



California Energy Commission

National Cases:

High Gas Price, Low Gas Price, and Constrained Shale Gas

Staff Workshop

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National Cases: Road Map

- Purpose of the Cases
- Major Policy Issues
- What are the National Cases
- Case Descriptions
- General Impact of Price Changes
- Performance of Cases
 - Prices
 - Supply Portfolio Impacts
- Difference Results
- Conclusions



National Cases: Purpose of Cases

- **To examine price and supply in the national natural gas market**
 - **Potential vulnerabilities to California**
 - **Potential opportunities for California**
- **To investigate natural gas price and supply uncertainty**
 - **Plausible range of conditions developed**
- **To evaluate the impact of relevant policy drivers**
- **To develop plausible outlooks of prices and supply**



National Cases: Major Policy Issues

- **Implementation of Renewables Portfolio Standard (RPS)**
- **Conversion of coal-fired generation**
- **Environmental mitigation of shale development**
 - **Water use and disposal**
- **Licensing of liquefied natural gas (LNG) export capability**



National Cases: What are the National Cases

- **Staff constructed the following national cases:**
 - High Price case
 - Low Price case
 - Constrained Shale case
- **Cases constructed to evaluate natural gas price movements and impacts**



National Cases: High Price Case Description

- **Removed 50 GW (280,000 GWh) of coal-fired generation distributed per Brattle Group analysis.**
- **Assumed robust economic performance, with long-term annual economic growth capped at about 3.5%.**
- **Delayed RPS implementation by additional 10 years as states grapple with budgetary concerns**
- **Starting in 2016, assumed robust LNG export capability developed and utilized at:**
 - **Kitimat (Canada, Apache)**
 - **Sabine Pass (Cheniere), Lake Charles (BG), and Freeport**
 - **Cove Point**

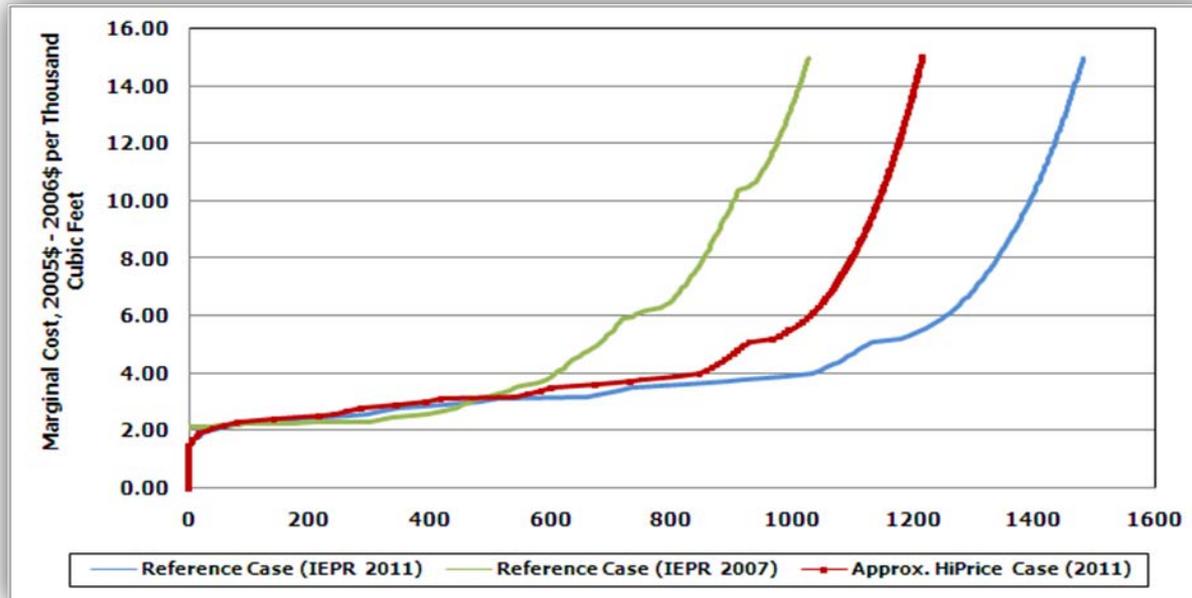


National Cases: High Price Case Description (cont'd)

- **Assumed added environmental compliance costs in Canada and the United States:**
 - \$0.40/Mcf to the O&M cost of developing shale formations
 - \$0.20/Mcf to conventional resources
- **Removed from development potential shale resources in particular regions, such as Pennsylvania, New York, Colorado, and Wyoming**
 - Altered the available gas resource and shrank resource base by about 17.8%
 - Re-established merit order of resource selection
- **Introduced constraints on development in Iraq, Iran, Venezuela, and Russia**



National Cases: High Price Case Description (cont'd)



- Resource base shrinks as a result of "turning off" potential reserves in sensitive areas
- Resource base shrinks by about 17.8%

Sources: California Energy Commission; Altos Management Partners; Baker Institute; National Petroleum Council.



National Cases: Low Price Case Description

- Assumed all states meet RPS targets on time
- Capped long-term annual economic growth at about 2.1%, portending weak gross domestic product growth
- Disallowed LNG exports, thus keeping North America isolated
- Assumed technology develops at a rate of 2.5%

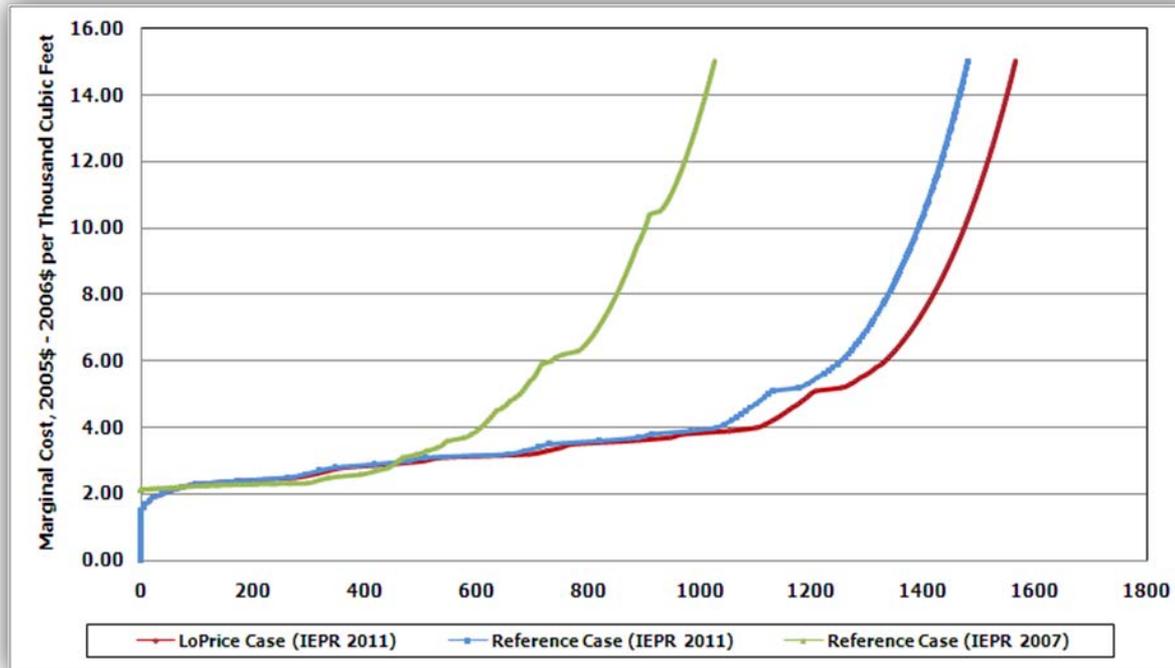


National Cases: Low Price Case Description (cont'd)

- **Assumed larger resource base**
 - Increased assessment size in the Marcellus, Haynesville, and western Canadian shale formations
 - Used upper range of published data
 - Resulted in additional 5.76% rightward shift of overall supply cost curve
- **Allowed Iran, Iraq, and Venezuela to enter the market unimpeded beyond pre-specified dates**



National Cases: Low Price Case Description (cont'd)



- Resource base expands as larger assessments of reserves become more likely
- Resource base expands by about 5.8%

Sources: California Energy Commission; Altos Management Partners; Baker Institute; National Petroleum Council.



