

**DOCKETED**

<b>Docket Number:</b>	21-IEPR-05
<b>Project Title:</b>	Natural Gas Outlook and Assessments
<b>TN #:</b>	237862
<b>Document Title:</b>	Presentation - Simulating California's Gas System
<b>Description:</b>	02_Jason Orta CEC
<b>Filer:</b>	Raquel Kravitz
<b>Organization:</b>	California Energy Commission
<b>Submitter Role:</b>	Commission Staff
<b>Submission Date:</b>	5/19/2021 3:14:48 PM
<b>Docketed Date:</b>	5/19/2021



# California Energy Commission

Simulating California's Gas System

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May 20, 2021



# Warren-Alquist Act and Gas System Analysis

## Public Resources Code:

- CEC conducts assessments and forecasts of gas supply, production, transportation, delivery, distribution, demand, and prices
- Assessments and forecasts used to develop and evaluate policies:
  - Conserve resources
  - Protect the environment
  - Ensure energy reliability
  - Enhance the state's economy
  - Protect public health and safety



Images Courtesy of CEC, CA Department of Water Resources, Sacramento State University, Fresno County Visitors Bureau, City of Glendale, CA.



# 2021 IEPR Scoping Document and Gas System Analysis

## 2021 IEPR Scope:

- Assess the outlook for gas use in California both in the 10-year and 25-year planning horizons
- Develop and refine gas demand forecasts and scenarios to assess gas use across key sectors:
  - Infrastructure Assessments
  - Gas Price & Rate Forecasts
  - Assess GHG Emissions



## 2021 Integrated Energy Policy Report

Screenshot from CEC Website



# Gas Demand In California

- Space and water heating
- Restaurants, schools, commercial laundries, health care, food processing, etc.
- Industrial - fuel and input
- Electric generation and renewable integration
  - Electric system reliability
- Transportation fuels
  - Oil refineries
  - CNG/RNG fueling stations
- Gas delivered to customers via extensive gas infrastructure



Images courtesy of the CEC, energystar.gov, Northern California Power Agency, National Park Service, UC Berkeley, UC Davis Medical Center, Southern California Public Radio.



# Gas Supplies In California

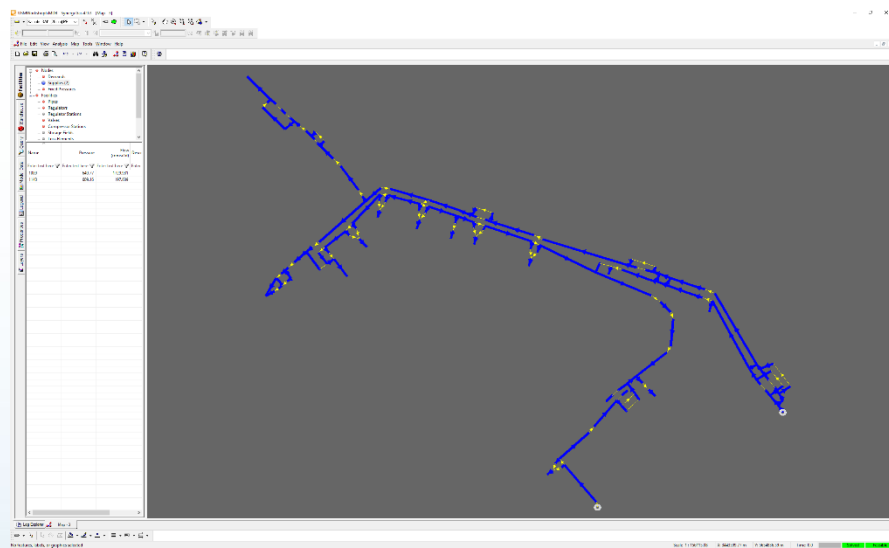
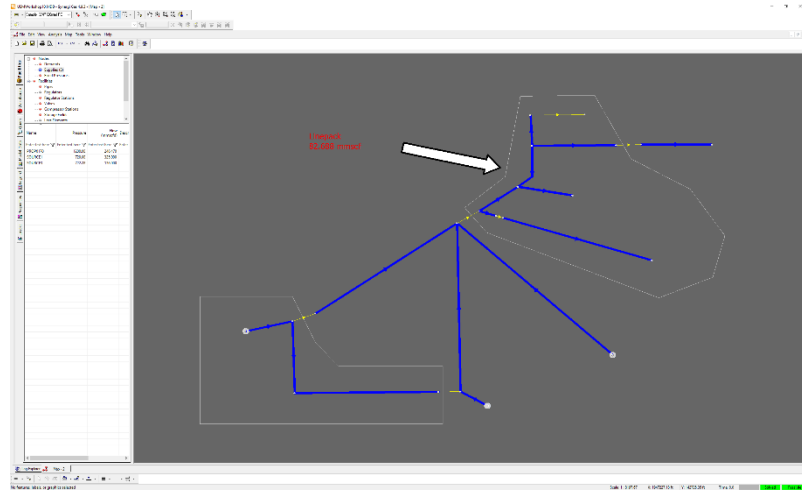
- California demand - Out of state supplies, in-state production, and storage
- Extensive infrastructure connects supplies and demand
- The infrastructure configuration differs with different demand distribution
- Storage interconnects to PG&E and SoCalGas systems
- Transmission-only map (no distribution infrastructure)



