DOCKETED	
Docket Number:	24-OIIP-03
Project Title:	Informational Proceeding on Non-Energy Benefits and Social Costs
TN #:	270022
Document Title:	Combined Slides - Staff Webinar on Integrating NEI Metrics in Supply Modeling for the NEI OIIP
Description:	N/A
Filer:	Mikayla Roberts
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	5/15/2026 4:40:45 PM
Docketed Date:	5/15/2026

Introduction: Non-Energy Impacts - Next Steps

Moderator, Liz Gill, PhD, Branch Manager – Reliability Analysis Branch, EAD

Housekeeping

- Workshop is being conducted remotely via Zoom
- Workshop is being recorded
- Attendees may participate in the workshop by:
- Asking questions during public Q&A periods.
  - Questions can be entered in the Q&A section of the Zoom application or by using the raise hand feature
- Making comments during public comment period and
- Submitting written comments by 5 pm on **June 1st, 2026**

Workshop Overview

(Times are approximate)

- Opening Remarks 9:00 – 9:05
- Opening Comments from Commissioners 9:05 – 9:15
- Presentations 9:15 – 10:45
  - The Vision for Non-Energy Impacts in Energy Assessments Division
  - Overview of CEC's Resource Planning Processes
  - Integration Approaches and Metric Calculations
  - Next Steps
- Questions from the Commissioners 10:45 – 11:00
- Public Q&A 11:00 – 11:30
- Public Comments 11:30 – 11:45
- Closing Remarks & Adjourn 11:45 - Noon

Commissioners Opening Comments

The Vision for Non-Energy Impacts in EAD

Aleecia Gutierrez, Director, Energy Assessments Division (EAD)

NEIs + EEIs: A Unified Approach for Improved Future Outcomes

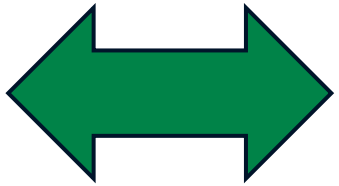
Working together to embed equity

EEI

Inform Near-term Efforts

Goals: Pinpoint insights to help identify at risk communities & prioritize CEC efforts & investments

Product: Data visualization & mapping tool for screening



NEI

Inform Long-term Planning

Goals: Determine methodologies to integrate NEIs into CEC's resource planning processes and decision making

Product: Report & Improved Modeling

Energy Equity Indicators Tool

1 Data Visualization and Mapping

Socio-economics

Health

Affordability

Clean Energy Adoption

Database of Equity Data

Geographic Data Layers

Data Access and Analysis

2 Insights to Help Prioritize CEC Efforts and Investments

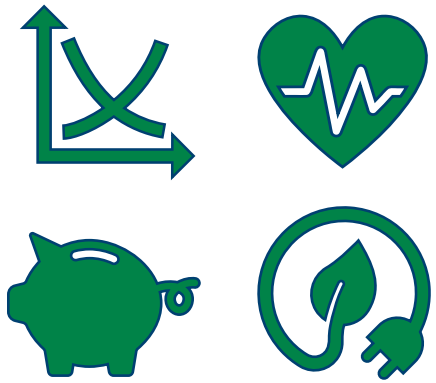
3 Complement to CalEnviroScreen 4.0

THE LONG-TERM VISION EXAMPLE

Working together to embed equity into EAD areas of responsibility

EEI

NEI



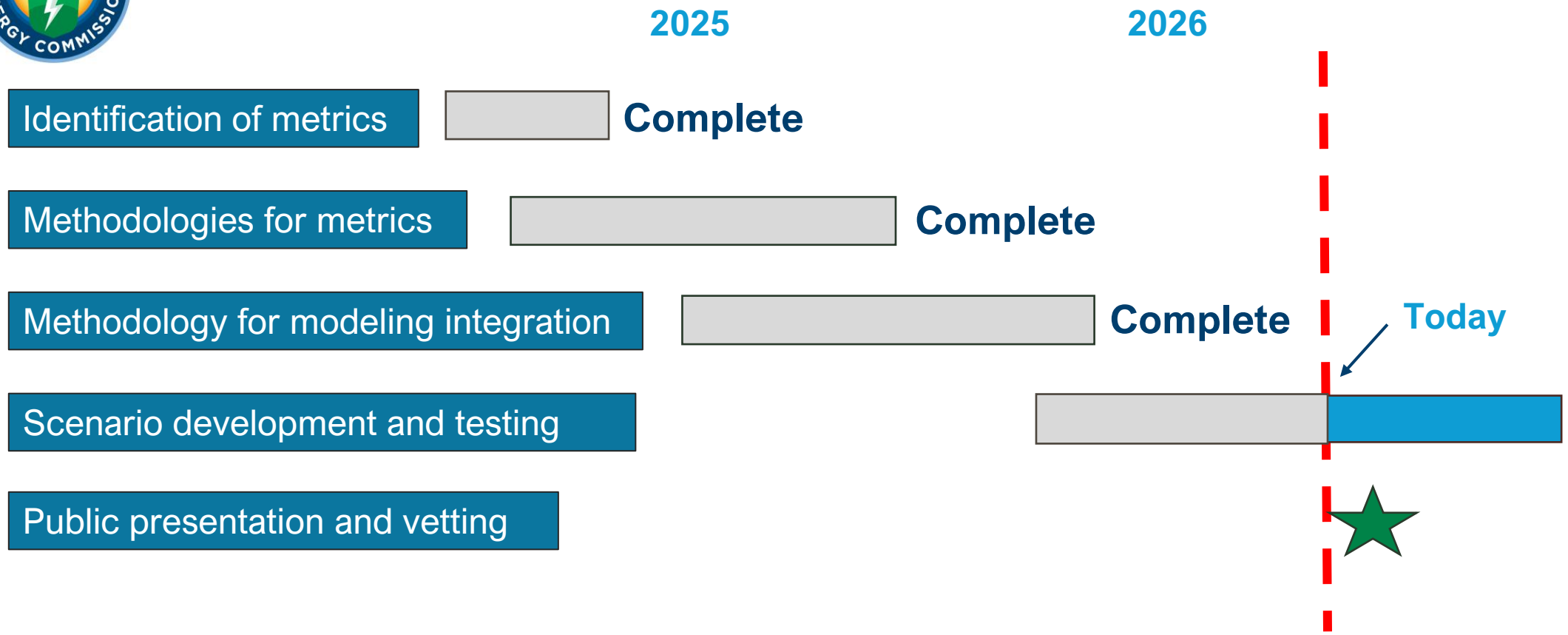
Planning

Investments

Programs

IDENTIFY + FORECAST

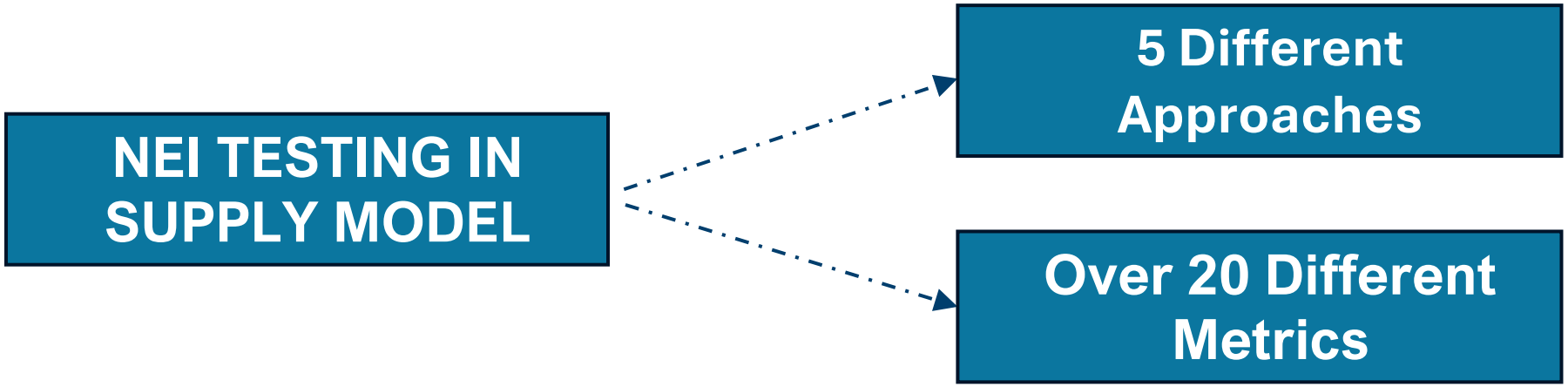
Current NEI Status



Q2 26: workshop

Opportunity for Testing Integration of NEIs in Supply Modeling

- We have a selection of metrics and integration approaches



Appendix – Background on Petition

Background on Petition

- Coalition of petitioners[1] requested CEC institute a rulemaking to integrate non-energy benefits (NEBs) and social costs (SCs) into resource planning and investment decision-making.
  - Integrate NEBs and SCs into cost-effectiveness determinations
  - Separate and transparent rulemaking to comprehensively address NEBs & SCs
  - Iterative process, starting with specific categories, refine methodologies with other economic considerations, and reflect qualitative life cycle value of externalities as standards for resource portfolios
  - Inform the 2025 SB100 Interagency Report

- On March 13, 2024, the CEC partially granted the Petitioners' request by initiating a transparent process to determine methodologies to integrate NEBs and social costs into the CEC's resource planning, processes, and decision-making and determined an Informational Proceeding to be the appropriate forum. The NEI OIIP (docket 24-OIIP-03) was initiated.
  - Results will not be available to inform the 2025 SB 100 Interagency Report

[1]Center for Biological Diversity, Central California Asthma Collaborative, California Environmental Justice Alliance, Asian Pacific Environmental Network, Greenlining Institute, Local Clean Energy Alliance, Sierra Club California, The Climate Center, Center on Race, Poverty and the Environment, Clean Coalition, 350 Bay Area, GRID Alternatives, The Protect Our Communities Foundation, the BEEP Coalition, the Local Government Sustainable Energy Coalition, and Environment California.