National Cases: Constrained Shale Case Description

- **Assumed heightened environmental concerns related to development of shale formations**
 - Implementation of additional regulatory requirements on further development, particularly related to fluids used in the hydraulic fracturing process
 - Acquisition, treatment, and disposal of water push state regulators to issue new policy directives.
 - Added requirements for protection of groundwater aquifers
- **Regulatory compliance after 2013 in both Canada and the United States:**
 - Adds another \$0.40/Mcf to the cost of production of shale natural gas;
 - Adds \$0.20/Mcf to conventional production.
- **Resource base remains unchanged from reference case**



National Cases: General Impacts of Price Changes

- **Price changes produce various responses:**
 - **Higher prices**
 - Depress demand
 - Stimulate added supply
 - **Lower prices**
 - Stimulate demand
 - Suppress supply
- **Usually, a combination of dual impact occurs**
- **Price *changes* also re-configure the order of economic selection and, thus, the supply portfolio**
 - **In a dynamic market, this can affect the attractiveness of particular supply resources**
- **Question: What is the dominant effect?**

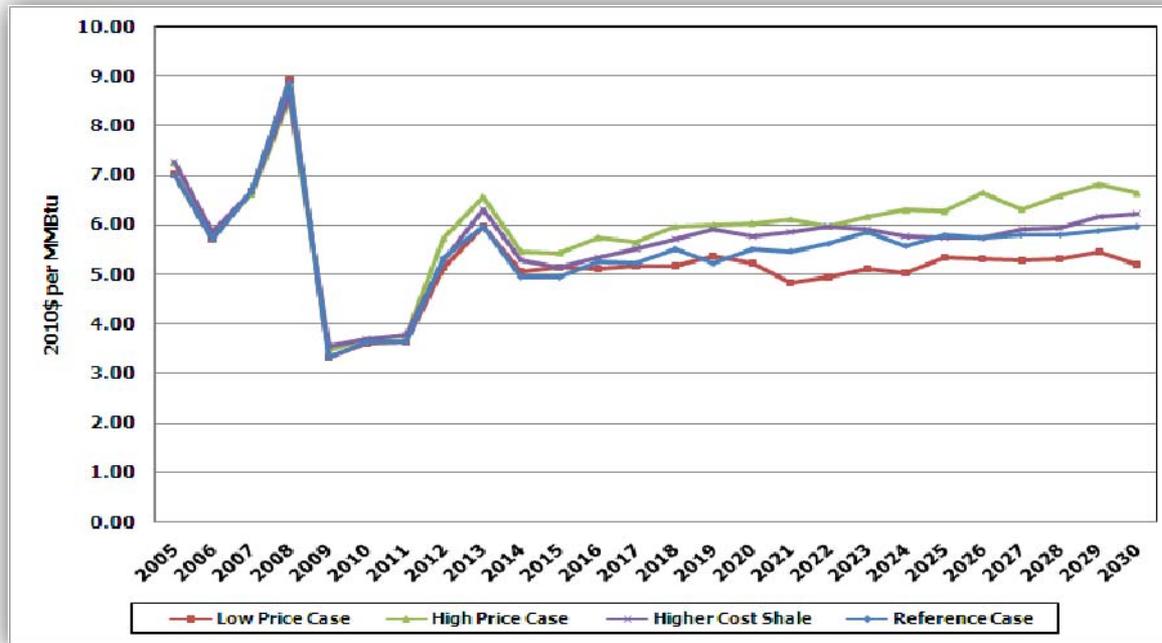


National Cases: Supply Balance

**Performance of Cases:
Lower 48**



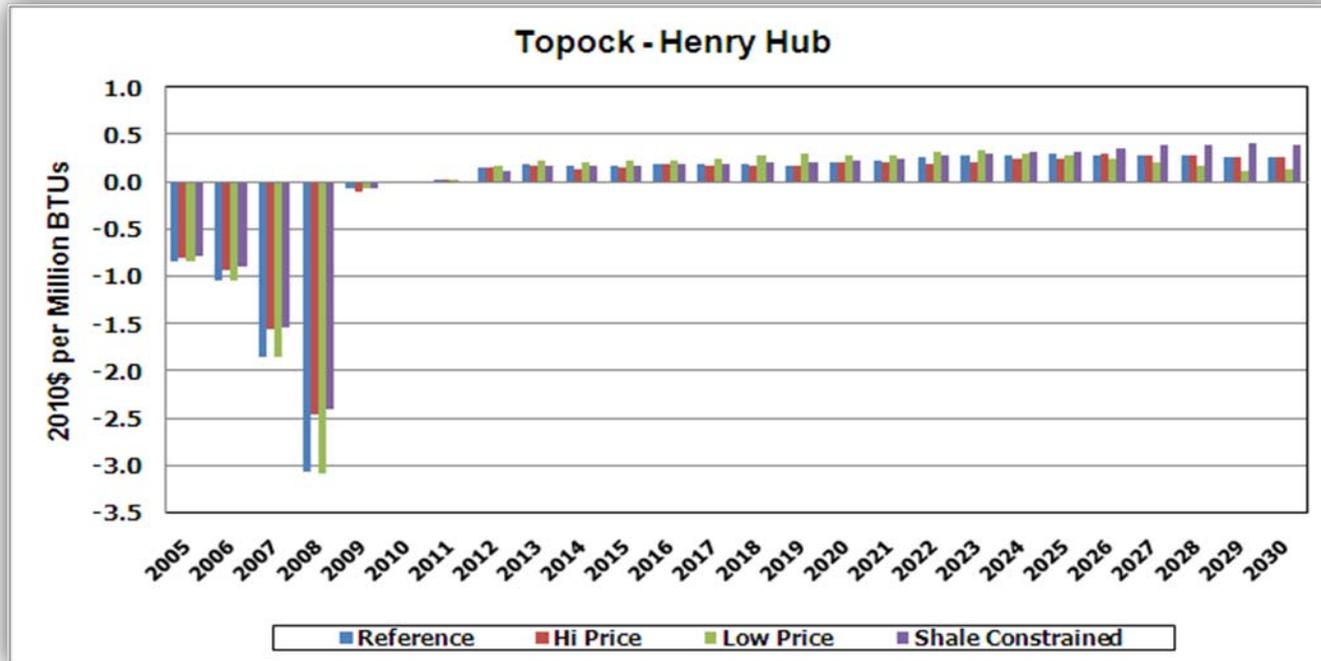
National Cases: Price Performance of Cases (Henry Hub)



