THE ROLE OF CLEAN FUELS AND BUSINESS TRANSFORMATION WORKSTREAM

Presentation to NARUC Gas Committee

N. Jonathan Peress, Despina Niehaus

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SoCalGas A Sempra Energy utility®

Business Transformation | Setting the Prudency Standard

A new Strategic Planning program to proactively advance energy system decarbonization

- Business Transformation Workstream – development and implementation
    - Considering codified utility public interest guideposts
    - Essential Service – provision of gaseous molecules to Core customers for thermal needs
    - Public Interest tenets: reliability, safety, J&R rates / affordability, emissions and climate policy imperative, utility creditworthiness
- Goal Setting
- Decarbonization Modeling and Planning
- Transparent Planning Process
- Clean Fuels Deployment and Electrification

SoCalGas' ASPIRE Commitment

Net zero emissions in our operations and delivery of energy by 2045

SoCalGas ASPIRE. https://www.socalgas.com/sites/default/files/2021-03/SoCalGas_Climate_Commitment.pdf

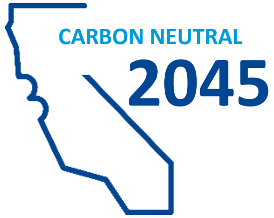
Carbon Neutrality: Key Questions

- Economy-wide decarbonization modeling examining role of clean fuels and clean fuels network in a decarbonized end-state
- Key questions:
  - What are California's options for achieving carbon neutrality?
  - What decarbonization solutions are resilient, affordable, and address hard-to-abate economic sectors?
  - How can gas infrastructure advance the clean energy transition?

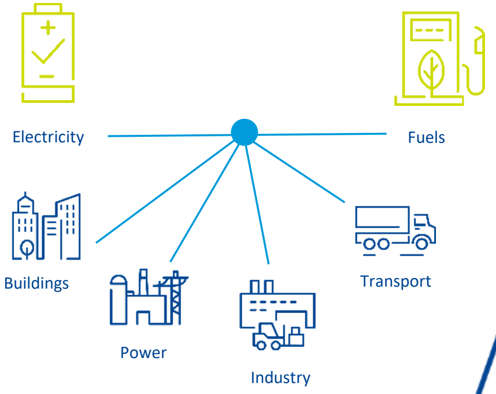
Study Methodology

Model Objectives

Achieve California climate targets



Integrate across electricity and fuels



Decarbonization Modeling

Demand side (Energy PATHWAYS)

- Economy-wide energy demand scenarios.
- User defined scenarios illustrate ways to achieve a GHG target (not cost optimized).

Supply Side

- Least-cost optimization.
- Develops portfolios of low carbon technology power generation, fuel production and carbon management.

Fuels Infrastructure Analysis

System-level clean fuels infrastructure needs

- Existing gas system retrofits to accommodate clean fuels (e.g., H2 Blending).
- Dedicated hydrogen/carbon management infrastructure.
- System resiliency infrastructure (e.g., fuel cells).

Key Scenarios Modeled

Four "corner cases" modeled designed to test end points of key variables

Resilient Electrification

Electrified building sector with fuels to serve thermal generation, industry, and transportation

High electrification – 100% heat and hot water appliance sales electric by 2035

Unlimited carbon capture sequestration allowed

5% Hydrogen cap[1]

High Clean Fuels

Roles for clean fuels in a decarbonized system

Hydrogen hubs to fuel cells supporting substations

Partial electrification – 50% heat and hot water appliance sales by 2035

No sequestration, lower cost electrolysis[1]

20% Hydrogen cap

High Carbon Sequestration

Understand the impact of large amounts of carbon sequestration

Partial electrification – 50% heat and hot water appliance sales by 2035

Unlimited carbon capture and sequestration allowed

Unconstrained Hydrogen volumes[1]

No Clean Fuels Network

Fully decarbonized California with no fuels network or gas fired generation

High electrification – 100% heat and hot water appliance sales by 2035

Sequestration not allowed, no carbon capture for SMR[2]

Hydrogen cap is N/A, no remaining pipelines

[1] Hydrogen blending cap for natural gas pipeline is volumetric

[2] In no sequestration scenarios, carbon captured must be used in power-to-liquids fuels or power-to-gas

Criteria Assessment

Results show that while a fuels network offers significant savings, modest cost differences between the more plausible pathways suggests the feasibility is the key differentiator between scenarios

Pathways that perform better for California against selected key criteria

Minimal challenges and/or highest benefit for California — Significant challenges; potentially not viable for California