Overview of CEC's Resource Planning Processes

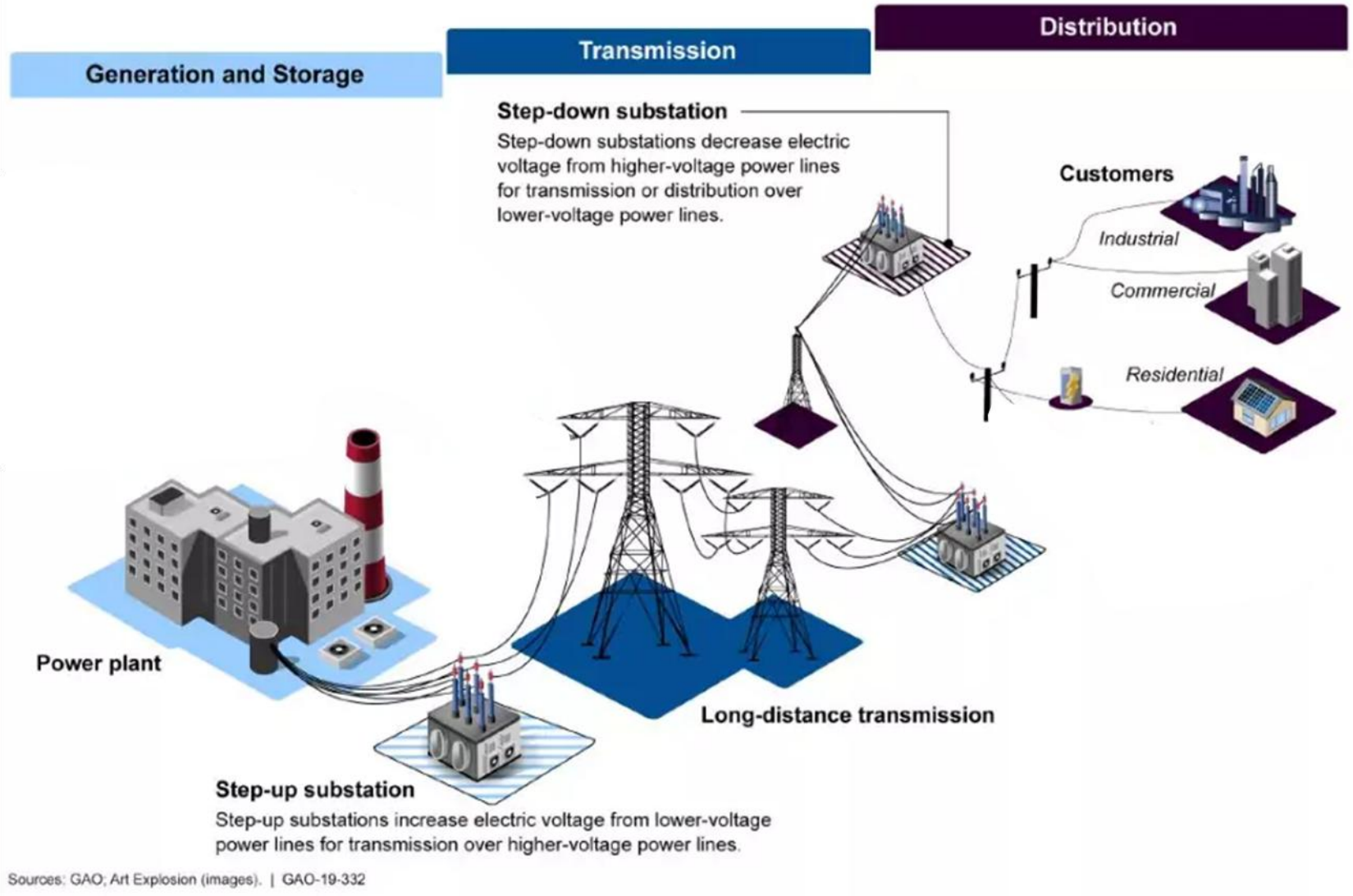
Dhruv Bhatnagar, Supervisor, Supply Planning

CEC's Resource Planning

- The CEC conducts statewide electricity system modeling
  - Provides independent, scenario-based analysis
  - Examines broader planning questions
  - Includes CAISO and publicly owned utility territories
  - Used by Legislature, the Governor's Office, and other state agencies.
- Key Resource Planning Products
  - SB100 Report
  - SB423 – Firm, zero-carbon resources
  - California Energy Resources and Reliability Outlook
  - SB846 – Quarterly Reliability Reports

