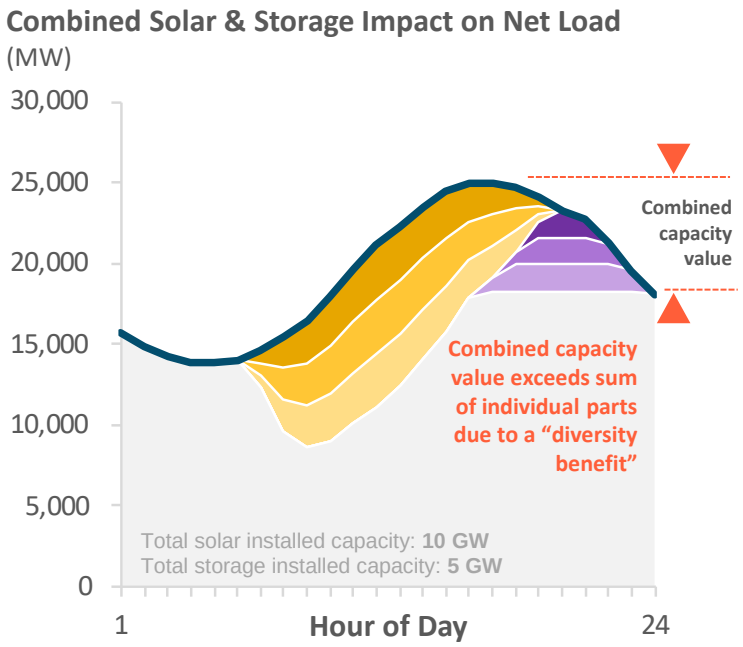
"Variable" resources shift reliability risks to different times of day



"Energy-limited" resources spread reliability risks across longer periods



A portfolio of resources exhibits complex interactive effects, where the whole may exceed the sum of its parts



The ELCC approach inherently captures both **capacity** & **energy** adequacy

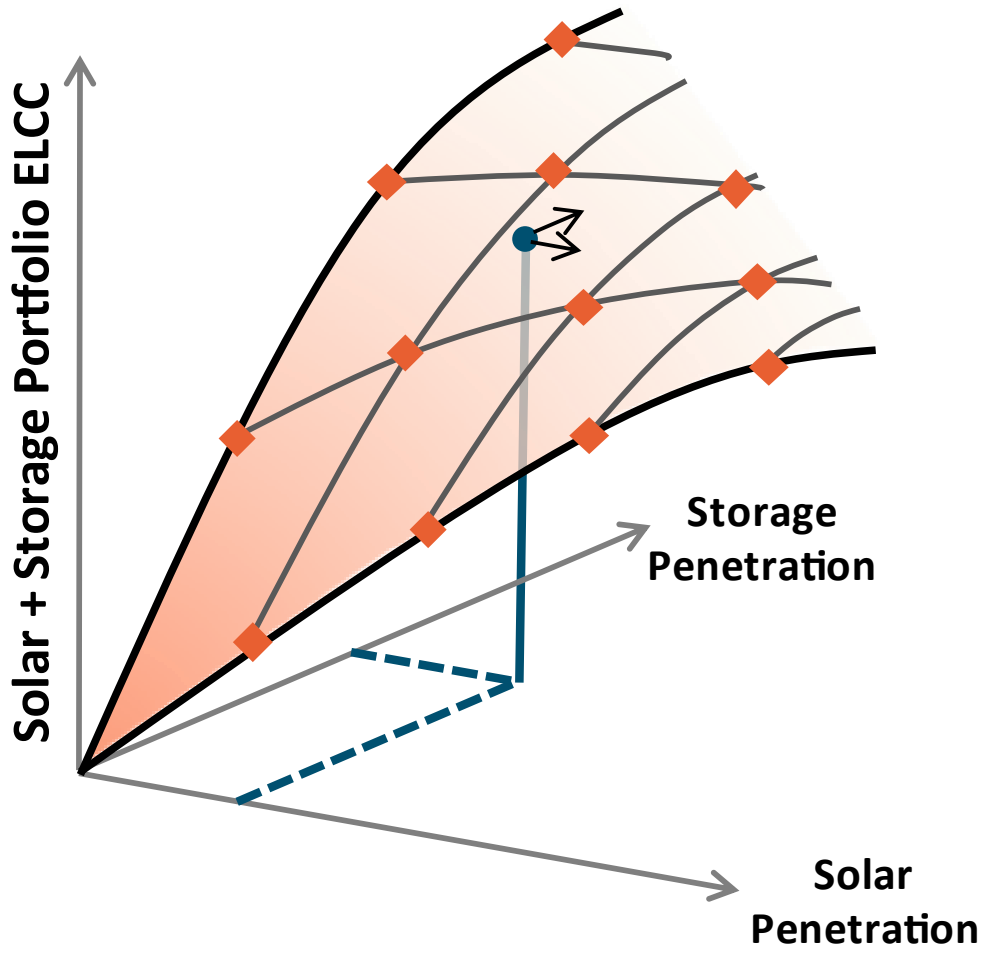
ELCC is a function of the portfolio of resources, not an intrinsic property of the resources themselves