- Prices behave as expected:
 - High Price case produced highest prices
 - Low price case produced lowest prices
- Together, four cases produced the "zone of uncertainty"



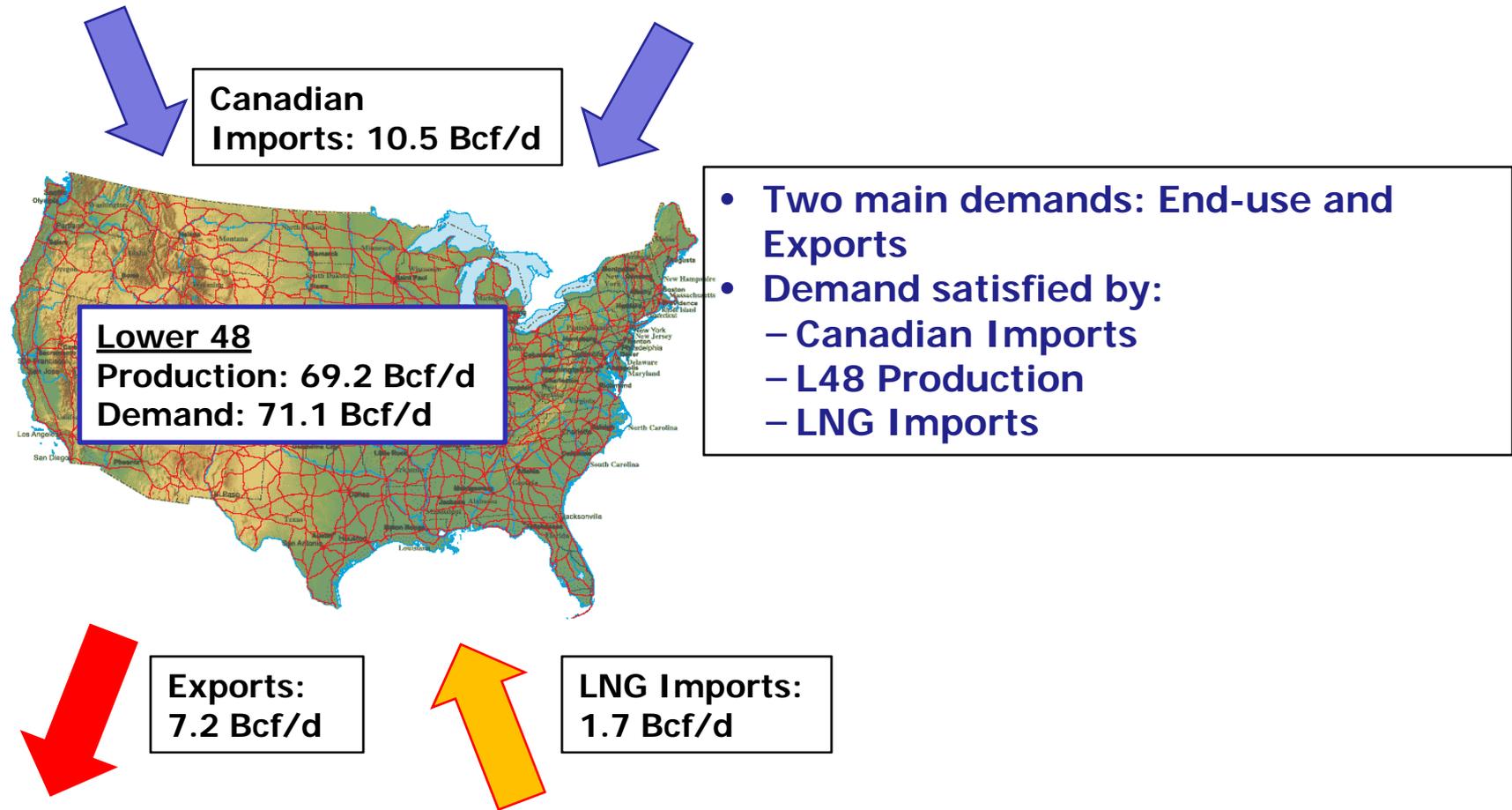
National Cases: Price Performance of Cases (Differentials)



- **Differentials turn positive around 2013:**
 - Access to shale and 'tight' gas resources is re-ordering the supply portfolio, impacting eastern prices more than western