Image from *The California Gas Report*.



# What is Hydraulic Modeling?



Images courtesy of DNV.

- Gas equivalent of a “power flow model”
- Can we ensure system can meet demand while avoiding curtailments?
- Simulates activities of gas system components to assess pressures and flows
  - Too low = reliability concern
  - Too high = safety concern
- Valid simulations must have pressures within minimum and maximum ranges.
- Explores a moment in time (steady state) or over a period of time (transient state)
- Uses engineering pressure flow equations
- Simple spreadsheet cannot be used for California’s gas systems
  - Multiple supply and demand nodes
  - Networks of pipe with different diameters and lengths



# What's In Hydraulic Modeling Files?

- System specifications including pipeline lengths and diameters
- Maximum and minimum operating pressures
- System components including valves, compressors, and regulators
- System supply and demand
- CEC regulations allow for automatic confidential designation due to the sensitivity of the data

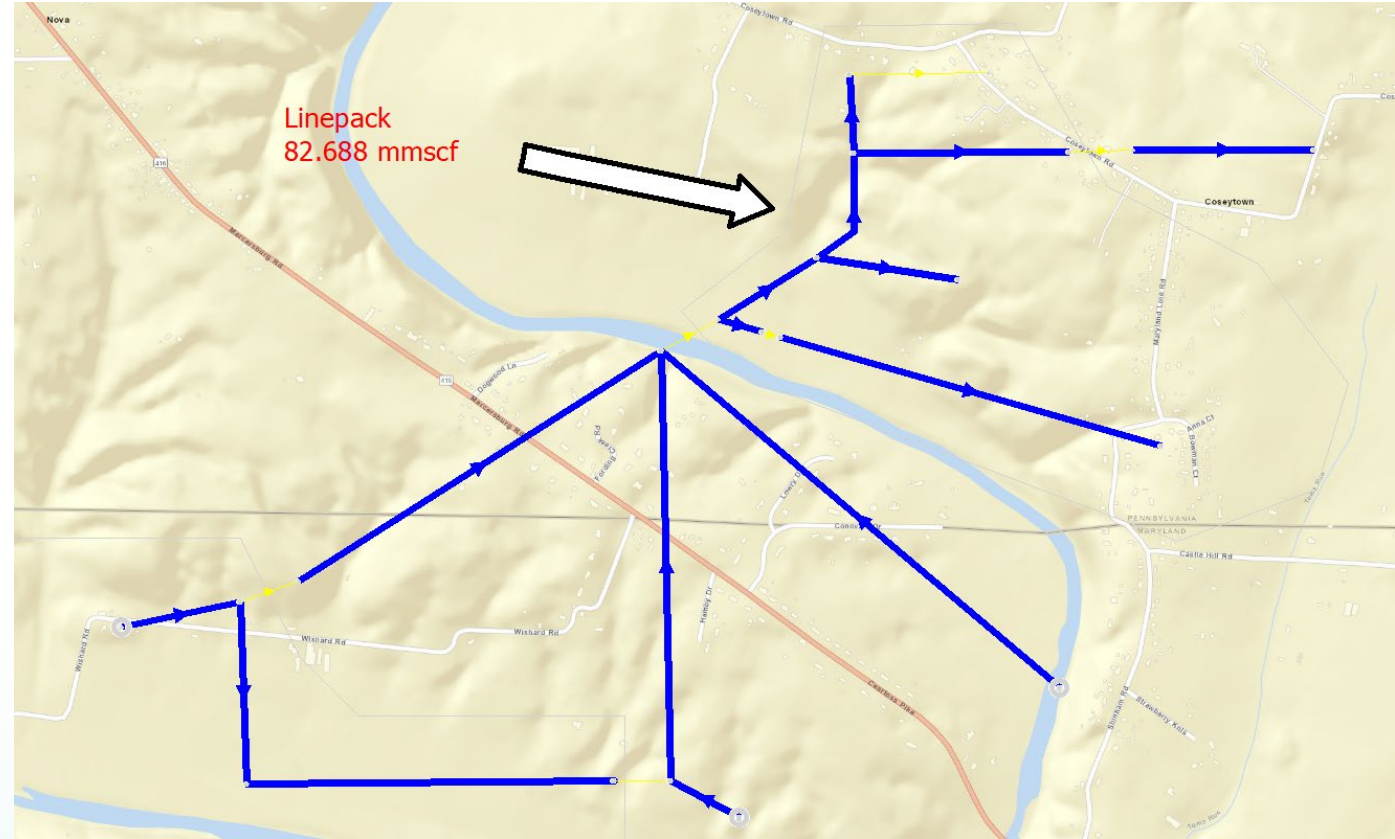
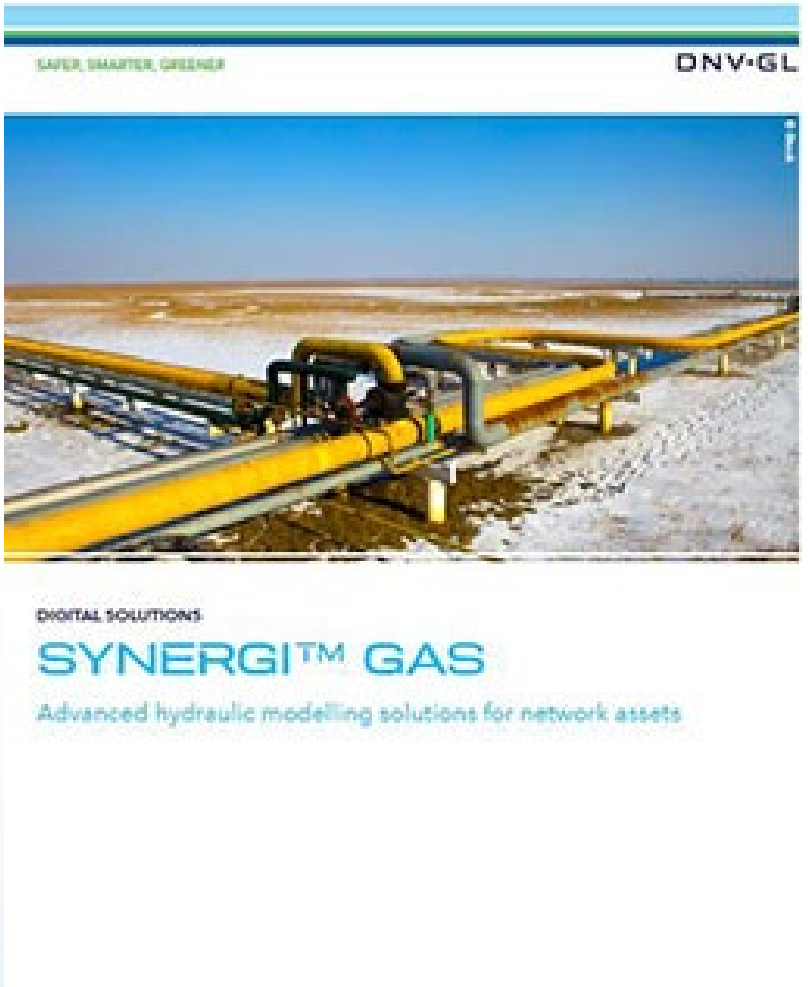


Image courtesy of DNV.





