Long-Term Regional Transmission Planning (LTRTP) Update

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Long-Term Regional Transmission Planning Workshop

July 21, 2023

Agenda

- LTRTP update Overview
- Scenario development process
- Next Steps

Overview

Why PJM is updating LTRTP

- Primary motivation is ensuring a reliable transition
  - Large-scale changes in the resource mix and load are expected in the coming decades. PJM needs to strengthen modeling assumptions and scenario building to identify and implement long-term transmission solutions and preserve reliability at the lowest possible system cost

- FERC is proposing Long Term Planning Rulemaking
  - Improved modeling assumptions and scenario building would be helpful for a possible compliance filing

Goal and Actions

Goal: Analyze Long-Term Scenarios to **(1)** identify transmission needs driven by the changing *resource mix* and load growth and **(2)** implement reliable, efficient and proactive transmission solutions

Long-Term Planning Action:
Identify and implement long-lead transmission solutions

Near-Term Planning Action:
Better inform near-term planning processes through robust transmission solutions

Workshop Focus

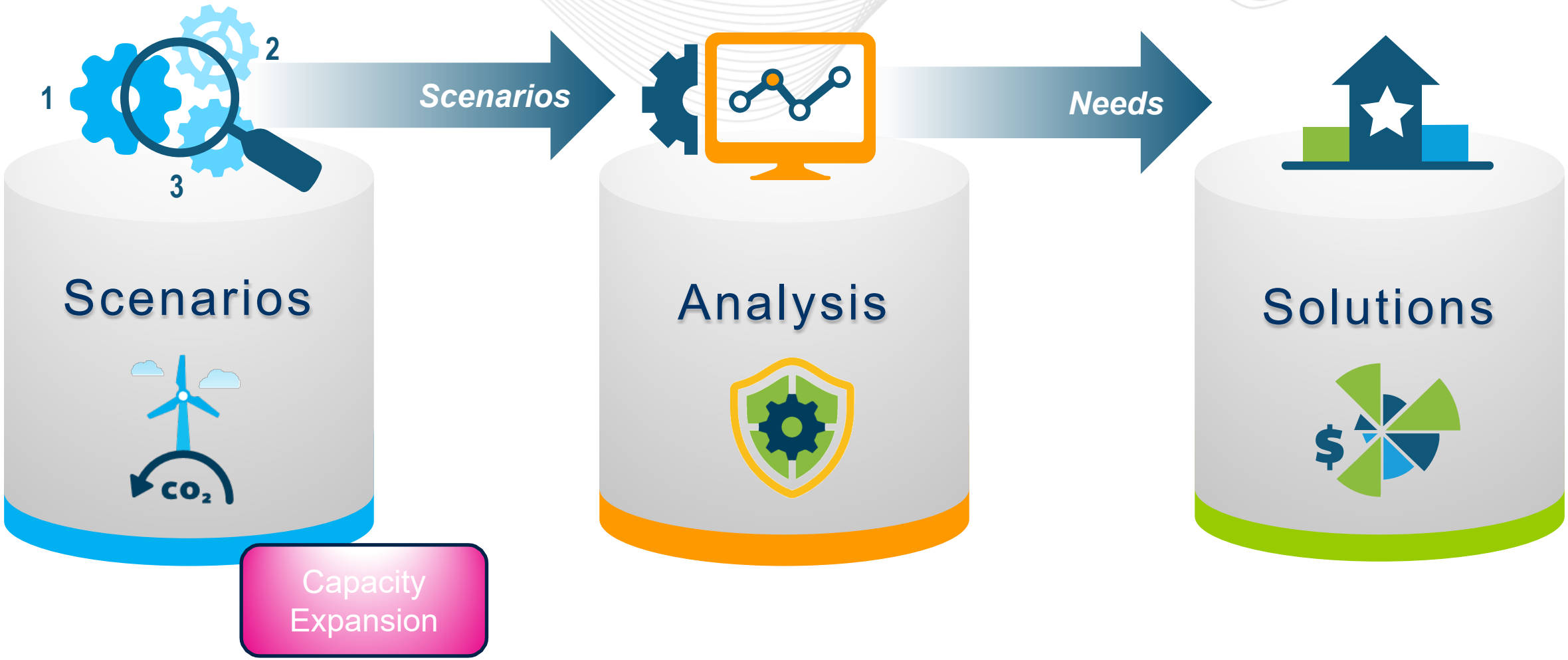
(1) Scenario based Reliability Planning

(2) Resource mix assumption updates

(3) Projected loads (electrification / data center)

(4) Capacity expansion process to develop resource mix for scenarios

LTRTP Framework



Principles

Scenarios

- *Scenarios must be plausible*
- *Scenario assumptions and methods are transparent*

Analysis

- *Reliability analysis is the primary focus*

Solutions

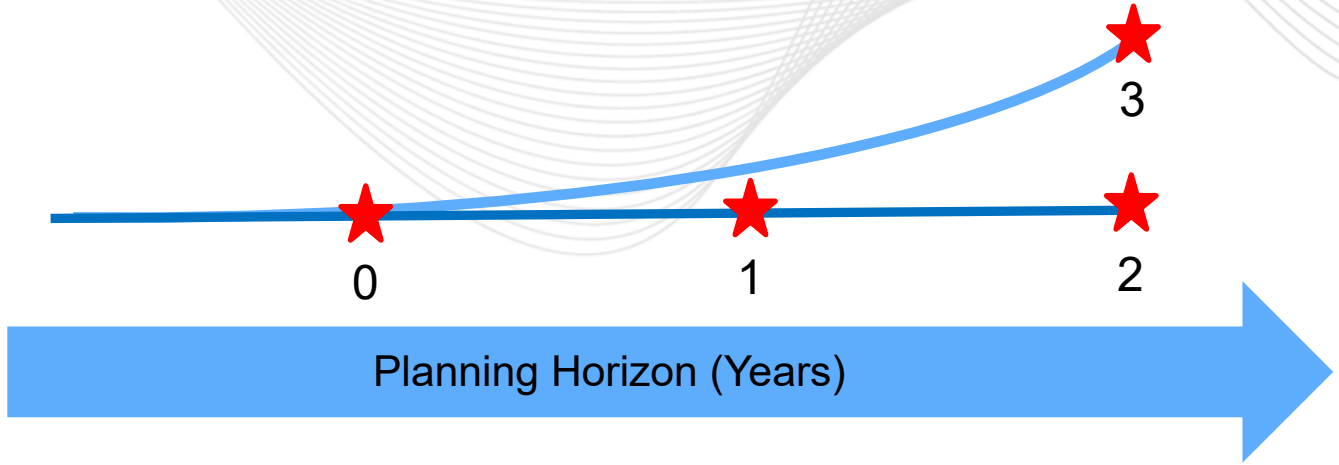
- *Transmission solutions must address reliability needs*
- *Secondary benefits inform project selection and portfolio savings*

Long-Term Scenario Development

Scenarios

- *Scenarios must be plausible*
- *Scenario assumptions and methods are transparent*

Potential Scenarios, Purpose



0: *Near-Term* (5 Year RTEP)

1: *Intermediate-Term* (8 Year)

- Helps identify robust Near-Term transmission solutions
- Anchoring point to determine timing of long-term transmission needs

