DOCKETED	
Docket Number:	19-IEPR-03
Project Title:	Electricity and Natural Gas Demand Forecast
TN #:	227207
Document Title:	Key Drivers and Structure
Description:	Presentation by Anthony Dixon of CEC
Filer:	Raquel Kravitz
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	3/1/2019 11:42:06 AM
Docketed Date:	3/1/2019

North American Market Gas-trade (NAMGas) Model:
Key Drivers and Structure

2019 Integrated Energy Policy Report

California Energy Commission

Presenter: Anthony Dixon

March 4, 2019

California Energy Commission

Simplified View:
North American Market Gas-trade (NAMGas) Model

NAMGas components:

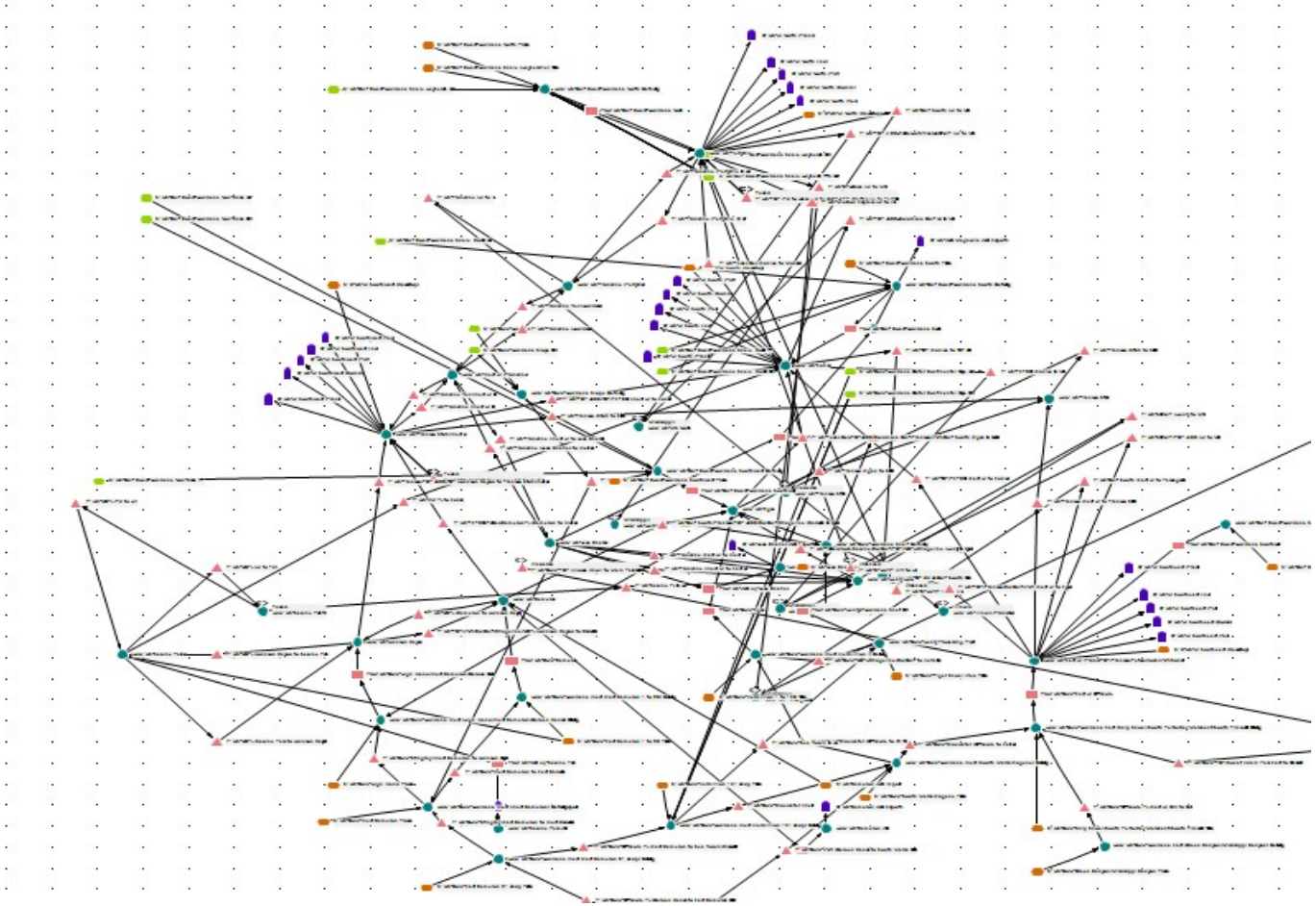
Natural gas supply basins
Connected to
Interstate and Intrastate pipelines
Connected to
Demand centers