Selected key criteria	Resilient electrification	High clean fuels	High carbon sequestration	No fuels network
System reliability and resiliency	● (green)	● (green)	● (green)	● (red)
Solution for hard-to-abate sectors	● (yellow)	● (green)	● (green)	● (red)
Customer conversion challenges	● (yellow)	● (green)	● (green)	● (red)
Technical maturity	● (green)	● (yellow)	● (green)	● (orange)
Affordability[1]	230[3]	215[2]	245	290

1. Net present value of California-wide cost versus reference ($B)
2. Assumes 20% hydrogen blending by volume can be achieved in existing infrastructure
3. Assumes 5% hydrogen blending by volume can be achieved in existing infrastructure

Ensuring an Affordable, Resilient and Feasible Energy Transition

A clean fuels network provides system resiliency and fulfills several valuable roles in a decarbonized world, including mitigating feasibility challenges

- The three most affordable, resilient, and technologically proven deep decarbonization pathways employ clean fuels and a clean fuels network.
- Clean fuels are essential for decarbonizing hard-to-abate sectors such as industry and heavy-duty transportation, vital segments of California’s economy.
- A clean fuels network supports electrification and reduces systemic risk of power outages.
- A clean fuels network that takes advantage of re-purposed infrastructure, along with carbon management, facilitates clean thermal electric generation and is the most cost-effective solution model, saving Californians as much as $75 billion while still achieving the State’s GHG emissions goals.

- The Role of Clean Fuels and Gas Infrastructure in Achieving California's Net-Zero Climate Goal
  - https://www.socalgas.com/sites/default/files/2021-10/Roles_Clean_Fuels_Full_Report.pdf

Gas System Planning | Transparent Planning Framework

An iterative near-term and long-term system planning process, with plans developed by gas utilities under the guidance of CPUC oversight and stakeholder review

Transparent framework to assess gas utility's planning process for providing safe, reliable and cost-effective gas supply while advancing the State's statutory and policy goals

Utility presents system needs (near-term and long-term). Plan will be supported with utility data, forecasts and assumptions, planning scenarios, analyses and results

CPUC oversight and guidance on process and methodologies to assess sufficiency of utility planning process

Resulting System Plan provides transparent documentation of utility's plans and decision-making, affords stakeholder and CPUC review to assess basis for utility planning decisions

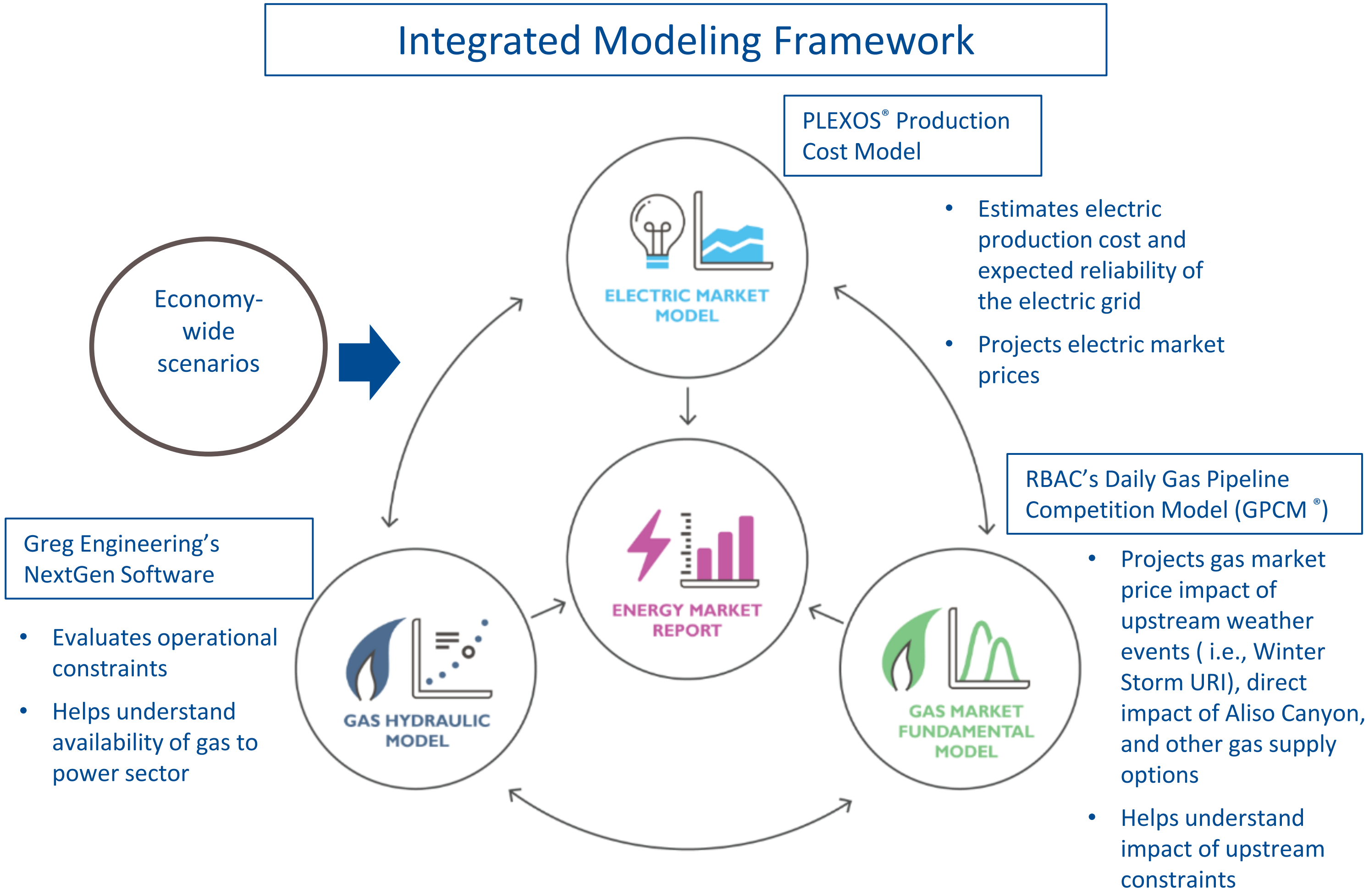
30 Year planning horizon, updated via a 5 year-planning cycle. The 5 year interval will identify near-term system needs, with more specific planning outcomes and defined elements. Longer-term view is directional in nature to identify needed decarbonization investments and policy changes to support an equitable energy transition.