# Hydraulic Modeling Software Platform - Synergi Gas



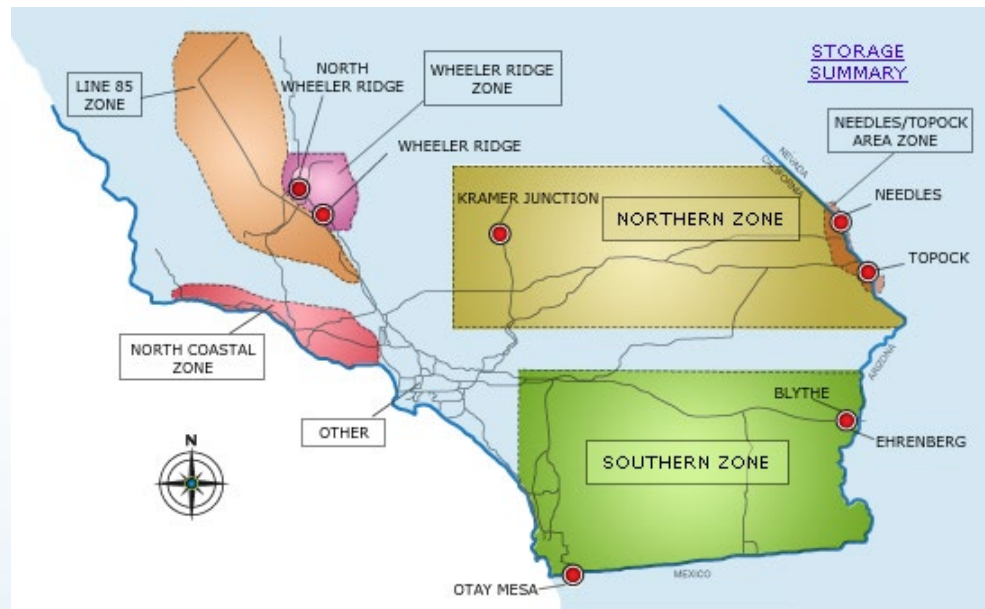
- Modeling files: Microsoft Access files read on a platform called Synergi Gas
  - Used by most large natural gas utilities in the United States
- Developed in the 1970s by Stoner and Associates of Mechanicsburg, PA
  - Industry vets may call it the “Stoner Model”
- After several acquisitions, Synergi Gas is now owned by Oslo, Norway based DNV

Image courtesy of DNV.



# Gas Utilities and Hydraulic Modeling

- Calculate available system capacity
- Planning Tool
  - Changes in demand (i.e. new subdivision, power plant)
  - Adding or removing infrastructure



A screenshot of the PG&E Pipe Ranger website. The page features a navigation menu with links for About CGT, Products, Tools & Services, Operating Data, and Reference/Library. The main content area is divided into several sections:

- OFO Outlook:** A table showing OFO status for various dates in 2014.
- Pipeline Status:** A section titled "Plan 5, posted 05:26 AM PT" with a note about the next update.
- Scheduling Cycle Status:** A section with buttons for "Today" and "Tomorrow" and a legend for cycle status (Unprocessed, Processing, Confirmed, Scheduled).
- Need to Know:** A section with links for "Weekend On Call", "Contact Us", and "Substation Services".
- System Inventory Status:** A section with a table showing ending inventory history and forecasts.
- Physical Pipeline Capacity:** A section with a table showing physical pipeline capacities for January 15, 2014, and January 16, 2014.
- Scheduled Volumes:** A section with a table showing scheduled volumes for Redwood Path and From Gas Transmission.
- INSIDEtrack:** A section with a "Login" button circled in red.
- Recent News:** A section with a "Recent News" link.

Images courtesy of SoCalGas Envoy and PG&E Pipe Ranger websites.



# CEC Hydraulic Modeling Timeline

## April 2016

- SoCalGas releases modeling results for Aliso study.
- State agencies relied on utility results without independent verification.



## February 2018

- CEC requires large gas utilities to submit hydraulic models.