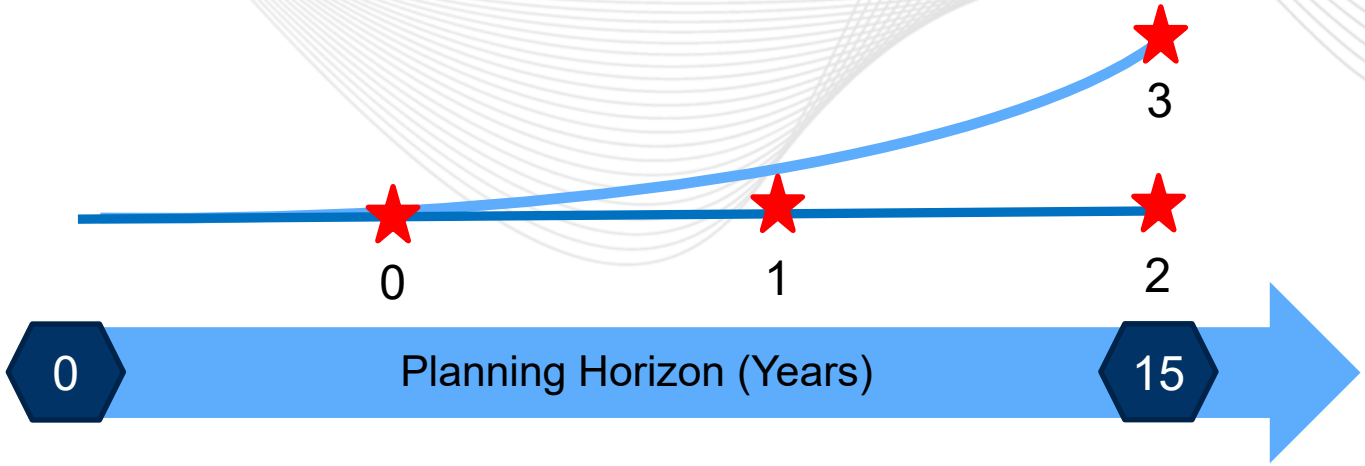
2: *Long-Term, Primary*

- Identify long-term transmission needs

3: *Long-Term, Accelerated*

- Helps identify robust Long-Term transmission solutions

Potential Scenario, Assumptions



Parameters	Scenario 1: Intermediate-Term	Scenario 2: Long-Term, Primary	Scenario 3: Long-Term, Accelerated*
Study Horizon	8 years	15 years	15 years
Reliability	At Least Minimum Reserve Margin	At Least Minimum Reserve Margin	At Least Minimum Reserve Margin
Load	Electrification, etc.	Electrification, etc.	Accelerated Electrification, etc.
Factors Driving Resource Mix Changes	Technology, Fuel Prices, Policy Mandates	Technology, Fuel Prices, Policy Mandates	Technology, Fuel Prices, Accelerated Policies