The total ELCC of a portfolio of resources is a function of all loads and resources in the system:

$$\text{Portfolio ELCC} = f(L, R_1, R_2, \ldots, R_i)$$

The marginal ELCC of any individual resources in the portfolio is the partial derivative of the portfolio ELCC function:

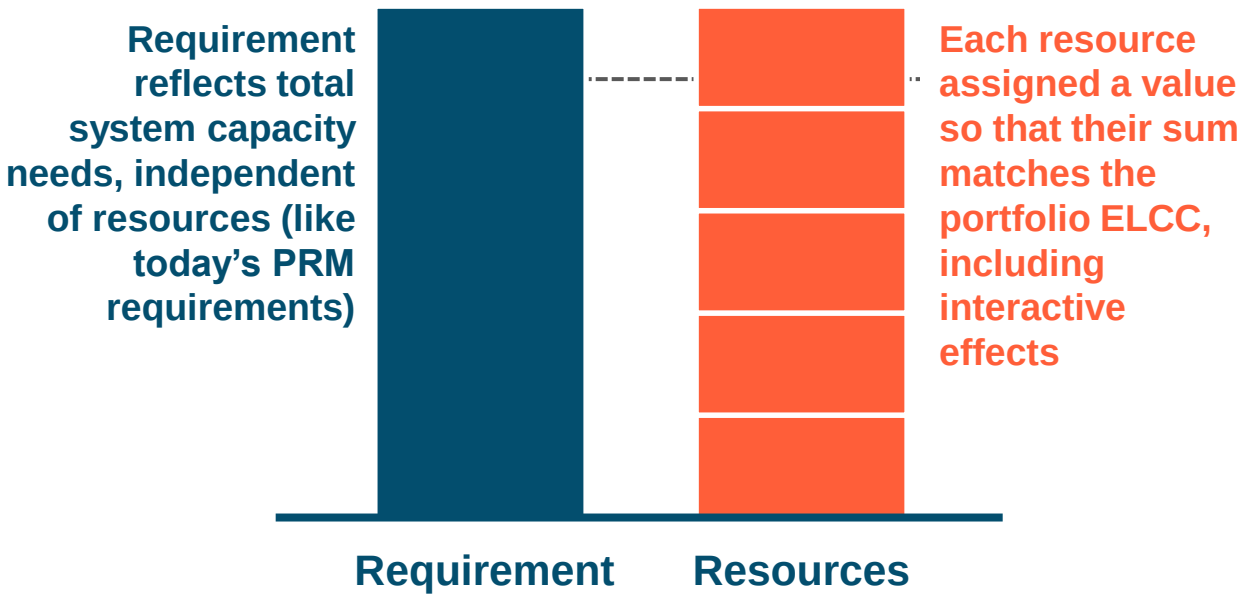
$$\text{Marginal ELCC}_i = \delta f(L, R_1, R_2, \ldots, R_i)/\delta R_i$$