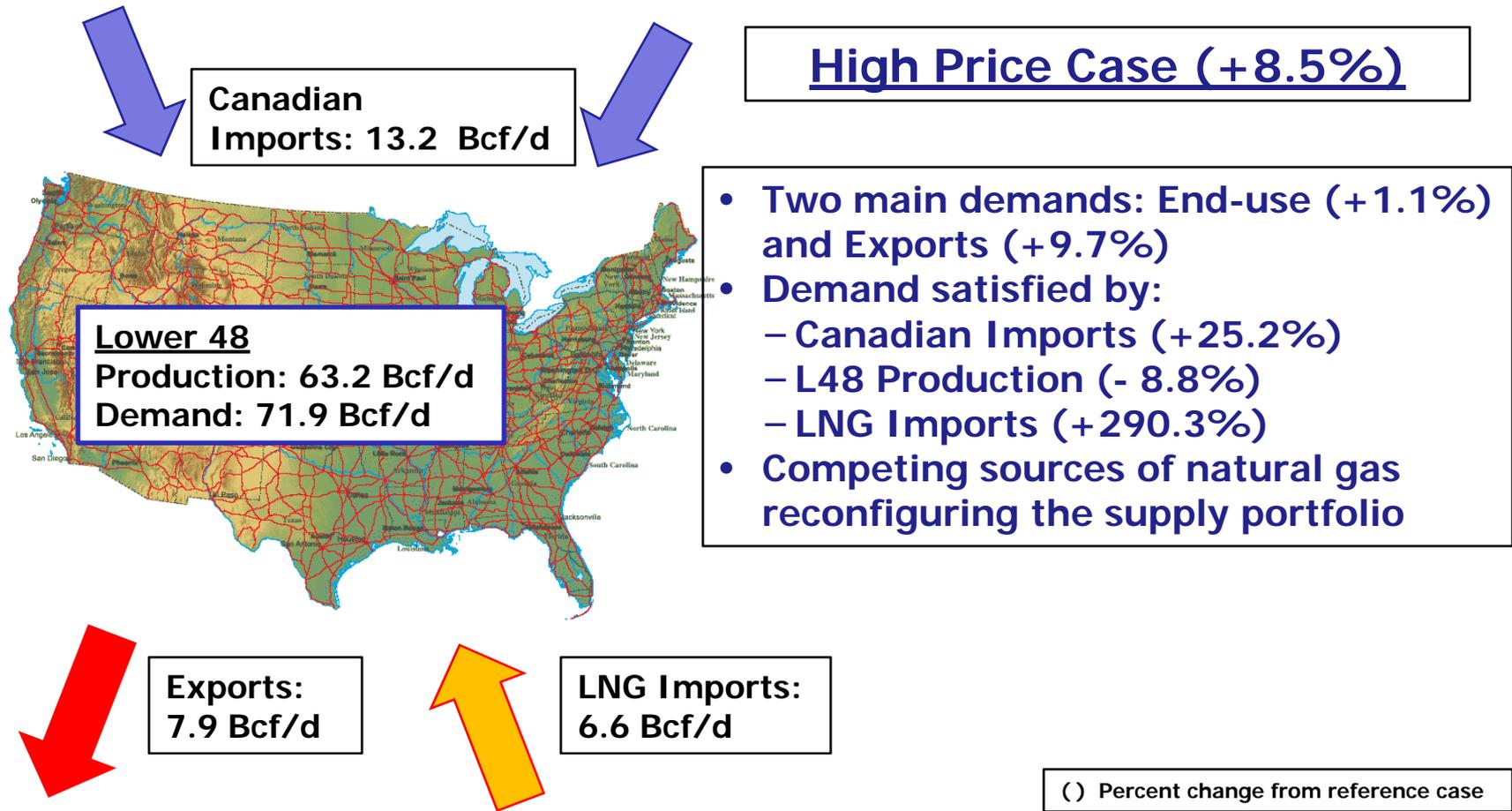


National Cases: Supply Portfolio of Reference Case (2025)



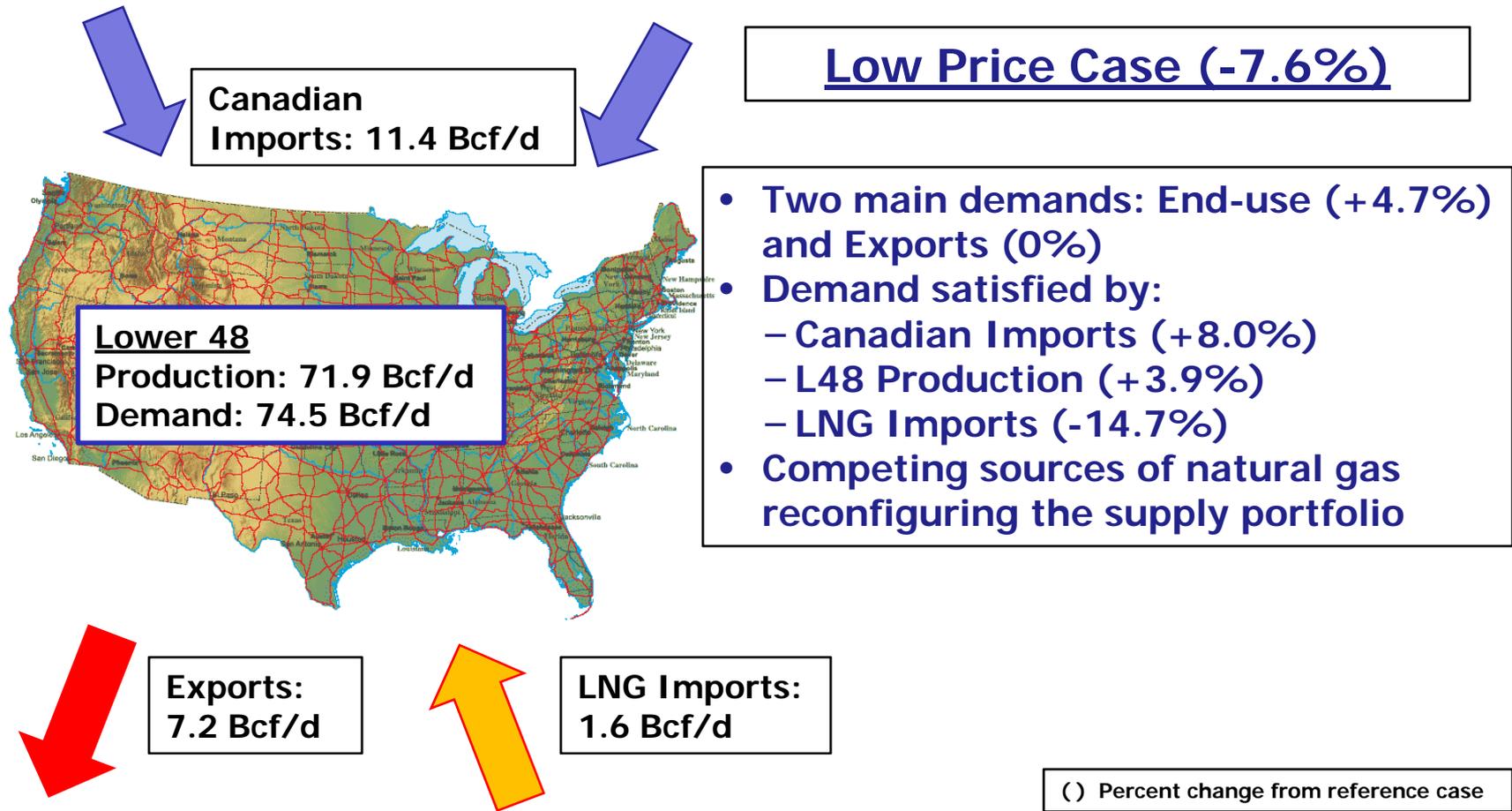


National Cases: Reconfiguration of Supply Portfolio (2025)