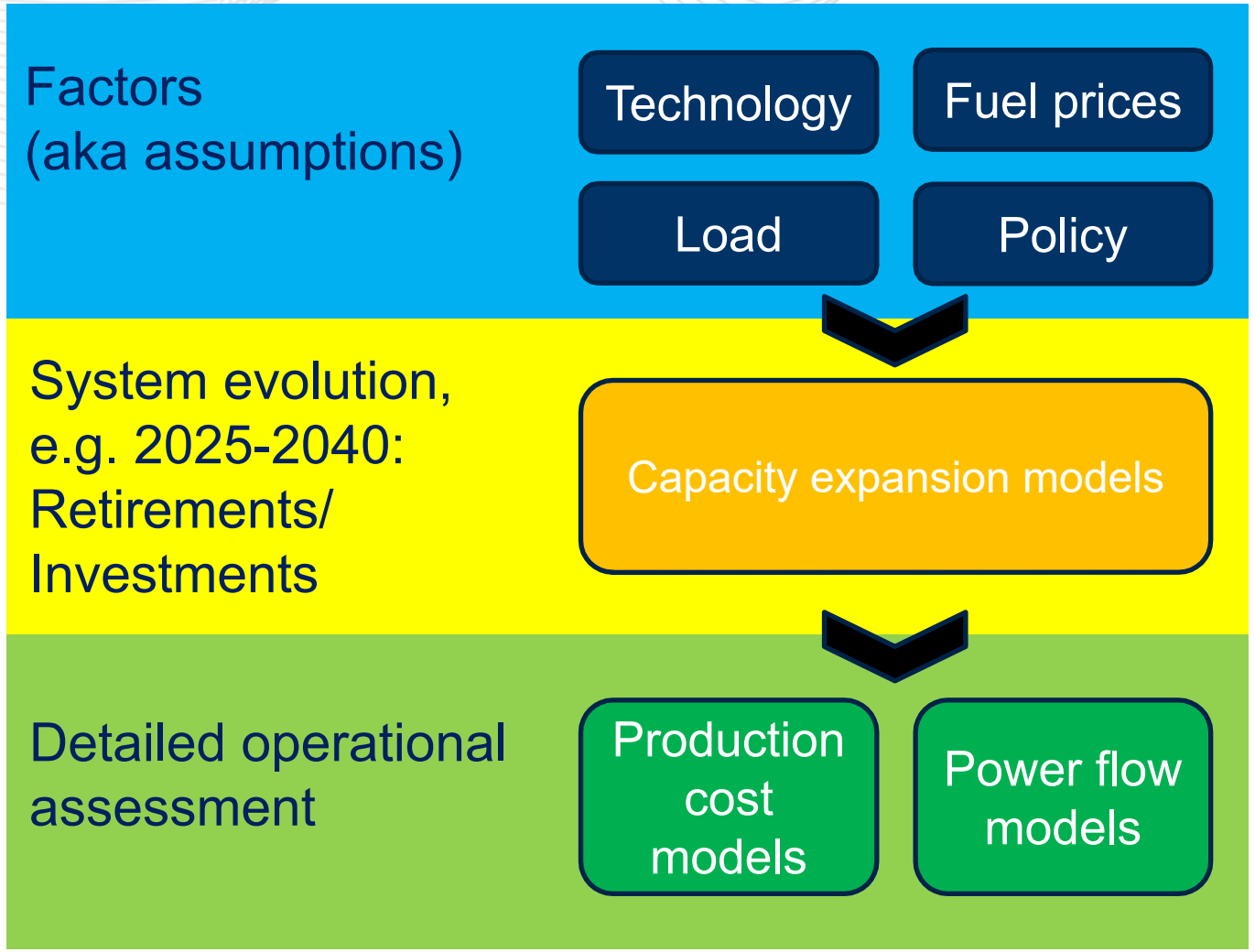
* Twenty year simulation

More Extensive List of Scenario Assumptions

1. **Load and Electrification**:
   - Data centers
   - Heating
   - EVs
2. **Policies**
   - IRA
   - Policy retirements
   - RPS
   - Offshore/BTM/Battery targets
3. **Renewables' capacity factors**
4. **Fuel Prices**
5. **Discount Factor**
6. **Power system's initial state**
7. **Generation and storage candidates**
   - Sites
   - Technical characteristics and costs
   - New technologies
8. **Resource Adequacy**
   - Reliability Target
   - ELCC

Capacity expansion modeling for scenario building

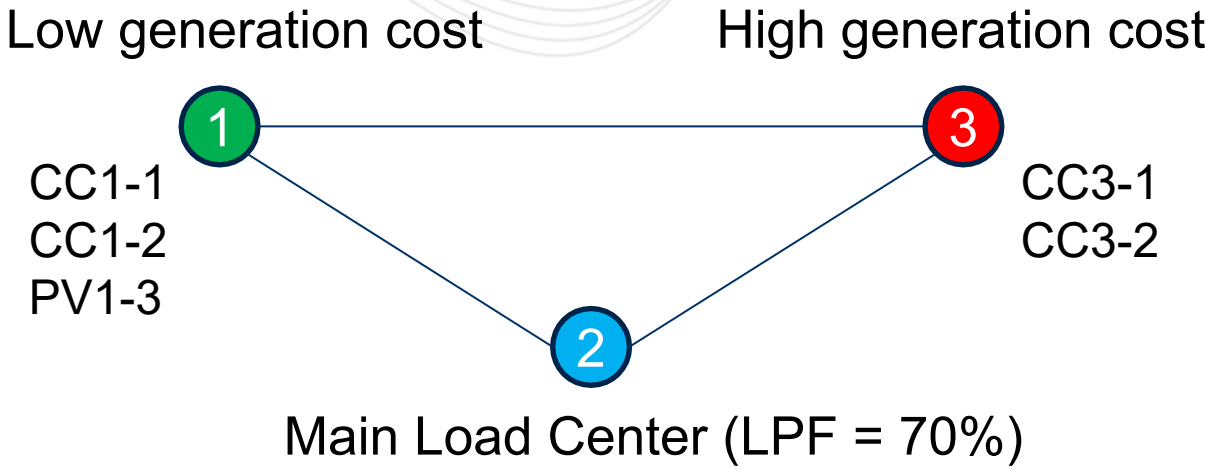
"Capacity expansion models simulate generation and transmission capacity investment, given assumptions about future electricity demand, fuel prices, technology cost and performance, and policy and regulation" DOE