## 2018

- CEC becomes first state regulatory agency to procure Synergi Gas software.
- DNV provides software training at CEC.



## 2018-2021

- Gas utilities submit models, perform model runs for CEC staff, and respond to data requests.



## 2018-2021

- CEC staff reviewed models.
- CEC staff now has ability to verify modeling findings.



# CEC Approach to Hydraulic Modeling

- Collaboration with:
  - Utilities who operate these systems/built the models
  - CEC colleagues who work on electricity and natural gas issues
  - Tech Support team
- Research
  - Regulatory proceedings related to natural gas
- Implementation
  - Running various scenarios



Image courtesy of California Natural Resources Agency.



# Observations From Gas Utility Models

- Where supplies come in and where they are delivered
  - Set pressures on compressors and regulators
  - Can try multiple scenarios
- Observe complexity of the system
  - If residential demand reduced off a pipeline system, system may still end with service to large customer(s)
- Intraday swings in pressures, flows, and linepack
  - Regulator settings
  - Opening and closing valves

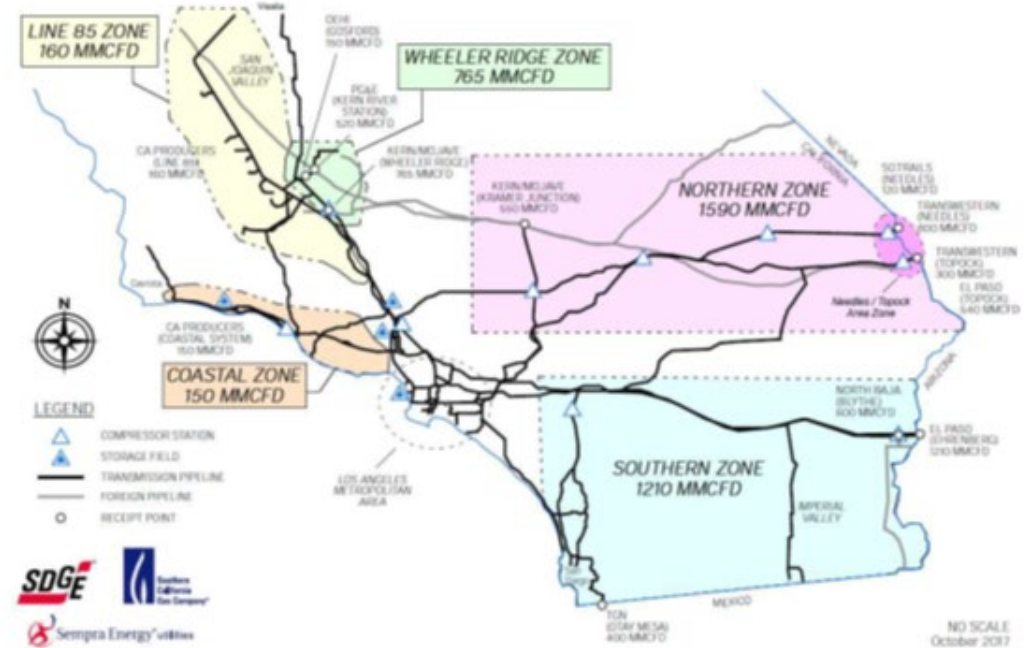


Image courtesy of the SoCalGas website.



# Observations From Gas Utility Models

- Deliveries between utility systems
- Can identify spots that are vulnerable to high and low pressures
- Assess impact of hypothetical service curtailments
- Systemwide impact of disabling pipeline segments, compressor engines, or other infrastructure
  - Bring in alternate supplies to compensate
  - Can evaluate impact to power plant service



Image courtesy of the PG&E website.



# CEC Analysis – Next Steps

- Reliability
  - Increase understanding of interdependence between electric and gas systems
- Deeper dive into local transmission and distribution models
  - Flow to residential customers
- Hydrogen injections
  - Different chemical property
  - Discuss w/DNV about this capability
- Continue collaboration on gas R&D efforts
- Incorporate different demand forecasts



Images courtesy of CA Department of Water Resources and CEC



# Questions



Jason Orta at RNG production facility near Bakersfield, CA. *Image Courtesy of Jason Orta.*