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<th><strong>Docket Number:</strong></th>
<th>19-IEPR-03</th>
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<tr>
<td><strong>Project Title:</strong></td>
<td>Electricity and Natural Gas Demand Forecast</td>
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<tr>
<td><strong>TN #:</strong></td>
<td>227207</td>
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<tr>
<td><strong>Document Title:</strong></td>
<td>Key Drivers and Structure</td>
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<tr>
<td><strong>Description:</strong></td>
<td>Presentation by Anthony Dixon of CEC</td>
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<td><strong>Filer:</strong></td>
<td>Raquel Kravitz</td>
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<td><strong>Organization:</strong></td>
<td>California Energy Commission</td>
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<td><strong>Submitter Role:</strong></td>
<td>Commission Staff</td>
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<tr>
<td><strong>Submission Date:</strong></td>
<td>3/1/2019 11:42:06 AM</td>
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<tr>
<td><strong>Docketed Date:</strong></td>
<td>3/1/2019</td>
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North American Market Gas-trade (NAMGas) Model: Key Drivers and Structure

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

- 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

Sources: California Energy Commission
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
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
• **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**
  - 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
Preliminary Results Workshop scheduled for April 22, 2019.

Questions and Comments