2022 -2027 **2030 - 2050**

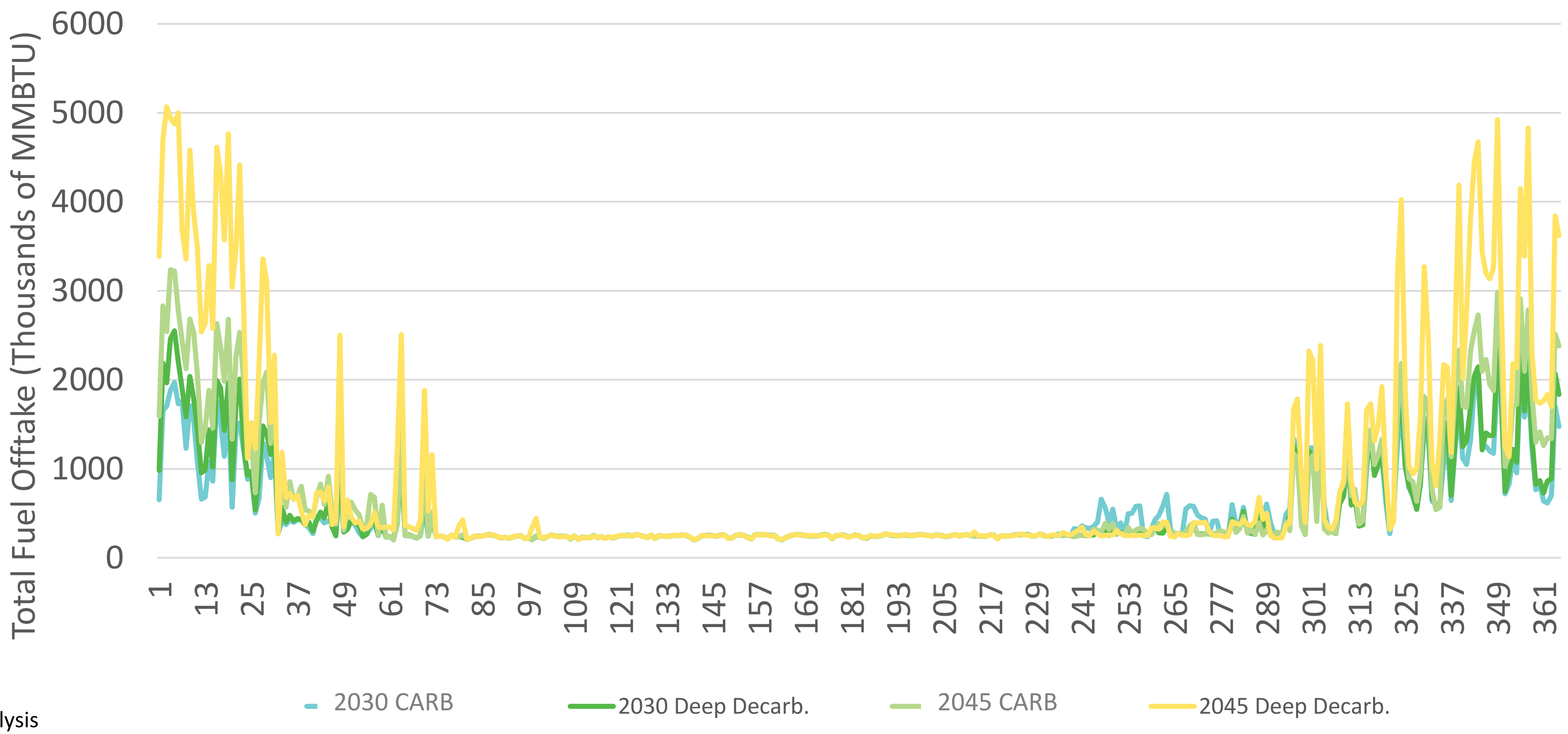
Gas System Planning | Planning Approach

- In advancing potential 2045 scenarios, the trajectory for meeting the state's climate targets must be examined with a greater level of granularity to be of value to the gas system planning process

- The SoCalGas Integrated Model takes a more granular look into the SoCalGas system evaluating the demand assumptions and supply outputs of the broader decarbonization models:
  - Analyze projections around EG ramps and electrification on gas systems
  - Analyze existing statewide decarbonization demand scenarios
  - Analyze potential changes to gas composition and the potential impact of hydrogen blending on system reliability
  - Examine dedicating transmission segments for clean fuel delivery



Resiliency - California Daily EG Gas Burn Under Various Decarbonization Scenarios



Source: Black & Veatch Analysis

Decarbonized Energy System | Rate Design Reformation

The energy transition will necessitate reform to current market and cost allocation structures

Themes	From	To
Gas system cost allocation	Majority of cost allocated based on peak demand throughput to gas-system end-users	Allocate based on metrics that reflect the flexibility and reliability provided to the electric system, and shared with new users of a clean fuels system
Primary cost drivers and end-users	Cost-causation approach; residential/small customers (who the original system was built for) drive most of the cost due to medium pressure distribution system	Hybrid cost-causation and value-based approach; electric generators/large industrial customers have become (and will increasingly be) the major beneficiaries of the reliability provided by the gas system while other users electrify *(separate class for dispatchable EGs)*
Service contracts	Long-term fixed contracts or gas spot market purchases of "ratable take provisions", which assume constant flow over a day	Shaped flow service, allowing for "non-ratable provisions" (i.e., variable flow over a day), accounting for the value of just-in-time delivery to customers *(RBS Tariff)*