Use of capacity expansion models for scenario building

- Federal government (DOE, Annual Energy Outlook; *NEMS*)
- States (Maryland; *WIS:dom*)
- National Labs (NREL, Sandia; *ReEDS, RPM*)
- ISO (MISO, NYISO, ISO-NE, SPP, ERCOT, SC; *PLEXOS, Aurora, EnCompass*)
- Information, finance, consulting (S&P, E3, AP; *GEO, Aurora, Resolve)*
- PJM's stakeholders (AEP, Dominion, Constellation; *PLEXOS*)
- PJM (for market design, MOPR, MSOC, CAPSTF; *in-house*)

Capacity Expansion – Illustrative Example



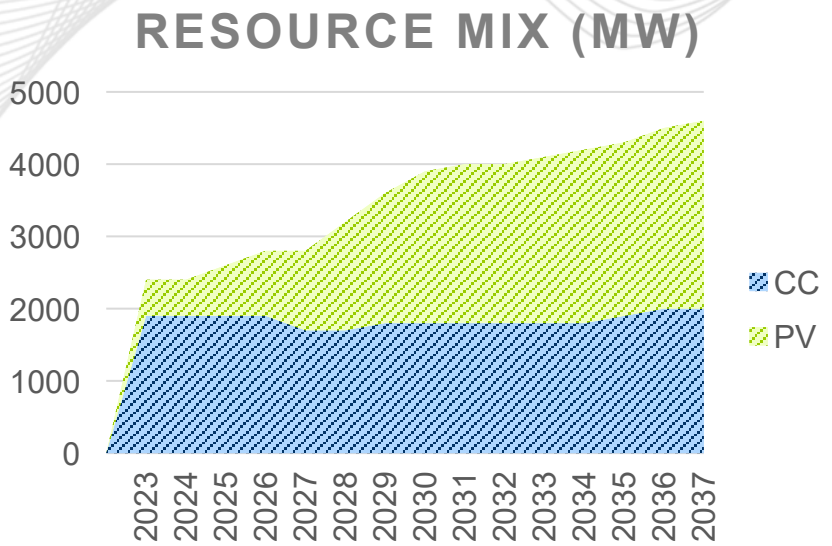
Factors
- Load grows over time
- Policy retirements
- RPS