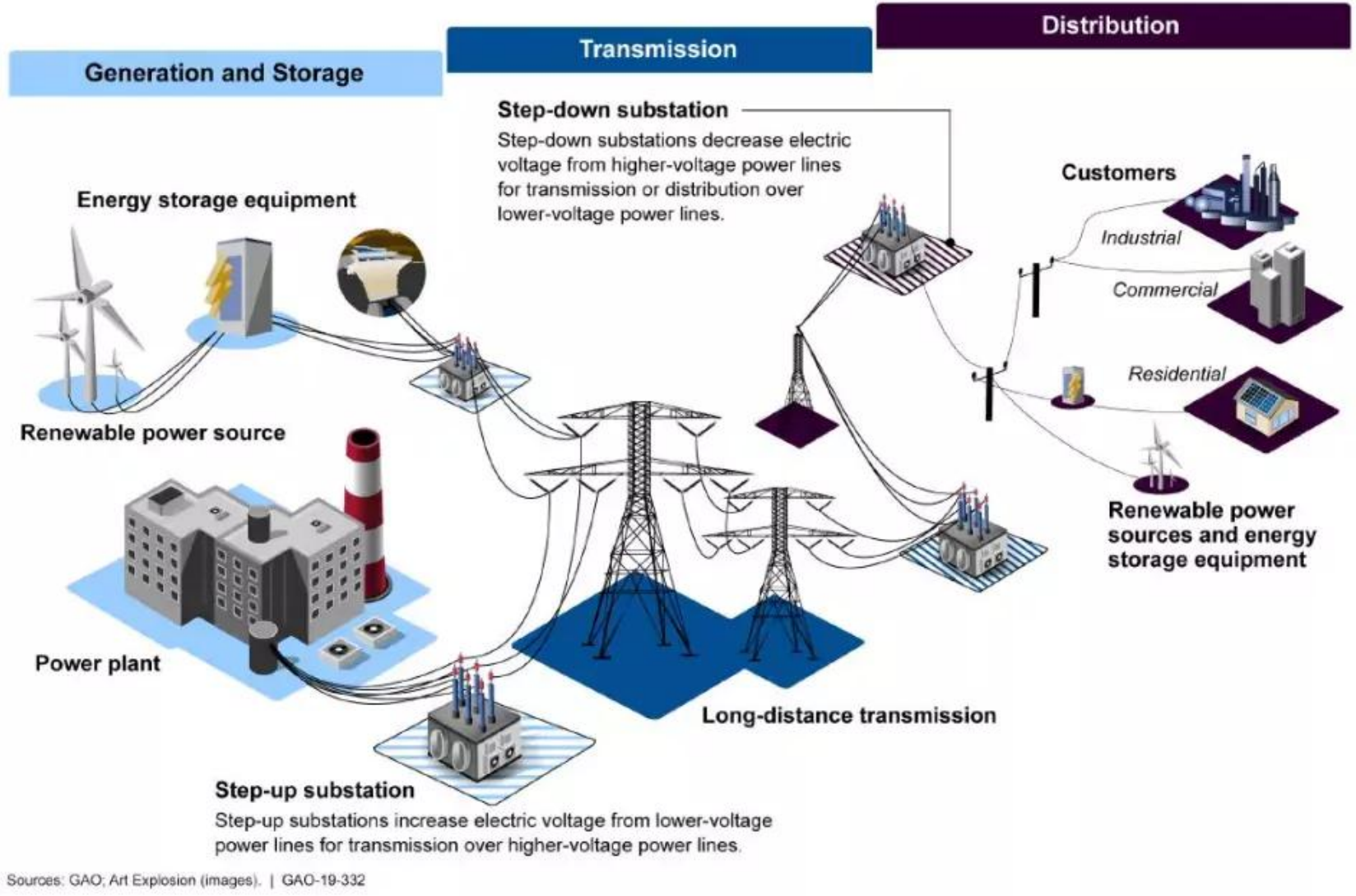
Supply Planning Models

Planning models were developed to optimize investment and operations

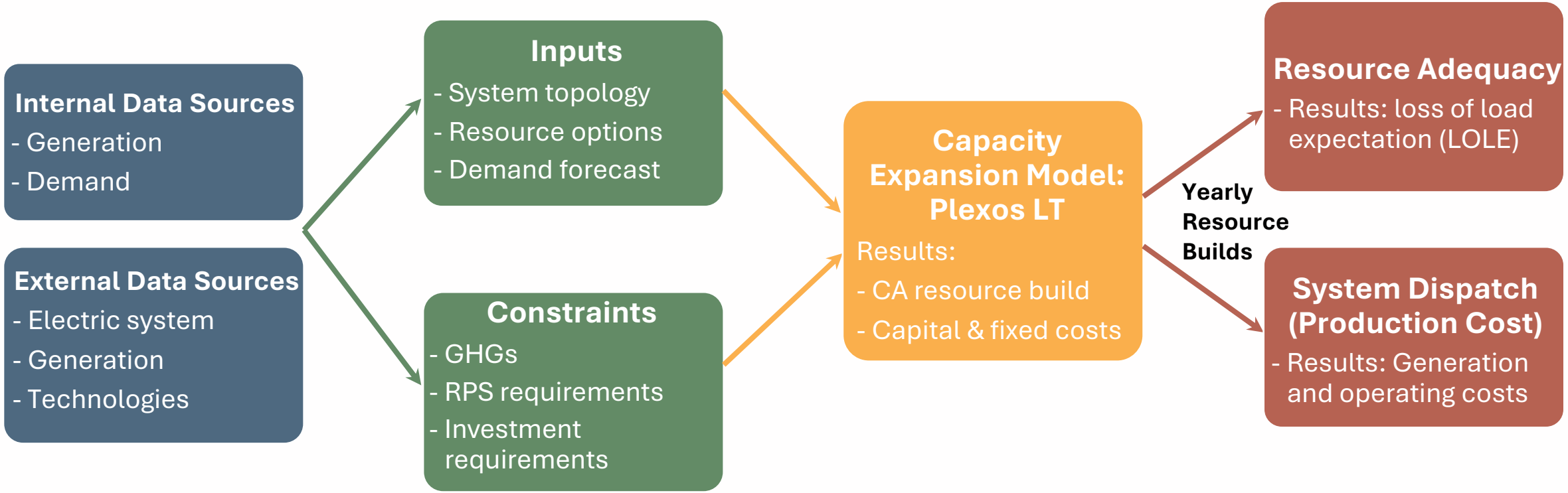


Supply Planning Models

Since then, the system has evolved with the addition of renewables, energy storage, DER, etc.



The Traditional Supply Modeling Process

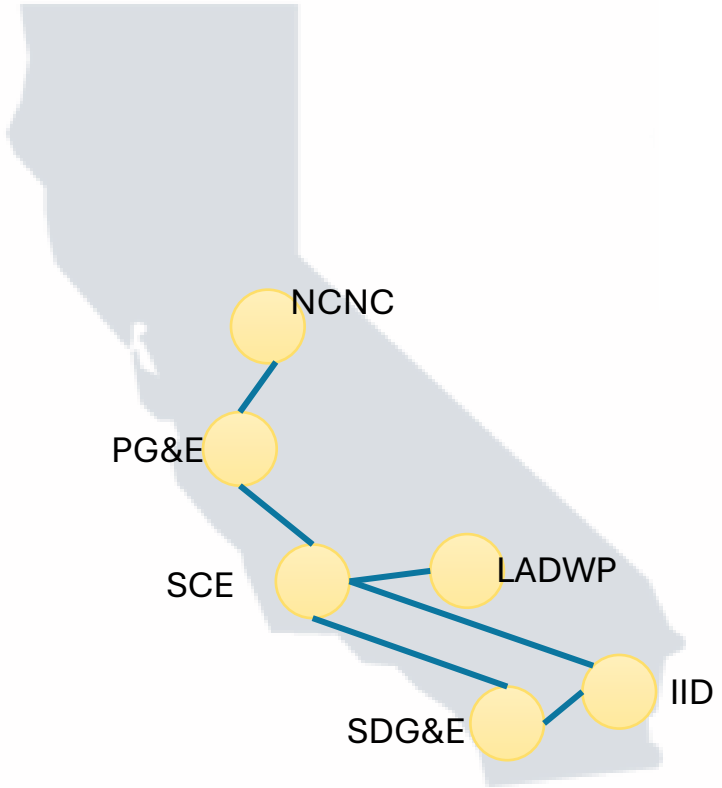


Resource Planning and NEIs

Models operate at the bulk system level – local impacts and benefits are missed

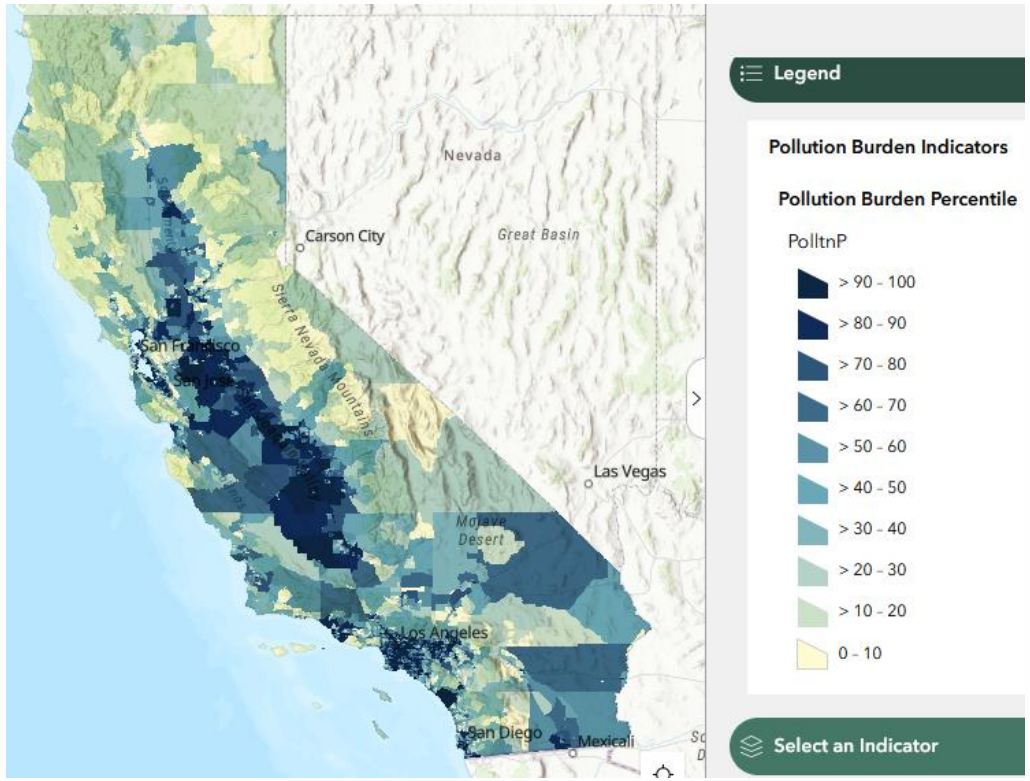
Model's View

Bulk System, aggregate cost



Community Reality

Distributional impacts (particulates and NOx)



Source: CalEnviroScreen 5.0 Draft

Bulk System Model
Optimizes aggregate cost of electricity production statewide

Not Modeled
Who bears localized air quality and health costs

Not Modeled
Full resource value beyond energy delivery

2021 SB 100 Report Quantified Non-Energy Benefits

Table 23 - Estimated Avoided Social Cost (Avoided Economic Damages) of SB 100 in 2045

	Social Cost of Carbon, US$ million (2016 dollars) 5% Discount Rate	Social Cost of Carbon, US$ million (2016 dollars) 3% Discount Rate	Social Cost of Carbon, US$ million (2016 dollars) 2.5% Discount Rate
SB 100 Core Scenario relative to 60% RPS Scenario	$887	$2470	$3430

Table 24 - Summary of Ranges of Health Impacts for the SB 100 Scenario in 2045

	Fewer Premature Deaths	Cardiopulmonary Hospitalizations	Asthma ER Visits
Primary $PM_{2.5}$	174 (136-213)	61 (8-114)	80 (50-109)

Parentheses represent the 95% confidence interval

Included qualitative discussions of:

- Water Supply & Quality
- Economic Development Impacts
- Community Resilience

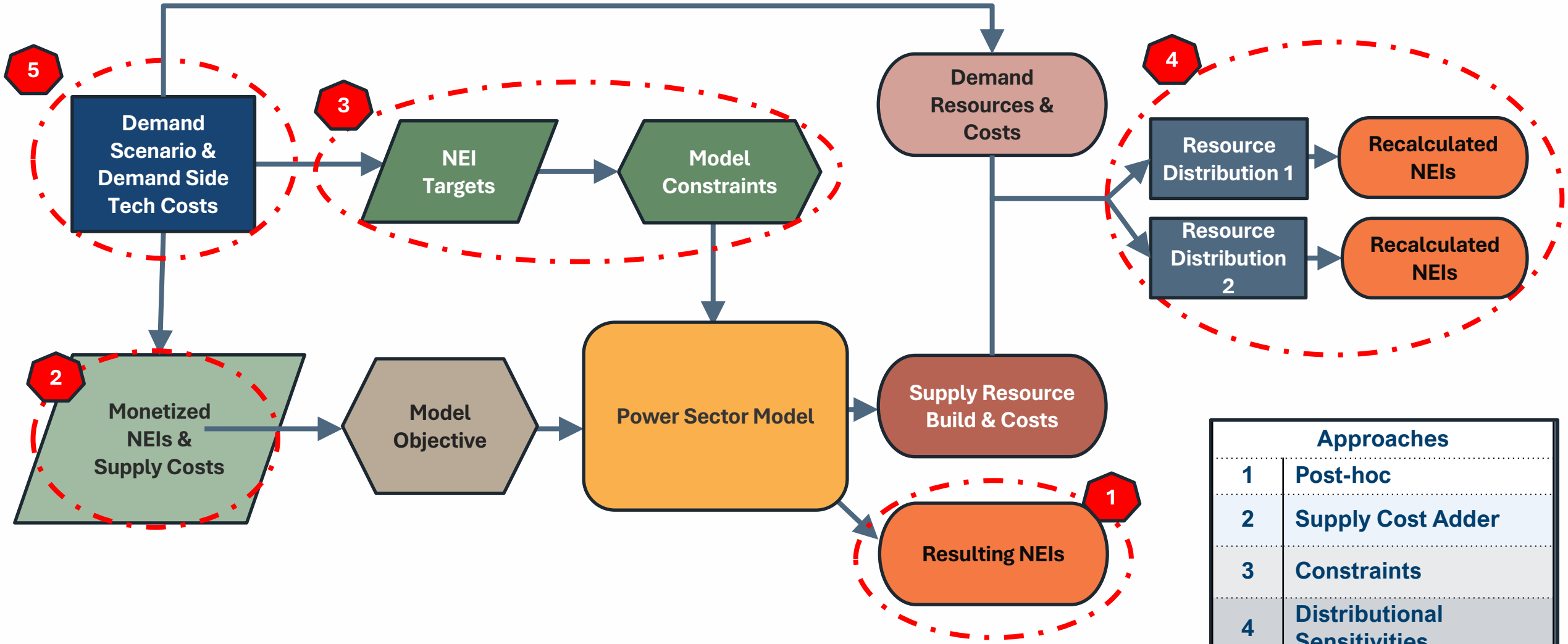
Additional Considerations

- Equity
- Housing Affordability Ratio
- Socioeconomic Vulnerability Index

Approaches for NEI Integration in Supply Modeling

- Established methods for integration of NEIs into modeling workflows are lacking, especially around demand side resources
  - **Post-hoc:** After modeling evaluate potential NEI impacts across scenarios.
  - **Supply Cost Modifier:** In the model, societal costs (positive or negative) associated with NEIs are added to the investment or operational costs for technologies.
  - **Constraints:** One or more constraints in the model can require the meeting of NEI targets, similar to GHGs targets.
  - **Distributional Sensitivities:** The magnitude of an NEI is strongly dependent on location of resources and who adopts them. Downscaling or bottom-up modeling can identify ranges of potential NEIs.
  - **Demand Side Technology Integration**: Demand side resources are added to resource portfolios as an input assumption.

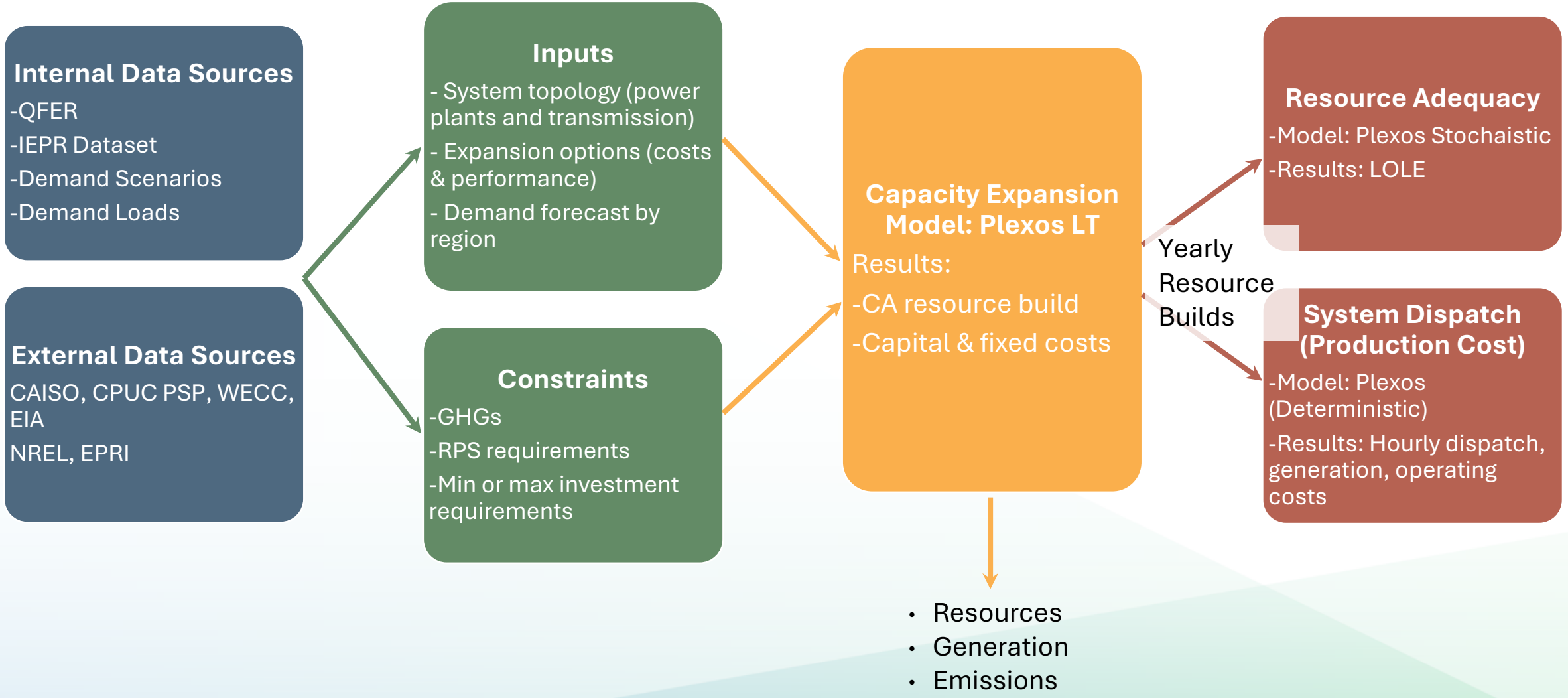
Explore Approaches for NEI Integration in Supply Modeling



Approaches	
1	Post-hoc
2	Supply Cost Adder
3	Constraints
4	Distributional Sensitivities
5	Demand Side Technology Integration

APPENDIX

The Traditional Supply Modeling Process



Modeling Limitations and Challenges

Including NEIs within existing system planning presents ongoing challenges

- Electrification of end-uses, a central strategy to economy-wide decarbonization, is leading to rapid deployment of demand-side resources in California, creating additional opportunity for these resources to mitigate bulk scale resource needs.

- Despite the important value they offer in conducting comprehensive evaluation of electric system evolution, supply models have limitations
  1. supply modeling occurs at a much coarser spatial scale (i.e., a balancing authority or regional level) than many NEI metrics are typically measured
  2. data to support NEI analysis are not immediately available at the scales of supply models which operate on high-level grid topologies
  3. established methods for integration of NEIs into modeling workflows are lacking, especially around demand side resources

Non-Energy Impacts – Metrics & Integration Approaches

Yunus Kinkhabwala, PhD, Senior Scientist, PSE Healthy Energy

Integration Approaches

Landscape of NEIs

NEI Criteria for Priority Consideration

Evaluated NEIs for this analysis were selected based on being:

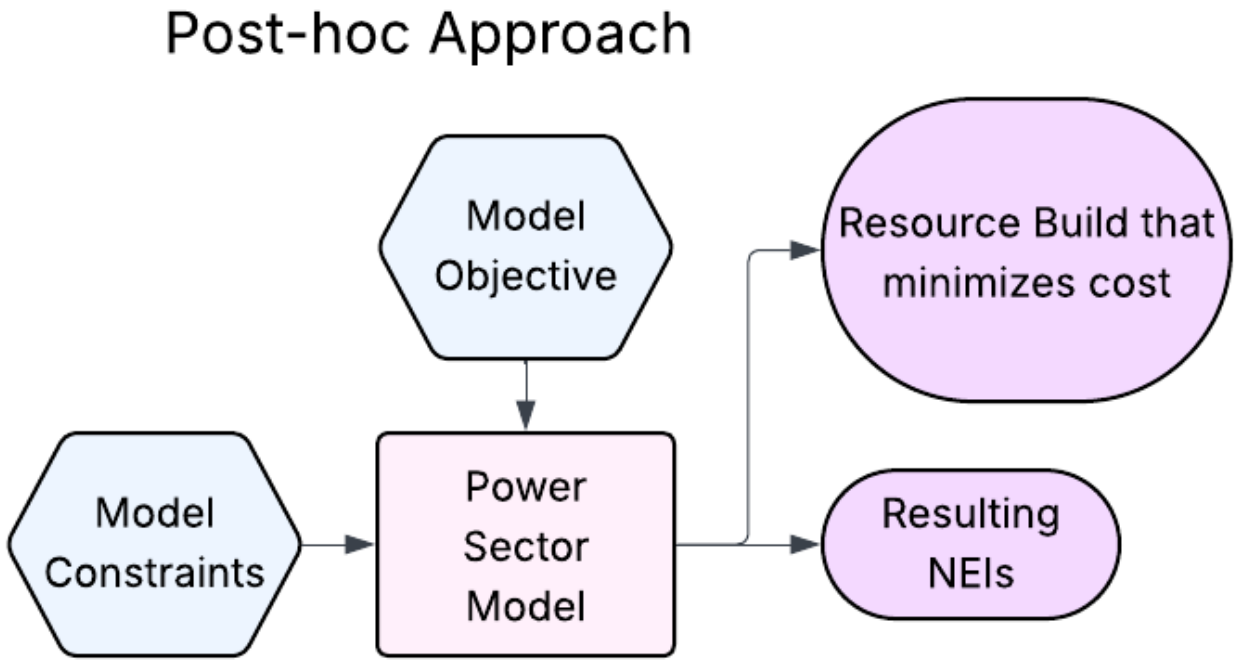
- Directly associated with generation and consumption of electricity
- Outside the scope of traditional planning, but relevant to state policy.
- Directly impacted by changes in generation and consumption of electricity
- Subject to significant change under feasible future alternatives.
- Prioritized for feasibility of analysis based on existing literature and data.

Upstream impacts including fuel production and manufacturing are not included here.