→

- Supply
- Transmission
- Demand

- **Model iterates between the three components to find economic equilibrium at all nodes at all time periods**
- **Results give prices, demand, and supply at equilibrium**

Not So Simplified View:
North American Market Gas-trade (NAMGas) Model



North American Market Gas-trade Model: Construction

- **Created in the MarketBuilder platform**
  - **General equilibrium modeling logic is well-vetted**
- **The 2019 NAMGas runs will incorporate:**
  - **Reset assumptions in the California portions to reflect the 2019 IEPR Common Cases**
  - **Update changes to North American pipeline system capacity**
  - **Update information on gas reserves and costs**
- **Vetting of staff assumptions and results by outside consultant and input from this workshop**

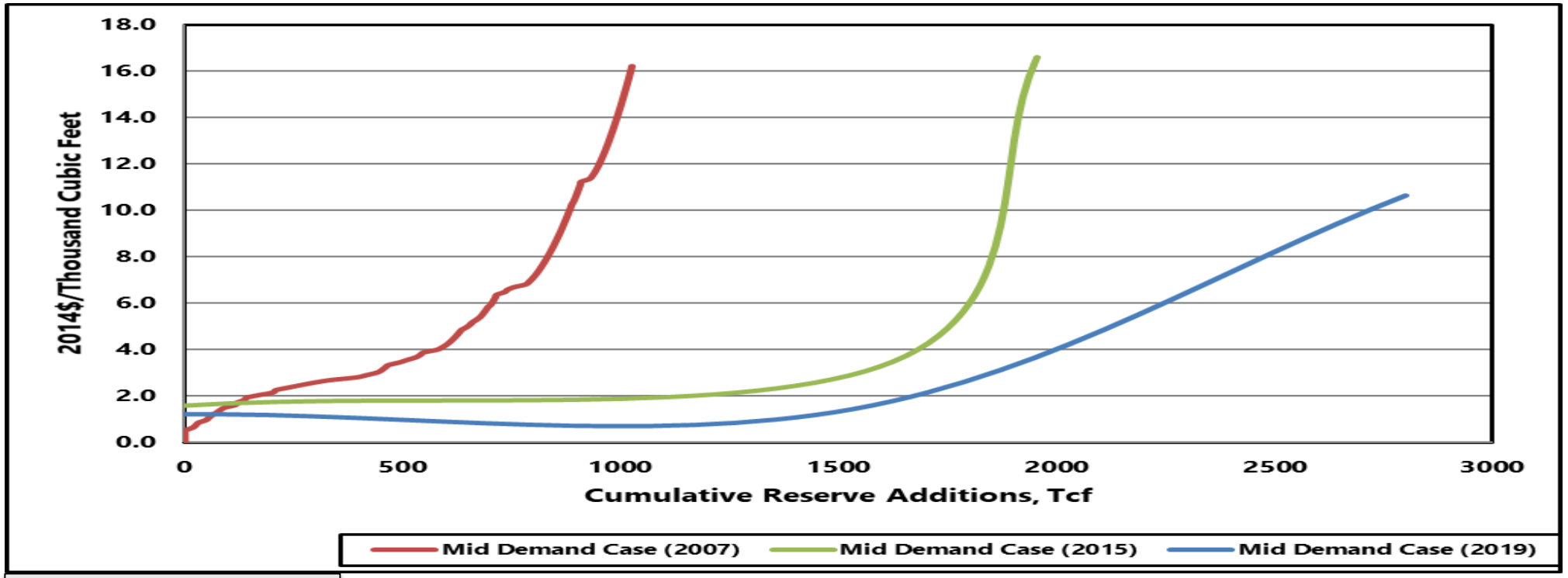
IEPR Cases

- **Staff scenarios/common cases:**
  - **High Demand/Low Price**
  - **Mid Demand**
  - **Low Demand/High Price**
- **All cases assume Senate Bill 100 - Zero carbon sources for power generation by 2045**

NAMGas Relies on Resource Assessments and Costs as Key Supply Drivers

- **Resource assessments:**
  - **Assessments of technically recoverable resources**
    - **Most important factor affecting regional trade flows and price**
  - **Model distinguishes between proved and potential resources**
    - **Proved resources – capital costs already incurred but not operational costs**
    - **Potential resources – undeveloped resources with no capital costs incurred**
- **Resource costs:**
  - **Development costs define the subset of *technically* recoverable resources that are *economically* recoverable**
    - **As prices rise, more resources become economic to produce**