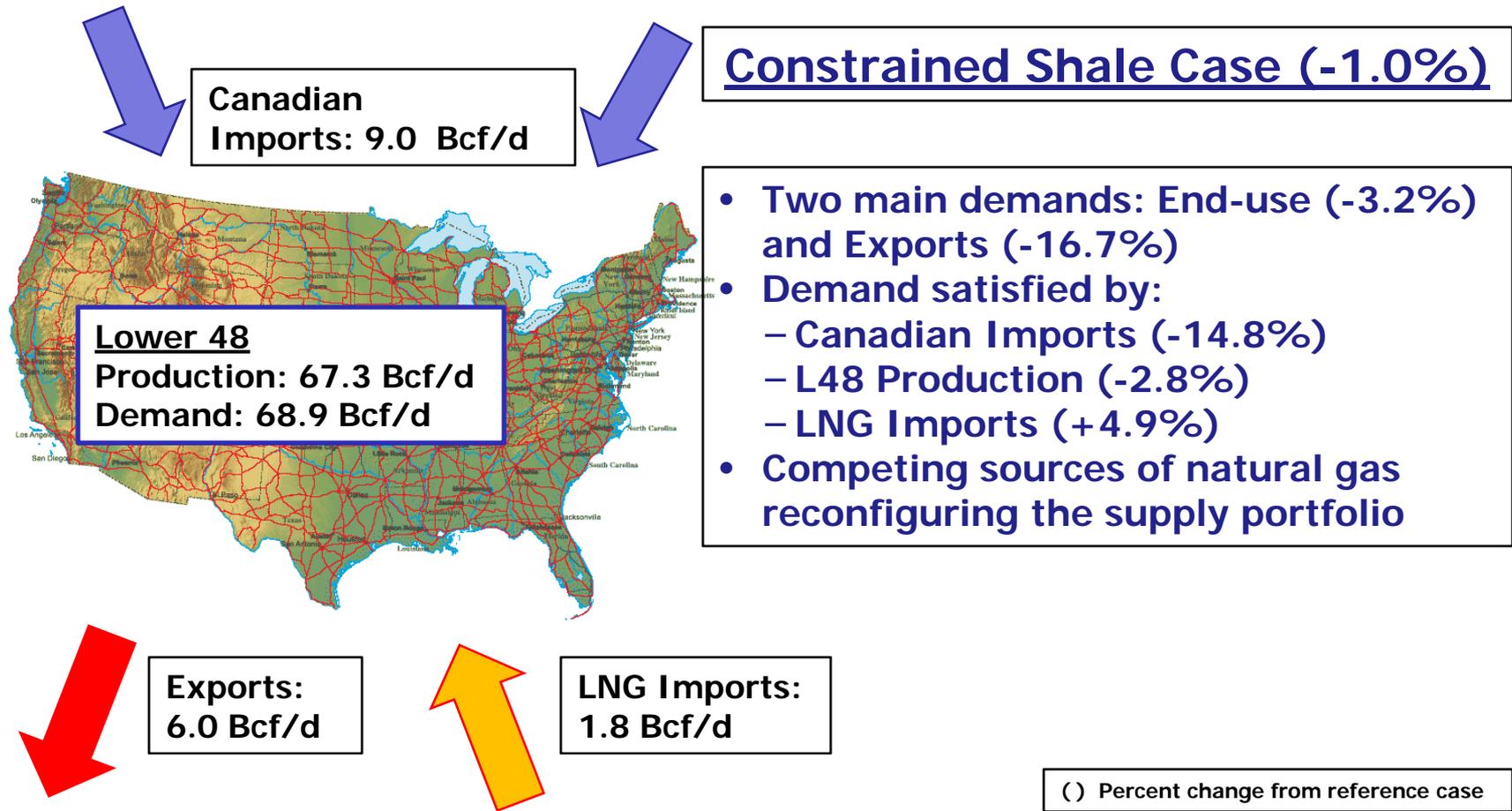


National Cases: Reconfiguration of Supply Portfolio (2025)





National Cases: Reconfiguration of Supply Portfolio (2025)



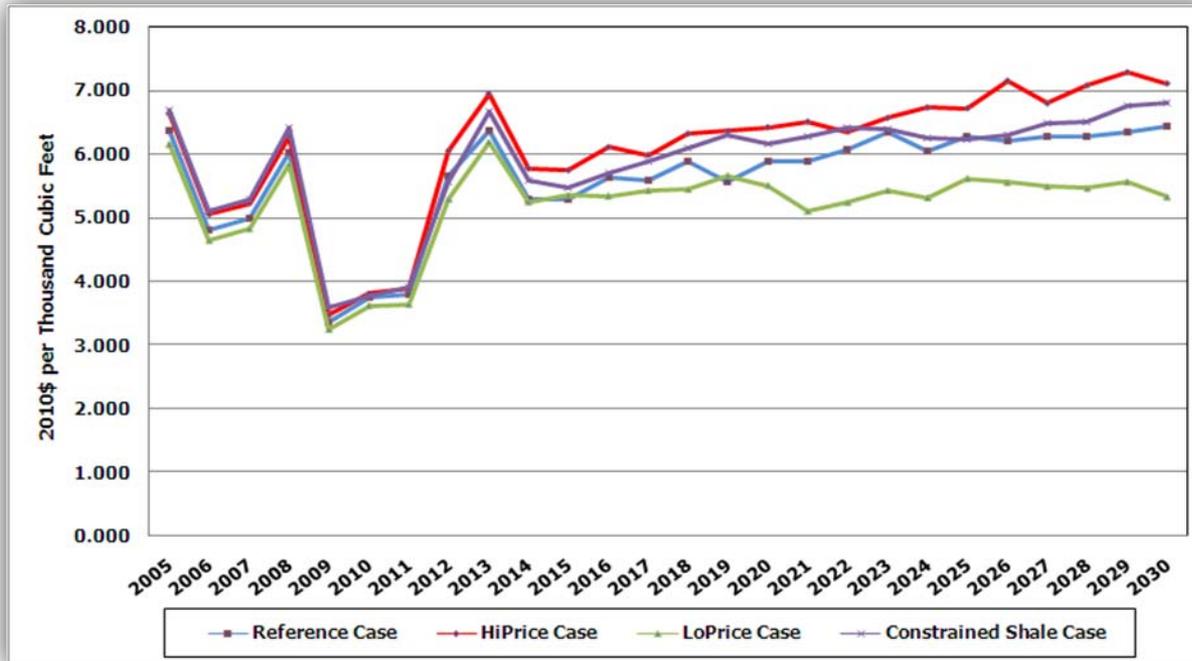


National Cases: Supply Balance

Performance of Cases: California



National Cases: Price Performance of Cases (Topock Hub)



- Prices behave as expected:
 - High Price case produced highest prices
 - Low price case produced lowest prices
- Together, four cases produce "zone of uncertainty"



National Cases: California Supply Portfolio (2025)

Reference Case

- California Demand: End-use
- Demand satisfied by:
 - Canadian Imports
 - Rocky Mountain Supplies
 - Southwest Supplies
 - Local Production