Dynamic & transparent transportation pricing	Pipeline tariffs are based on maximum daily transportation quantities, lacking intra-day variations to allow for market signaling and leading to inefficient workarounds by gas traders (note: the natural gas market primarily relies on a single daily "index" price)	Time-of-use tariffs, with daily and seasonal variations, allowing for demand response

Ongoing Research with CEC | Strategic Electrification and Decommissioning

Relationship between Electrification and Decommissioning

☐ Factors weighted most heavily due to (1) customer vulnerability, and (2) relative magnitude of impact on cost

Factor	Bias towards maintaining gas infrastructure	Bias towards full electrification with gas decommissioning	Rationale
Current High or Very High wildfire risk, in non-urban areas	✓		Resiliency benefits; underground electrification still an option for urban areas in significant wildfire risk zones
Industrial customers	✓		Electrification not viable for many industrial applications due to high thermal requirements
Population density	High	Low	Higher total customer costs and complications associated with fuel-switching due to higher number of end-uses
Average pipeline replacement costs	High	Low	High replacement costs are indicative of higher decommissioning costs
Future wildfire risk	Very High	Low	Gas system provides resiliency benefits through dual-fuel system, with gas remaining on even when electricity is off
Electric capacity	Low	High	Low capacity relative to peak load increases likelihood that T&D upgrades will be required for full electrification
Topography complexity	High (mountainous)	Low (flat)	More complex terrain may increase costs to build up electric T&D capacity and to decommission pipelines
Diversity of end-uses	High	Low	May lead to more complications associated with fuel-switching due to wider range of appliance/equipment and building types to convert
Fraction of small-diameter pipe	Low	High	More expensive to remove large-diameter pipelines, making decommissioning more expensive
Pipeline O&M costs	Low	High	High cost to maintain pipelines – more cost effective to take out of service