Supply Costs Continue Significant Decline – Major Input Parameter in NAMGAS



Sources: California Energy Commission

- Technology improvements and efficiencies allow more production at lower costs
- Shift in the marginal cost profile means more resources available at lower cost
- Staff's updates show a significant change in supply cost for the long term

Key Drivers (Demand)

- **Initial starting prices and demand quantities:**
  - **Excel-based econometric tool (Small ‘m’ model) uses historical data to calculate starting points to run NAMGas**
  - **Common cases will include modifications for California and the WECC**

Key Drivers (Demand)

- **Demand in Five Sectors:**
  - **Residential Factors:**
    - **Recent historical demand for natural gas, population, natural gas price, income, heating oil price, and cold and hot weather**
  - **Commercial Factors:**
    - **Recent historical demand for natural gas, income, natural gas price, population, heating oil price, and cold and hot weather**
  - **Industrial Factors:**
    - **Recent historical demand for natural gas, natural gas price, industrial production, and cold weather**

Key Drivers (Demand)

- **Power Generation Factors:**
  - Natural gas, coal, and fuel oil cost; coal, nuclear, hydroelectric and renewable generation, and hot weather
- **Transportation Factors:**
  - Recent historical demand for natural gas, income, natural gas price, and population
  - Applied outside California

- **Estimated Elasticity:**
  - Residential, Commercial, Industrial, Power Gen, and Transportation
  - Estimated range of price elasticity is approximately 0.5298-1.2363. (Baker Institute)

IEPR Common Cases:
Purpose of Cases

- **Examine price and supply in the North American natural gas market:**
  - **Potential vulnerabilities to California**
  - **Potential opportunities for California**
- **The North American gas market is linked – CA cannot be assessed in isolation**
- **Investigate range of natural gas price and supply uncertainty**

IEPR Common Cases: (Mid Demand Case)

- **Initial U.S. demand quantity:**
  - **2017: Total ~ 27.46 Tcf; Power Gen ~ 9.28 Tcf**
    - **EIA actual natural gas demand 27.09 Tcf**
    - **EIA actual power generation demand 9.25 Tcf**
  - **2020: Total ~ 29.14 Tcf; Power Gen ~ 9.85 Tcf**
  - **2030: Total ~ 35.52 Tcf; Power Gen ~ 12.00 Tcf**
- **Proved Reserves: approx. 438 Tcf (EIA estimate, Dec. 2018)**
  - **324 Tcf reserves assumed in 2017 IEPR**
  - **Record Production in 2018, approximately 32 Tcf**
  - **Proved Resources increased 114 Tcf, 35%**
- **Coal Conversion: 65 Gigawatts (beginning in 2019)**
  - **Analysis of EIA data of forecasted fuel use**

IEPR Common Cases Assumptions: Description (Mid Demand Case)

- **Potential Reserves:**
  - **2,112 Tcf @ $5.00/Mcf**
  - **2,816 Tcf @ $10.00/Mcf**
- **Rate of Return (Same as 2017 IEPR):**
  - **Resources: 12.2% (real after tax)**
  - **Pipeline Investment: 8.4% (real after tax)**
  - **Income Tax Rate: 35%**
  - **Return on Equity: 10%**
- **Backstop Technology (Updated assumptions for 2019 IEPR):**
  - **Unspecified at $15.00/Mcf**
- **Technology Factor (Same as 2017 IEPR):**
  - **1%/year.**

Methodology: Estimating Power Plant Burner Tip Prices

- **Natural gas burner tip prices**
  - **Include cost to procure and deliver gas to an electric generator**
  - **Include both a commodity and a transportation component**
- **Extract annual wholesale commodity hub prices from NAMGas Model**
  - **Examples: Hub: US-PG&E, US-Malin, US-SoCalGas**
  - **Convert annual price to monthly price**
- **Add transportation cost from hub to power plant to get burner tip price**
  - **Use pipeline utilities' tariffs**

https://www.energy.ca.gov/assessments/ng_burner_tip.html

Uses of NAMGas Outputs

- **Burner Tip Model**
- **Inputs to PLEXOS via the Burner Tip Model**
- **End-use natural gas rate forecast**
- **Electricity rate forecast**
- **Transportation fuel price forecast**
- **Cost of generation estimates**
- **Various stakeholders use as inputs for modeling or information source**

Next Steps

Preliminary Results Workshop scheduled for April 22, 2019.

Questions and Comments