Approaches for Model Integration: Post-hoc

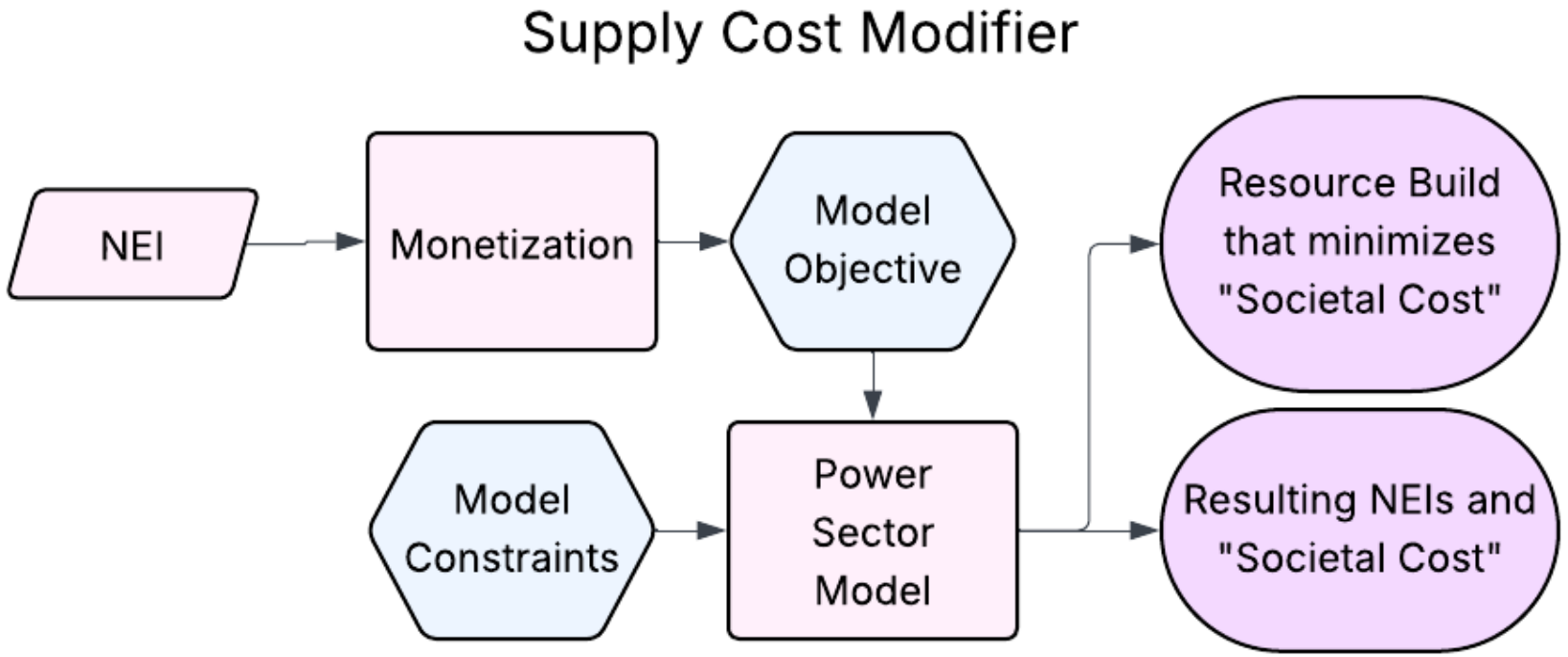
Approach	Description
Post-hoc analysis of NEI impacts	Calculate NEIs due to changes in capacity and generation resulting from predetermined scenarios.

Each model run should have all its NEIs calculated regardless of how scenarios are built.



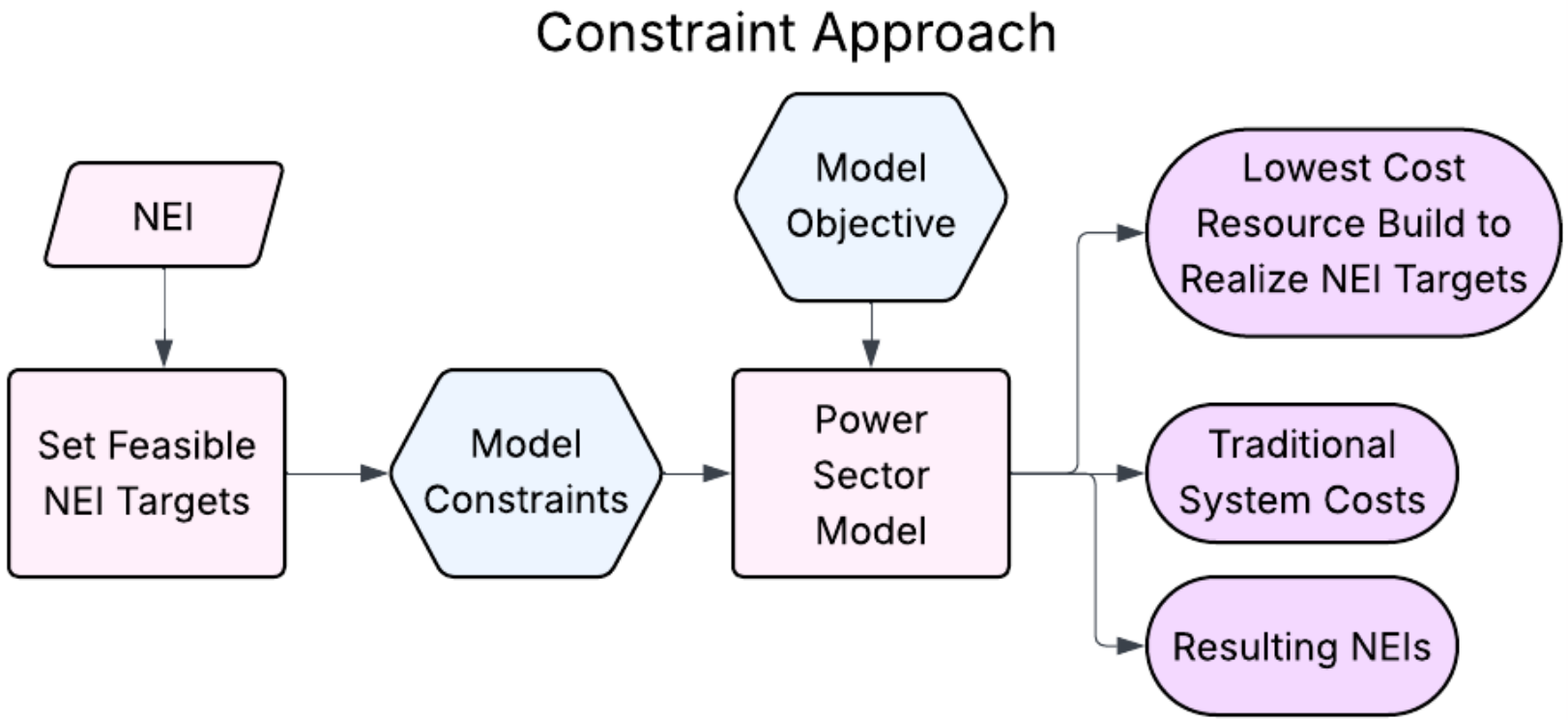
Approaches for Model Integration: Supply Cost Modifier

Approach	Description
Supply cost modifier	Addition of societal costs to traditional financial costs for each technology.



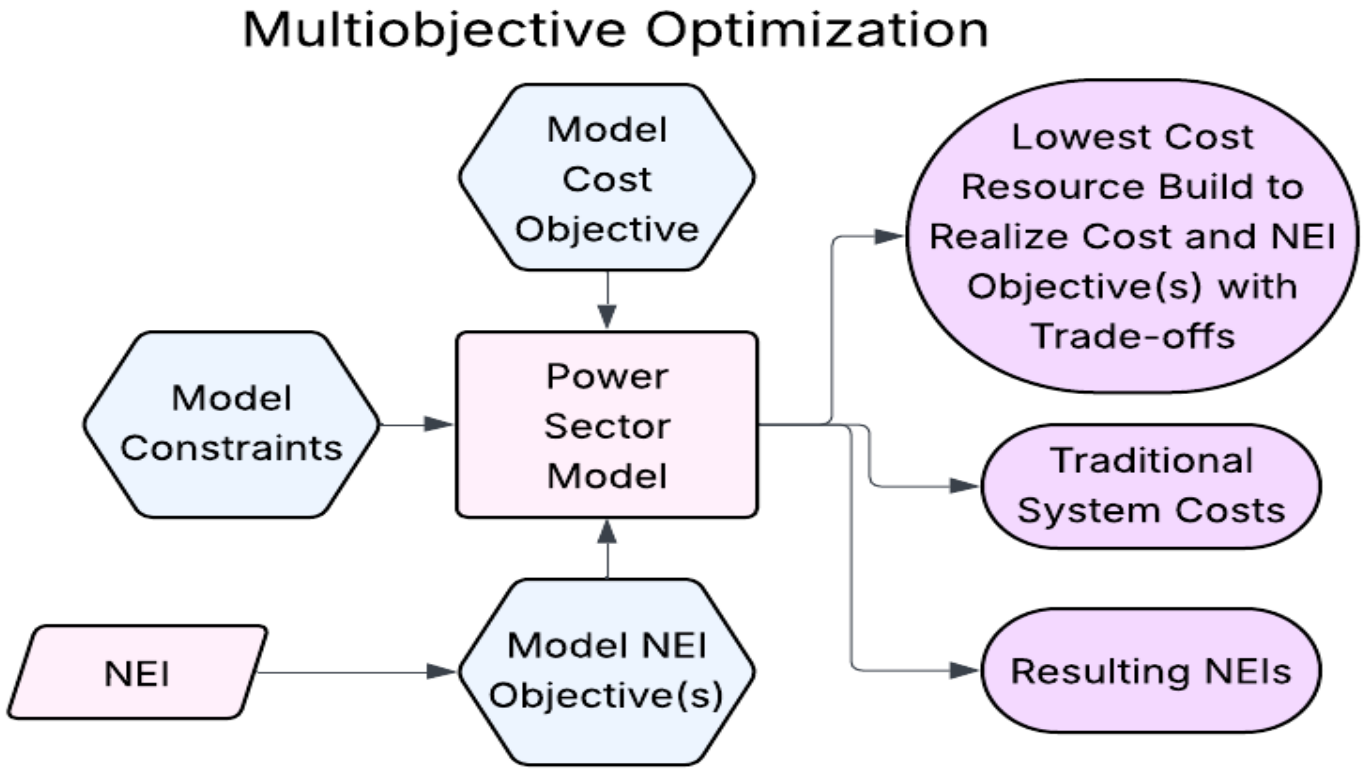
Approaches for Model Integration: NEI Constraints

Approach	Description
Constraints to meet NEI targets	Constraints can force modeled capacity and generation to meet a NEI target(s), similar to how GHGs targets are incorporated.