Canadian Imports:
2.41 Bcf/d

Rocky Mountain:
1.25 Bcf/d

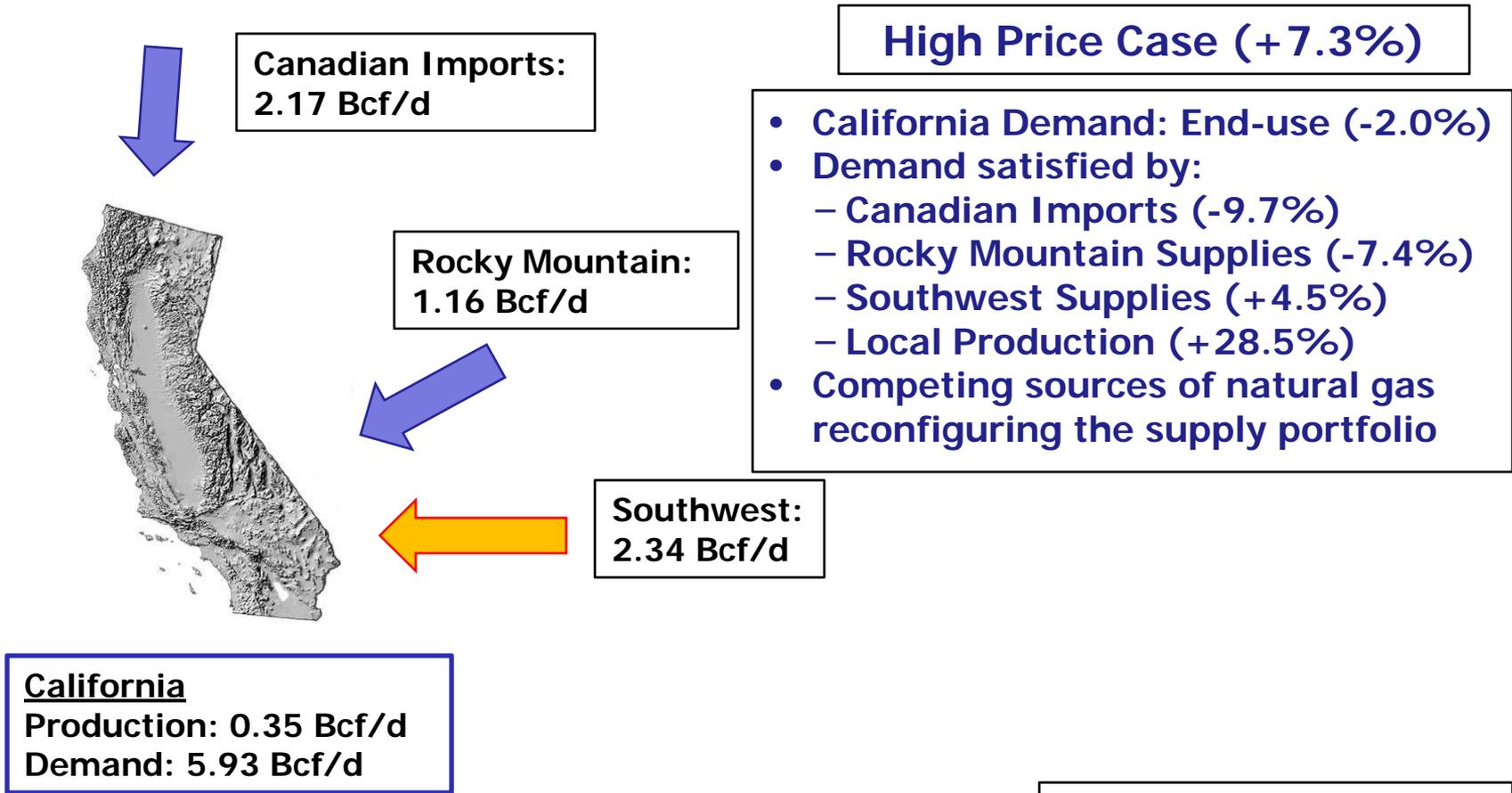
Southwest:
2.24 Bcf/d

California
Production: 0.28 Bcf/d
Demand: 6.05 Bcf/d

() Percent change from reference case



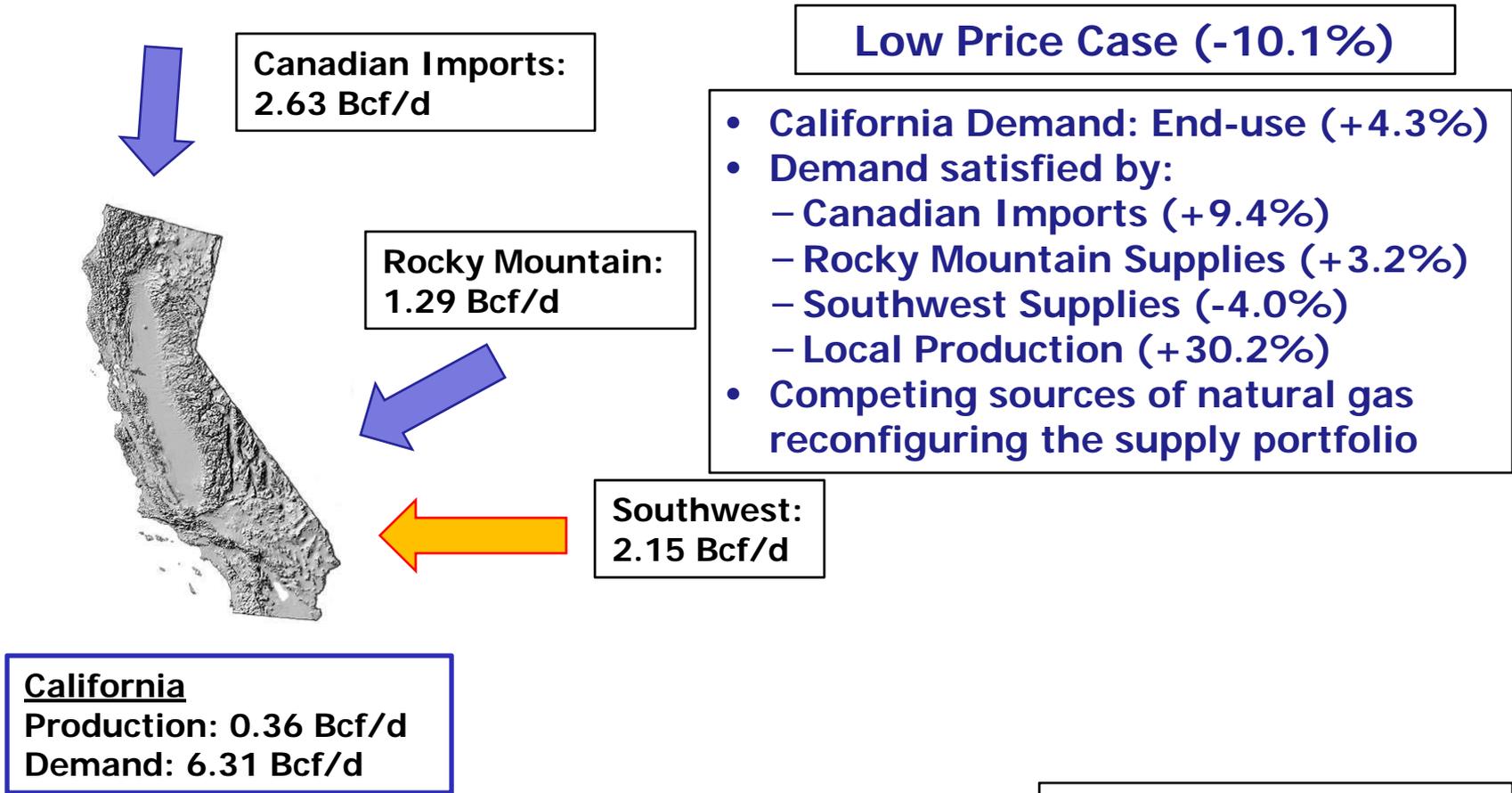
National Cases: California Supply Portfolio (2025)



() Percent change from reference case



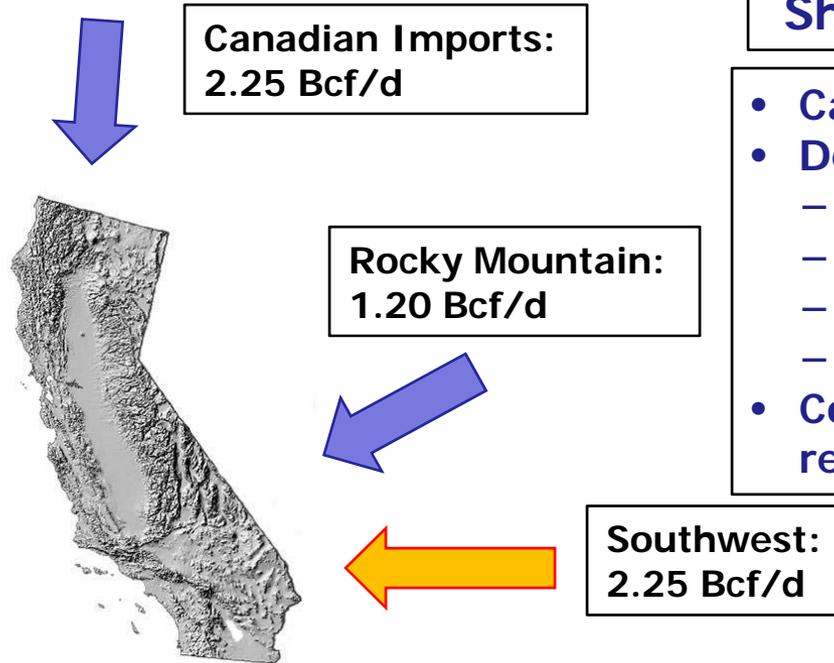
National Cases: California Supply Portfolio (2025)