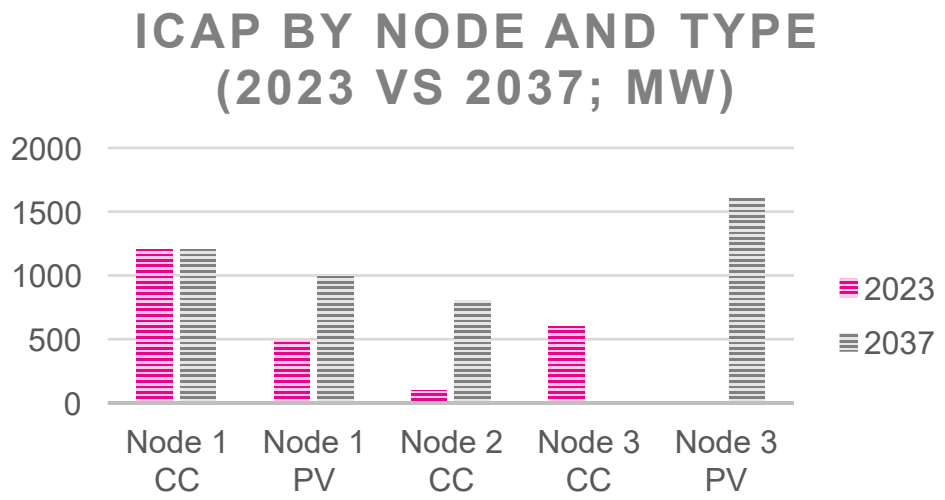
Find time, location of CC and Solar investments minimizing the net present value of system costs between 2023-2037 subject to constraints

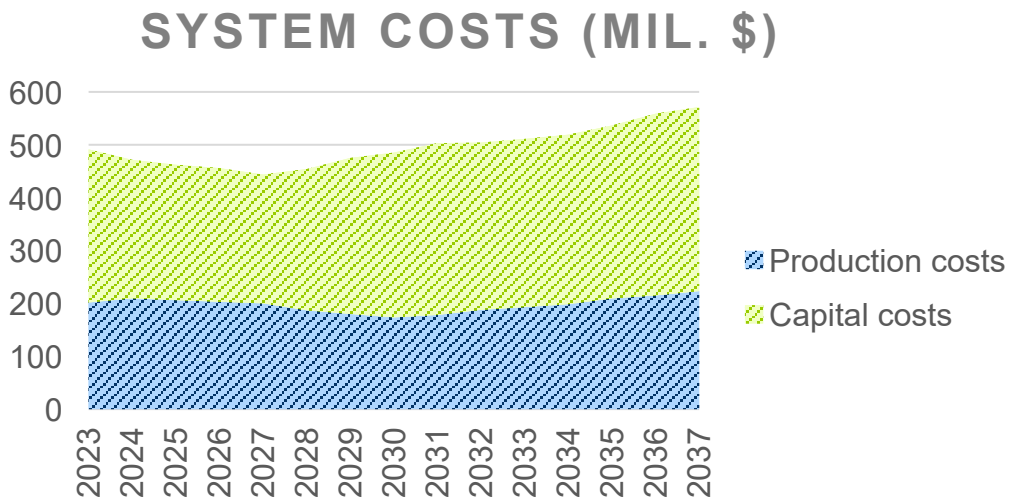
Detailed Inputs for Illustrative Example

- Peak load: 1305MW in 2023, 3% annual growth
- ATWACC: 10%
- Generators
  - Existing: CC1-1 500MW, CC1-2 700MW, PV1-3 500MW, CC3-1 400MW, CC3-2 200MW
  - CAPEX $900/kW for solar (after IRA), $1200/kW for CC
  - CC heat rate: 9000 BTU/kWh
  - PV average capacity factor: 25% at Node 1; 20% at Node 3; none at Node 2
- Fuel Price
  - Gas: $3/MMBtu at Node 1; $3.67/MMBtu at Node 3; $4.33/MMBtu at Node 2
- Topology: Line12 and Line13 transmission limit 500 MW, Line23 400 MW
- Policies
  - RPS: 30% in 2028, 35% in 2029, and 40% 2030
  - Retirement: CC3-1 in 2027, CC3-2 in 2031

Some Results for Illustrative Example







Next Step

- Provide LTRTP update(s) at upcoming workshop(s)
  - Analysis pillar
  - Solution pillar

Contact

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Revision History

Version No.	Date	Description
1	7/18/2023	• Original slides posted
2	7/31/2023	• Update to slide 16, bullet point regarding CC heat rate to remove “at node 1”. • SME and facilitation team contact information added.

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