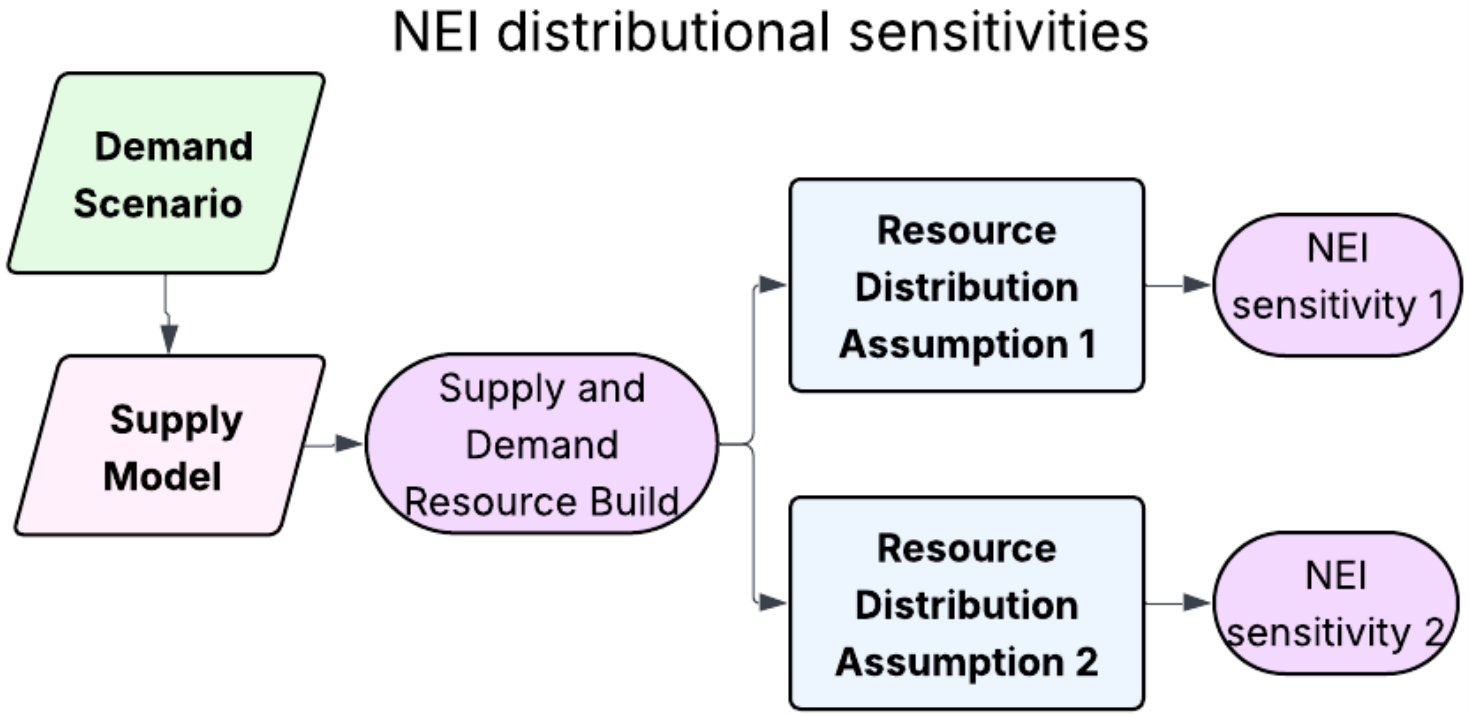
Approaches for Model Integration: Multi-objective

Approach	Description
Multiple objective optimization	Modeling frameworks exist to simultaneously optimize multiple separate objectives but are not common for power sector planning.



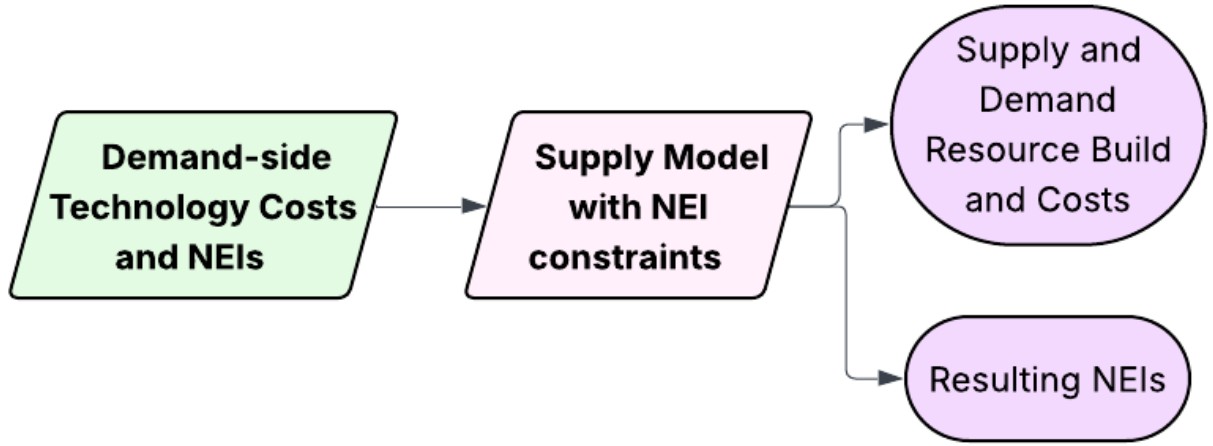
Approaches for Model Integration: NEI Distributional Sensitivities

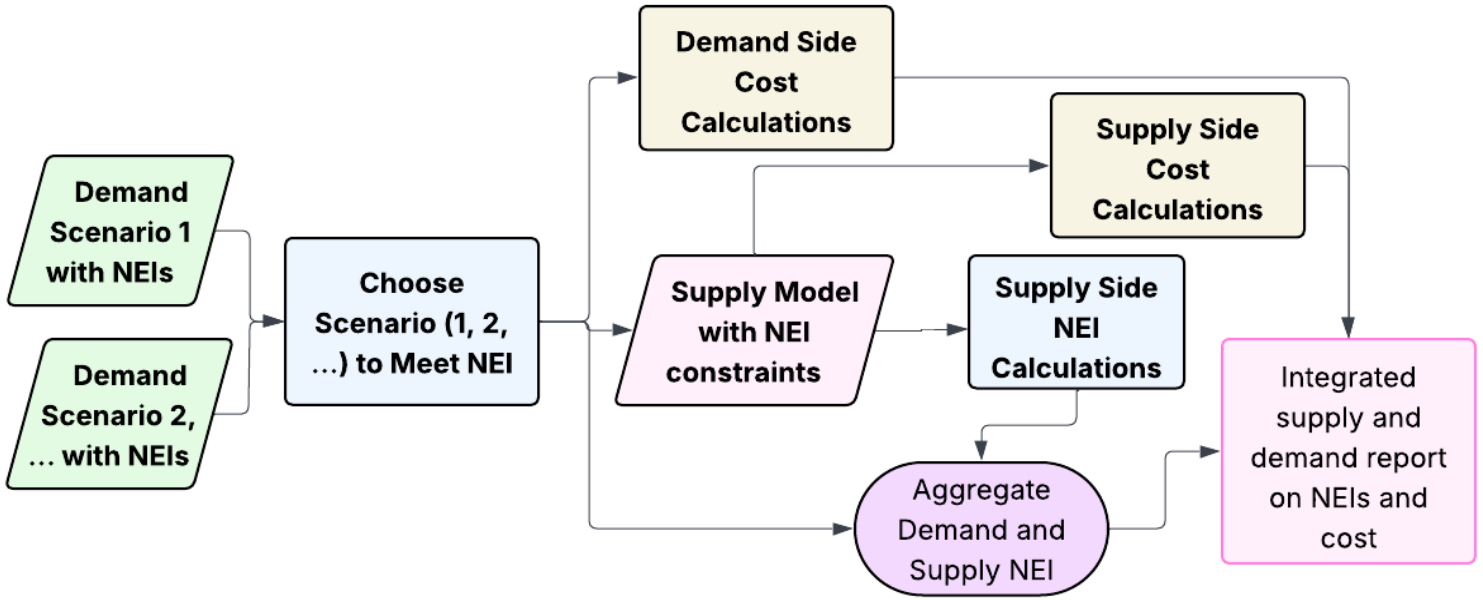
Approach	Description
NEI distributional sensitivities	Sensitivities capture the range of values a given NEI may realize dependent on location of resources and who adopts them.