() Percent change from reference case



National Cases: California Supply Portfolio (2025)



Shale Constrained Case (-0.6%)

- California Demand: End-use (-3.0%)
- Demand satisfied by:
 - Canadian Imports (-6.4%)
 - Rocky Mountain Supplies (-4.1%)
 - Southwest Supplies (+0.6%)
 - Local Production (+4.8%)
- Competing sources of natural gas reconfiguring the supply portfolio

() Percent change from reference case

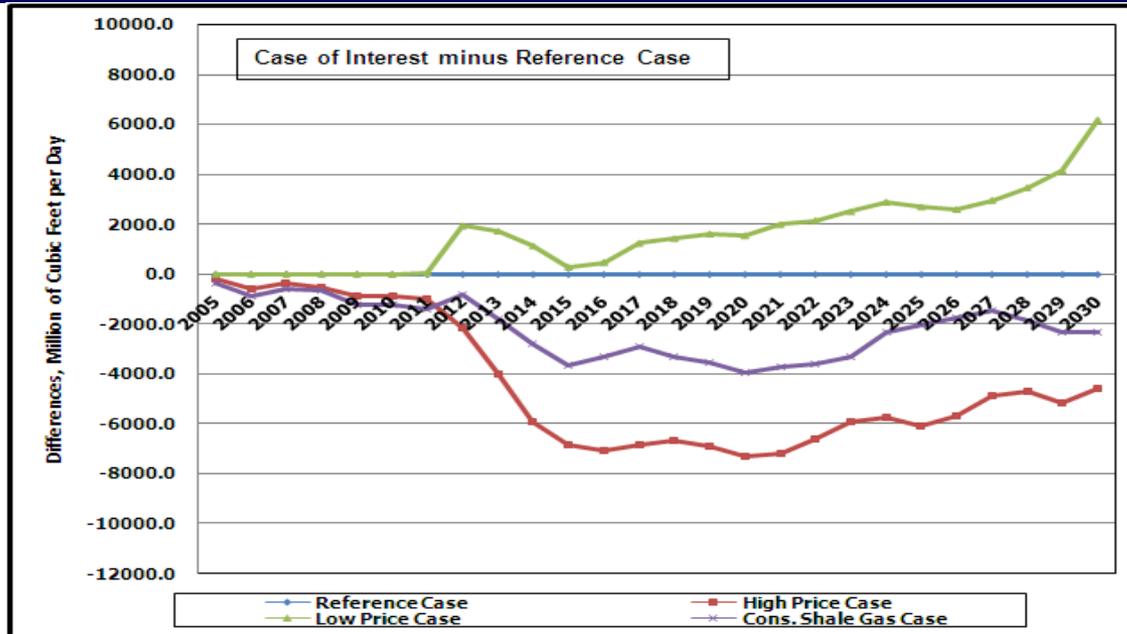


National Cases: Difference Results

Difference Results



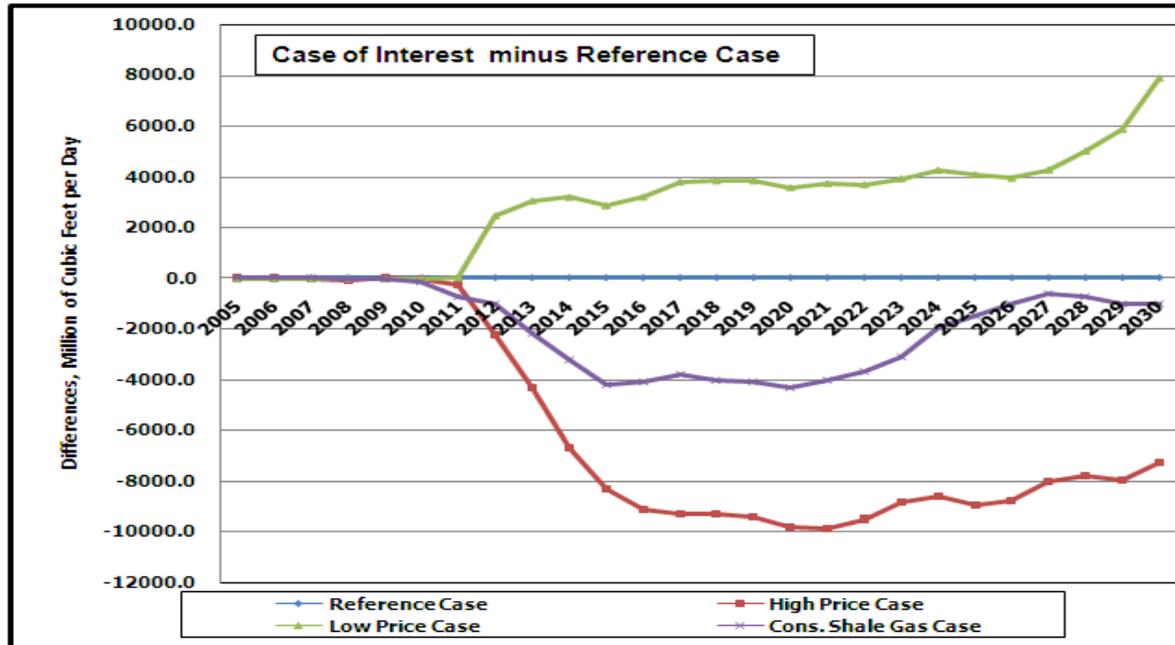
National Cases: Difference Results (All Supply Sources)



- Higher environmental cost reconfigures the order of selection resources, pushing US production lower in the High Price case and the Constrained Shale case
- In the Low Price case, lower domestic prices pushes out LNG imports and increased domestic production fills the gap



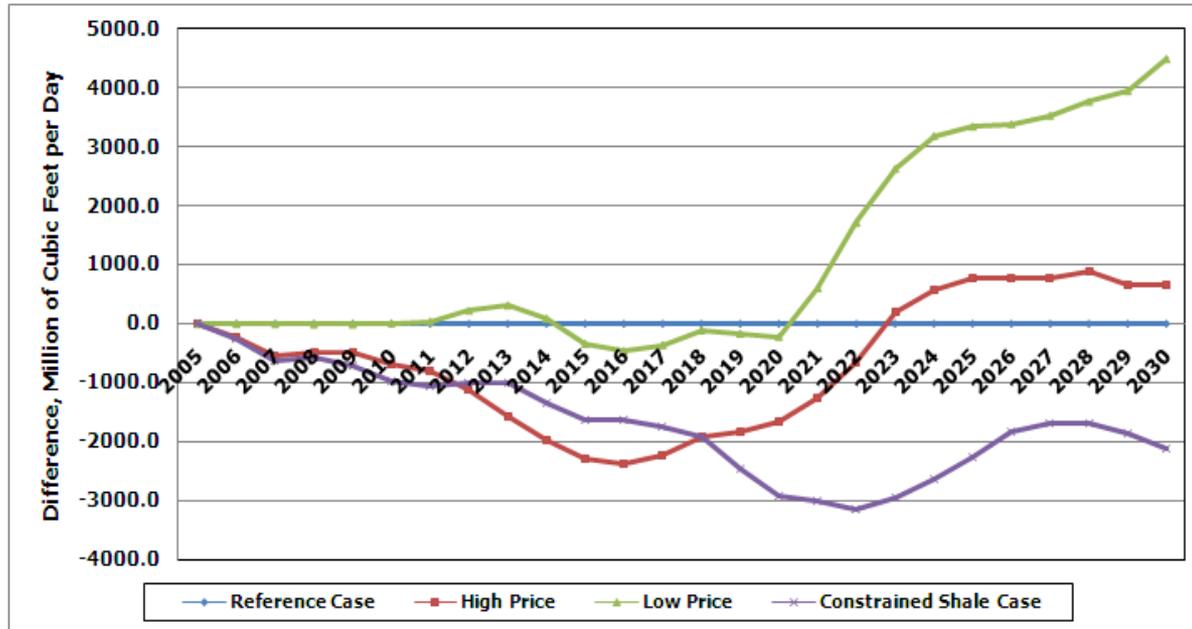
National Cases: Difference Results (Shale Gas Production)