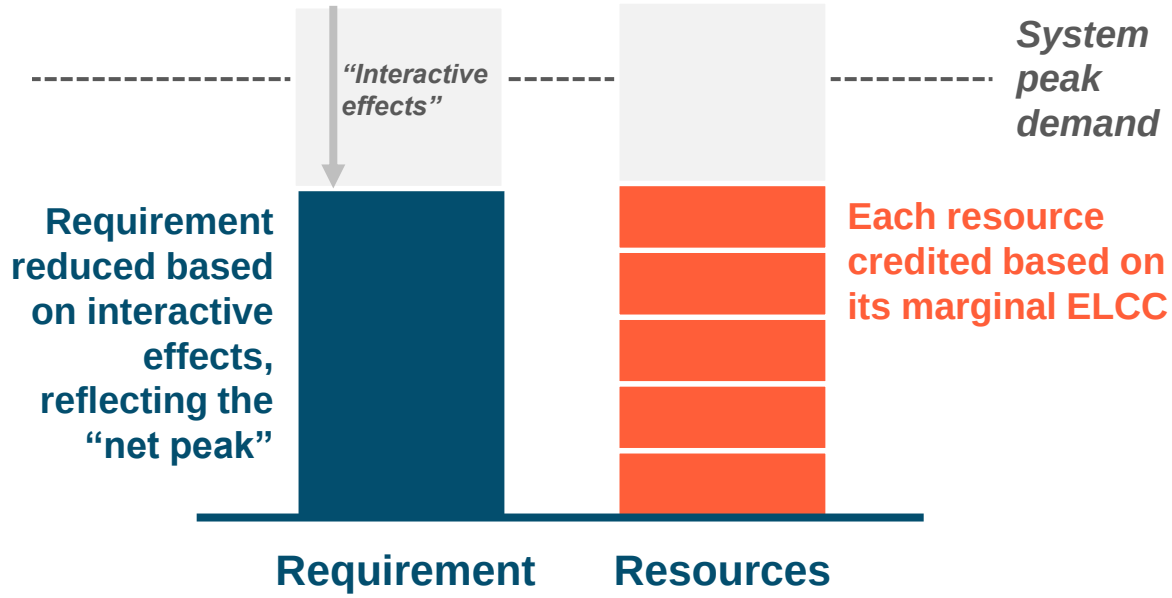


The Great Debate: considerations for average & marginal accounting constructs

Average ELCC accounting is compatible with a conventional planning reserve margin, crediting resources such that the whole is equal to the sum of the parts – but does not provide an efficient signal for new investment

Marginal ELCC accounting prioritizes economic efficiency, establishing need and crediting resources based on conditions during scarcity – but requires a change in how need is established





Additional challenges for capacity accreditation

+ **Circularity of accreditation process**
  can an *ex ante* accreditation process yield consistently reliable portfolios when the true value of resources is dependent on the outcome?
+ **Quality of data & modeling assumptions**
  how can we build confidence in the data sets and algorithms used in LOLP modeling, considering opportunities for empirical validation are exceedingly rare?
+ **Locational considerations**
  how should transmission constraints on resource delivery be considered in a paradigm when capacity credits depend on dynamics across the system?
+ **Annual/seasonal/monthly products**
  what is the right granularity to use in the design of market instruments?

These questions are not unique to ELCC accreditation, but are fundamental to planning a reliable decarbonized grid

Thank You!

Nick Schlag, Partner

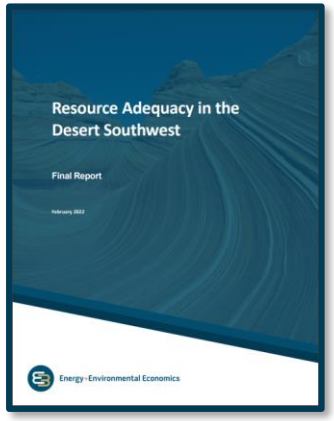
nick@ethree.com

44 Montgomery St Suite 1500

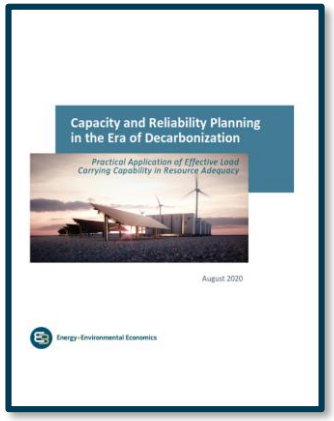
San Francisco, CA 94104

(415) 391-5100

For further reading:



Resource Adequacy in the Desert Southwest



Capacity & Reliability Planning in the Era of Decarbonization