Approaches for Model Integration: Strategies for Demand-side Integration

Approach
Compete by cost in supply-side model: Add monetized NEI to DERs and determine if sufficient to adopt resources
Pre-defined Changes in Demand Scenario: Multiple supply models with new demand scenarios





Approaches for Model Integration: Strategies for Demand-side Integration

Approach	Advantages and Disadvantages
Compete by cost in supply-side model: Add monetized NEI to DERs and determine if sufficient to adopt resources	**Advantage:** • Easy to interpret results **Disadvantage:** • Costs for DERs are highly variable and not well captured by average NREL ATB values. • DERs may not be chosen due to incomplete DER NEIs and model limitations.
Pre-defined Changes in Demand Scenario: Multiple supply models with new demand scenarios	**Advantages:** • Acts like constraint to investigate scenarios with various amounts of DERs. • Allows for resources that increase demand, not just distributed generation. **Disadvantages:** • More complex post-hoc analysis to capture the tradeoffs of DER adoption.

Ambient (Outdoor) Air Quality

The Need for Air Quality Impacts in Energy Modeling

- Electricity generation and consumption directly affect outdoor air quality and human health.
- Below are the three sectors that offer the greatest opportunity to improve air quality across all communities while also driving direct resource planning impacts.
  - **Power Generation:** Combustion-based power generation is a significant and addressable source of air pollution.
  - **Buildings:** Heating and appliances powered by fossil fuels or wood release harmful pollutants into our air.
  - **Transportation:** The single largest contributor to air pollution in California

Translating Emissions into Health Impacts

- Ambient Air Quality NEIs Methodology:
  - Calculate shifts in emissions from each energy scenario
  - Calculate how those changes in emissions impact air quality
  - Use established relationships between air quality and human health to determine changes in premature mortality
    - For example, studies have shown that a 10 ug/m3 reduction in PM2.5 concentration is associated with a 3-12% decrease in all-cause mortality.
  - Use the value of a statistical life (VSL; an established economic measure) to calculate monetized effects.

Ambient Air Quality & Health Metrics

Metric	Unit	Description
Health Impacts Rate	- mortalities/fuel used (transportation & buildings) - mortalities/MWh (natural gas generators)	Calculates mortalities resulting from emissions and air quality changes. Additional health end points are also available.
Monetized Health Impact Rate	- $/fuel used (transportation and buildings) - $/MWh (natural gas generators)	Uses the value of a statistical life to convert mortalities into dollars per unit of energy generated or consumed.

Integrating Air Quality into Capacity Expansion Modeling

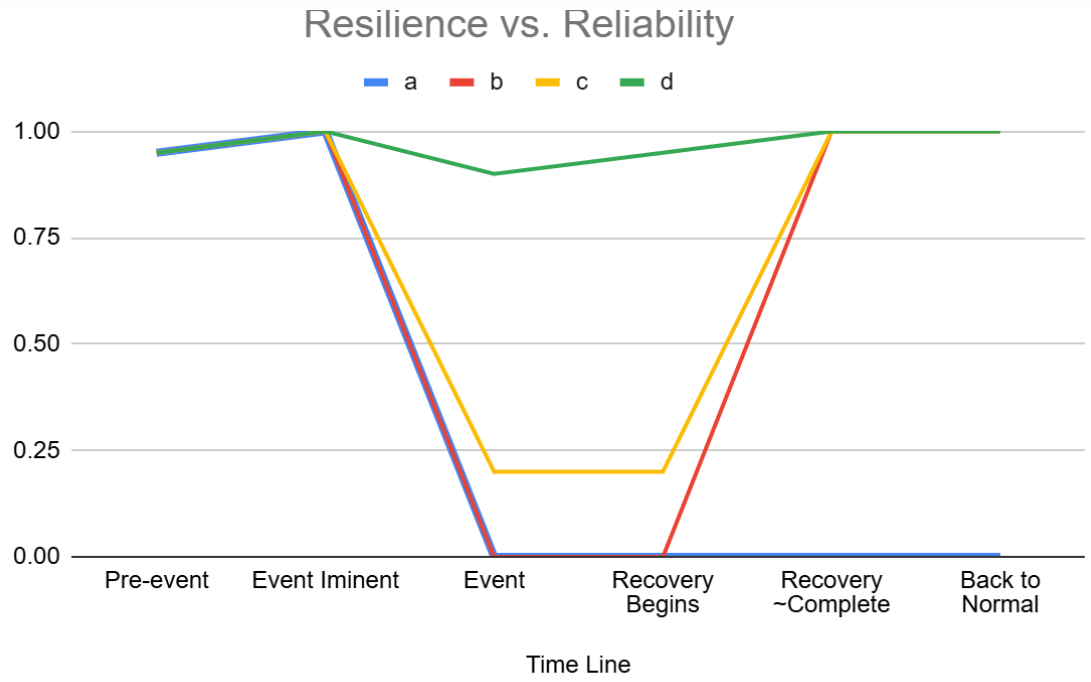
The monetized or mortality rate impacts of varying scenarios can then be used in expansion modeling via three approaches:

- **Post-Hoc Analysis:** Evaluates air quality impacts separately after modeling. Includes building and transportation electrification.
- **Supply Cost Modifier:** Incorporates monetized health damages ($/MWh or $/fuel used) directly into the cost inputs of the expansion model.
- **Health Impact Constraint:** Caps the model to a maximum allowable health impact, allowing exploration of resource mixes that meet a mortality-reduction goal without requiring monetization.

Energy Resilience

Definition of Household and Community Energy Resilience

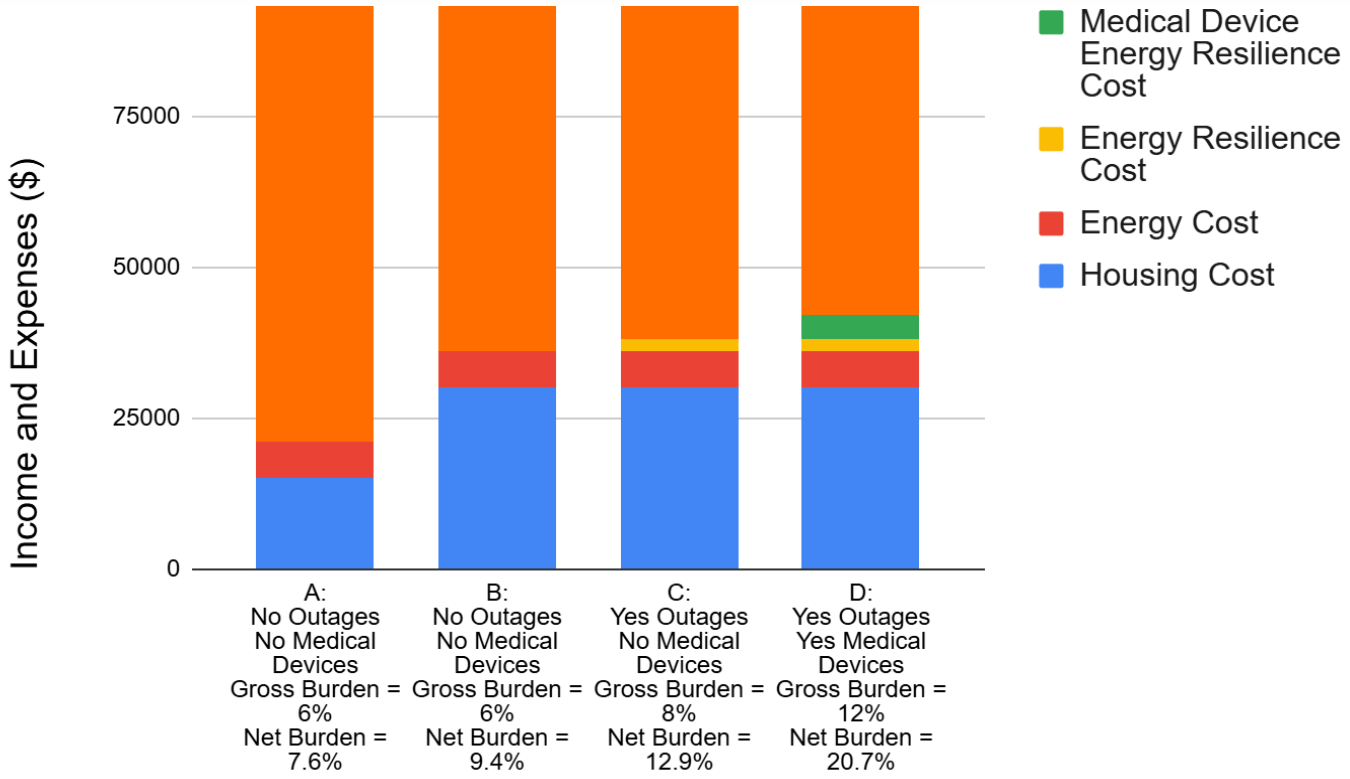
- **Energy resilience** is the ability of systems (buildings, businesses, households, and communities) to withstand, adapt to, and recover from inevitable disruption in centralized energy systems.
- **Grid resilience** concerns narrowing the time between events and grid recovery, but does not account for what happens to customers while the grid is down.



a: fails ~ not resilient
b: recovers ~ resilient
c: critical backup ~ more resilient
d: minimal impact ~ most resilient

Bruneau et. al, (2003)

Quantifying Differences in Energy Resilience Needs for Priority Populations



Conceptual graph of households with identical income and energy cost but increasing need for energy resilience (left to right)

- Households experience wide range of energy resilience needs depending on:
  - income,
  - vulnerability,
  - outage likelihood,
  - exposure to climate hazards.
- Energy resilience metrics should capture the extent and range of household resilience need

Energy Resilience Metrics

Metric	Units	Description
Household Resilient Energy Cost Burden	% of gross income	Proportion of income spent on resilient energy, including the cost of mitigations and interventions and the remaining unmitigated outage costs.
Household Resilient Energy Affordability Gap	$	Total spending on outages and resilient energy at home, beyond an energy cost burden threshold
Households with backup power subdivided into priority groupings for resilience need	# and % of households	Number of households and percentage of households with resilient backup power (by income, vulnerability, and outage and hazard exposure, etc.).