- Higher environmental costs lower domestic shale production in both the High Price case and the Constrained Shale Gas case
- In the Low Price case, shale gas production increases as LNG imports lose out as a result of lower domestic prices



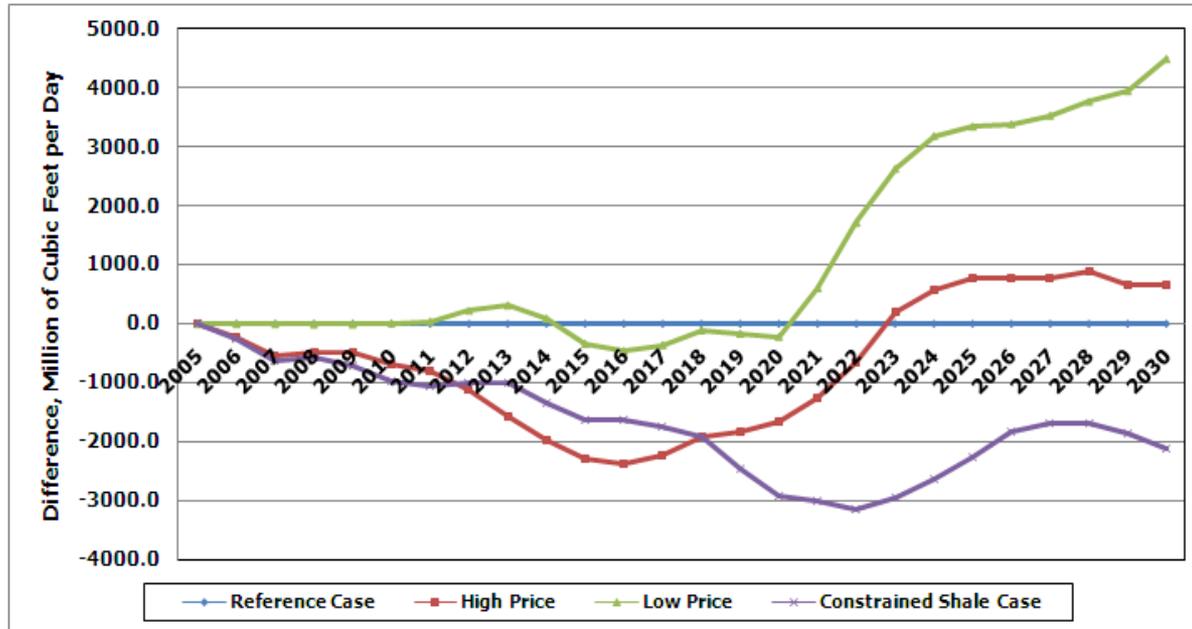
National Cases: Difference Results (US Demand)



- Higher prices push demand lower in the High Price case and the Constrained shale gas case
- Although demand starts out lower in the High Price case, robust economic performance and coal conversion push US demand higher after 2022



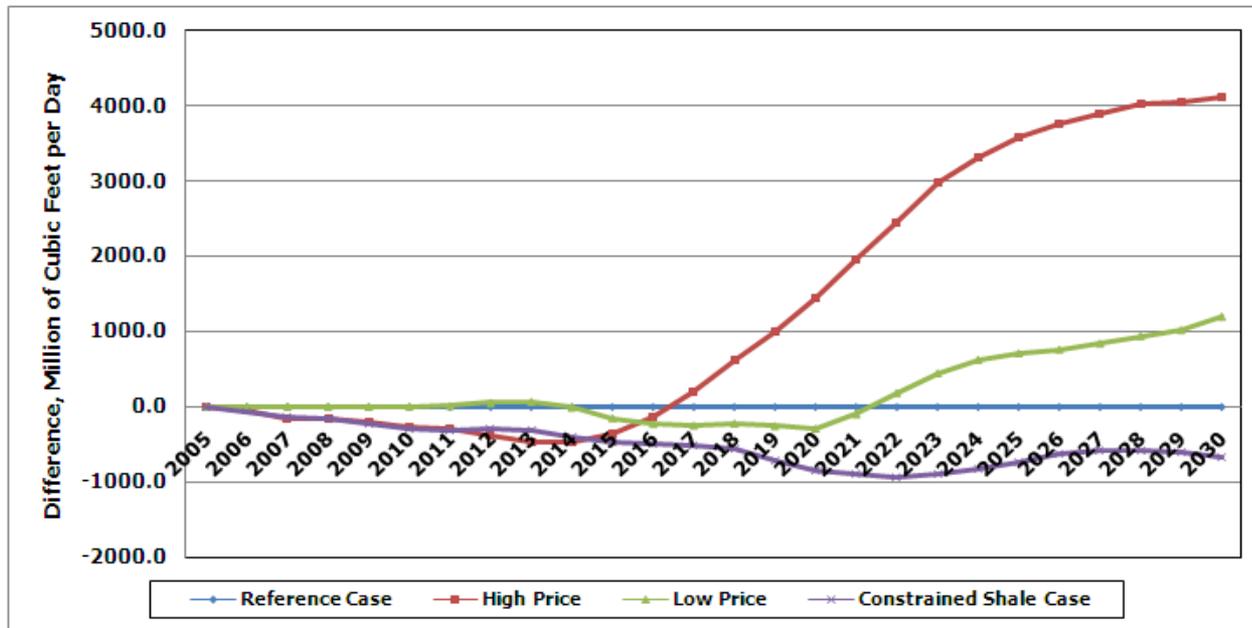
National Cases: Difference Results (US Demand) (cont'd)



- Low prices stimulate demand in the Low Price case, pushing demand higher
- All states meet RPS implementation on time
 - Dampen natural gas demand between 2012 and 2020



National Cases: Difference Results (US Power Generation)



- In the High Price case, power generation gas demand climbs higher as robust economic performance and coal conversion pull in more natural gas



National Cases: Conclusions

- **Added environmental mitigation costs may delay the development of shale formations**
- **Price changes can reconfigure the supply portfolio**
- **Plausible national cases produce a range of price and supply outcomes**



National Cases: Epilogue

Questions & Comments