CAPACITY EXPANSION

HISTORY

Capacity Expansion is a planning process used to meet future system needs by evaluating installation of new generation and transmission and retirement old facilities.

Traditionally, tools to support this process have stacked generating resources necessary to meet system capacity requirements. Transmission facilities have been modeled as known with impacts limited to application of zonal transfer limits.

Contribution of resources to meet capacity requirements has been defined by "capacity factors" that are highly dependent on other resources and their location in the grid.

THE CHALLENGE

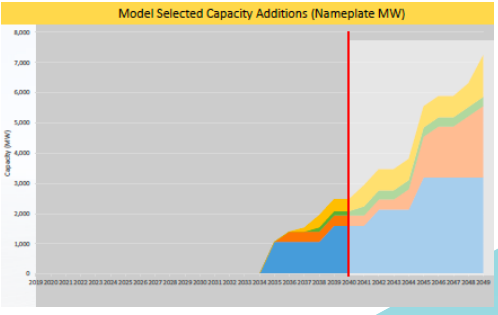
Capacity factors no longer reflect adequacy contributions of resources to grid reliability. Expansion planning needs to recognize the impact that each installation and retirement have on the ability of other resource to contribute to system needs.

With increasing impacts from weather-driven "common mode" events, the correlation of resource capabilities in time and space must be considered. We cannot rely entirely on co-located wind or solar resources with correlated power generation. Similarly, we cannot rely on capacity factors to any resource type whose value is dependent on competing capabilities of other resources that provide similar services.

WHAT IS UNIQUE ABOUT PSO?

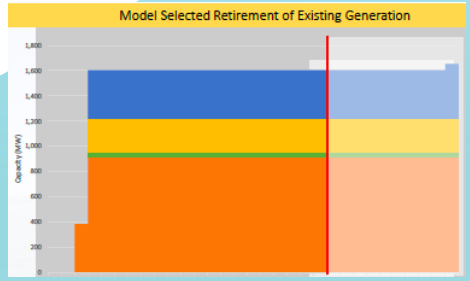
With increasing need for flexibility to manage variable generation, new models are needed to identify the value of storage, new transmission, new sources of flexibility from transmission, load, and generation, and integration with other energy systems.

PSO takes a **fundamentally different approach** to solve capacity-expansion models that relies on physical constraints and resource costs to guide expansion decisions. While capacity requirements and capacity factors can still be imposed, we observe that most expansion-planning decisions are driven by economic outcomes without reliance on capacity requirements and capacity factors.



Example
2040 Additions
New Nameplate Capacity
2,481 MW

- Onshore Wind 400 MW
- Photovoltaic 144 MW
- CT (Peakers) 388 MW
- CCGT 1,599 MW



Example
2040 Retirements
All Retirements
1,603 MW

- Boiler – Fuel Oil 386 MW
- CT/IC Natural Gas 267 MW
- CT/IC – Fuel Oil 34 MW
- Coal 916 MW

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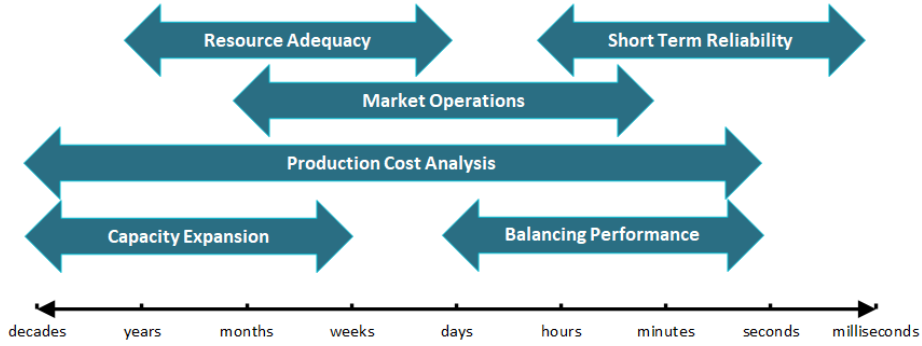
PSO's capacity expansion module

KEY FEATURES

PSO incorporates system and resource costs and constraints with far-greater detail than traditionally available. With a flexible, data-driven modeling approach, users have full control of the formulation.

Using shared data sets, results can be seamlessly validated by production cost modeling (PCM) and resource adequacy (RA) to identify future challenges.



- Identifies locational value with **security-constrained nodal solutions**
- Allows a mix of **both nodal and zonal**
- Optimizes operation and expansion of **transmission and generation**
- Optimizes installation and retirement, including **new classes of resources**
- Includes **all economic impacts** included in production cost models
- Optimizes facilities across **integrated energy systems**, including hydrogen hubs
- Models **time-coupled constraints** of power, fuel, emissions, and water storage
- Solves models with **non-heuristic** MIP-based optimization algorithm

A diversified portfolio of resources is the best way to achieve resiliency and reliability

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