Integrating Resilience into Capacity Expansion Modeling

- Since energy resilience is primarily driven by demand-side resources, it will be incorporated using **post-hoc** integration approaches combined with using a range of demand-side projections.
- Different adoption scenarios of demand-side resources will provide ranges of resilience impacts based on which households have access to technologies

Household Energy Cost

Household Energy Cost

- Essential household energy expenses are for homes and transportation.
- Rate changes, fuel switching, efficiency, and self generation impact energy costs.

Household Energy Cost Metrics

Metric	Units	Description
Home and Transportation Energy Spending	$	Aggregate and average cost households spend separately for operating homes and personal transportation
Home and Transportation Energy Cost Burden and CEC Affordability Index	% of income	Proportion of household income spent on home and transportation with mean/median values for strategic subgroups
Home Energy Affordability Gap	$	Aggregate home energy spending ($) greater than % cost burden thresholds

Each metric is calculated for all households and separately for just households eligible for CARE/FERA energy bill assistance.

Integrating Household Energy Cost into Capacity Expansion Modeling

- Due to complexities of customer cost and rates not included in cost minimization modeling, household energy cost impacts are only considered **post-hoc** and not incorporated into objective functions or constraints.
- Demand-side integration approaches will add information on household cost by exploring ranges of customer adoption.
- Different adoption scenarios of demand-side resources will provide ranges of cost statistics based on which households have access to technologies

Water

Water Impacts

Power generation impacts water availability through multiple pathways.

- Thermal generation (e.g. gas, geothermal) is the predominant water impact, but other generation resources are also calculated.
- Water use for hydrogen, though technically upstream, will be considered as consumption when hydrogen is used for generation.

Metric	Units	Description
Water Withdrawal Rate	gal/MWh	Water typically used for cooling that is returned to source with potential ecological impacts
Water Consumption Rate	gal/MWh	Water typically user for cooling that is lost due to evaporation

Integrating Water into Capacity Expansion Modeling

Water impacts have decreased significantly over recent decades. This NEI will thus be limited to **post-hoc** consideration to minimize the number of separate modeling scenarios but still add information around the water system impacts.

Workforce

Workforce Impacts

The Workforce NEI will translate generation planning into quantifiable workforce and economic impacts. Several metrics are under development.

Metric Name	Units	Description
Construction Jobs Created	Job-years	Total direct construction jobs by technology and region.
Operations Jobs Sustained	Annual jobs	Long-term employment supported through O&M activities.
Labor Intensity by Technology	Job-years / MW	Employment coefficient per MW of installed capacity.
Regional Workforce Distribution	% share	Share of total jobs by modeled region, reflecting localized impacts.
Employee Compensation	$ / year	Estimated total labor income associated with construction and operations employment under each scenario.
Job Quality (Employee Compensation)	$/job-years / MW	Employee compensation (as a proxy for job quality) coefficient per MW of installed capacity.
Total Economic Output	$ / year	The overall value of goods and services generated through direct and indirect effects of construction and operations activity under each scenario.
Economic Intensity by Technology	Economic output / MW	Economic coefficient per MW of installed capacity.

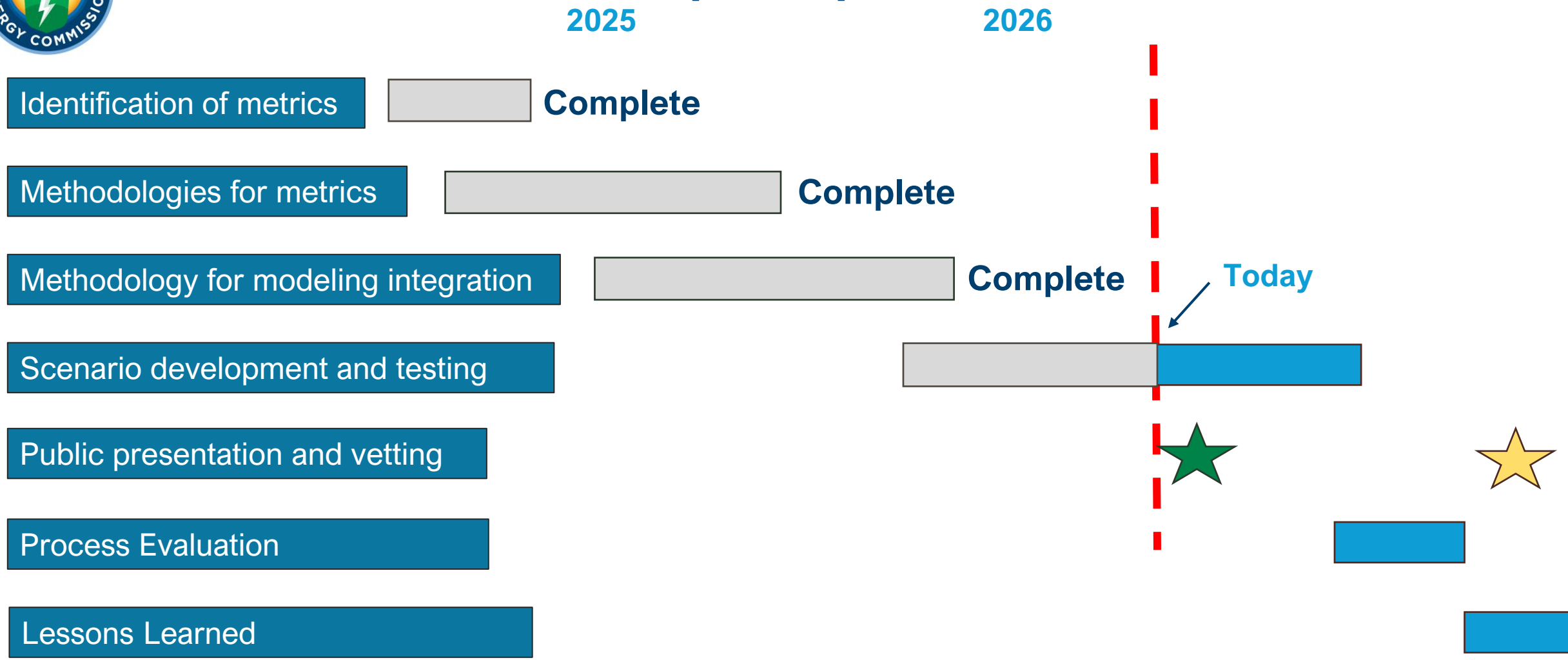
Workforce: Model Integration Strategy

- Workforce NEIs will be integrated **post-hoc** to track impacts associated with scenarios resulting from other NEI integration.
- Workforce NEIs might also be integrated as a **constraint** to develop scenarios with increased workforce benefits.

Non-Energy Impacts - Next Steps

Jacqueline G. Jones, Zero-Carbon Electricity Lead, Energy Assessments Division

Current NEI Status (cont.)



Public Feedback

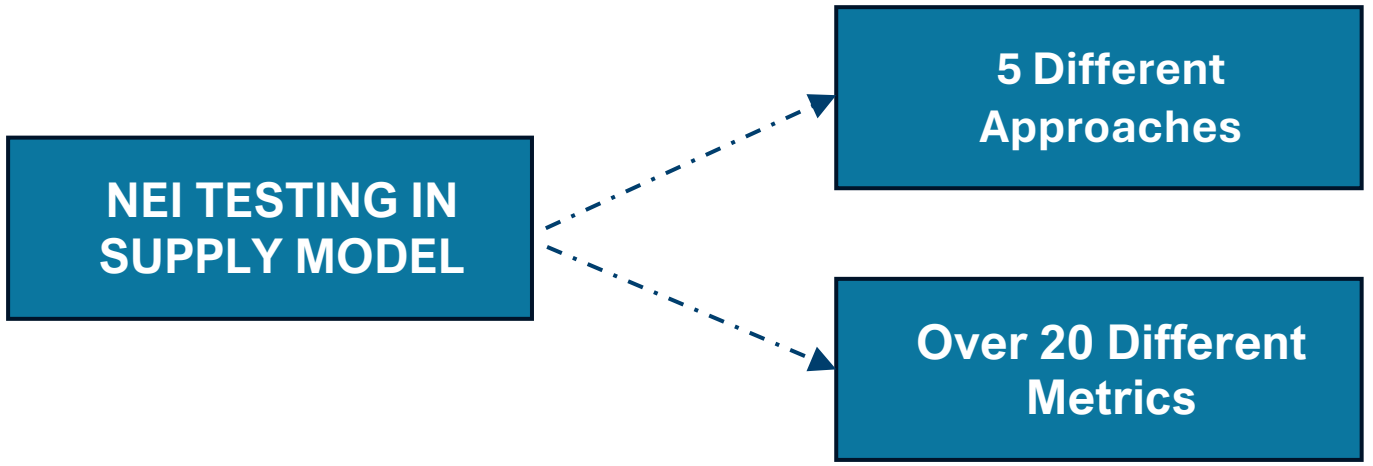
Opportunities to Provide Feedback

- Today during the webinar. The next segment includes:
  - Questions from the public
  - Public comments

  - Written comments by June 1st at 5 pm
  - More detailed material will be made available at California Energy Commission : Docket Log -24-OIIP-03

Next Steps

- Review Feedback
- Process Evaluation
  - Finalize Test Plan
  - Perform Selected Tests
  - Summarize Results – late Fall 2026



Questions from Commissioners

Public Q&A

Public Comment

Zoom App/Online
- Click “raise hand”

Telephone
- Press *9 to raise hand
- Press *6 to mute/unmute

When called upon
- CEC will open your line
- Unmute on your end
- Spell name and state affiliation, if any
- 1 minute or less per speaker, 1 speaker per entity

3-MINUTE TIMER

Closing Remarks