

*The Brattle Group*

**Making Energy-Only Markets Work:  
Market Fundamentals and  
Resource Adequacy in Alberta**

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**Harvard Electricity Policy Group Meeting  
Calgary  
June 13, 2013**

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# Background and Summary

## **Our 2011 Resource Adequacy Review:**

- ◆ In 2010, the AESO asked us to review long-term challenges to resource adequacy in Alberta's electricity market and assess the sustainability of the energy-only market design from a long-term resource adequacy and investment perspective
- ◆ As we stated in the resulting March 2011 report, we found that the Alberta market was sustainable from a resource adequacy perspective (i.e., continued investment, no missing money) but offered a number of recommendations

## **2013 Update to our Resource Adequacy Review:**

- ◆ We updated our 2011 assessment for recent market conditions and changes to underlying market fundamentals
- ◆ This update again confirmed that, from a resource adequacy and generation investment perspective, the Alberta electricity market is generally well functioning given current market conditions and policies

# Alberta Market Overview – Characteristics

## Characteristics:

- 14,400 MW – the smallest North American deregulated power market
- Six major generators plus large oil and gas cogeneration sector
- High load growth (2.7%) and high load factor (80%)
- Only approx. 800 MW of simultaneous transfer capability with neighboring systems (BC Hydro, Sask, MT)

## Market design:

- Real-time energy-only market (no day-ahead market), settled hourly
- Single price for entire market (no zonal/nodal congestion pricing)
- No centralized unit commitment, simple merit-order dispatch in real time
- Ancillary services markets; not co-optimized with energy market dispatch

**Annual capacity additions averaged 450 MW since 2000, but an average of 530 MW per year is needed through 2030**

# Alberta Market Overview – Transmission

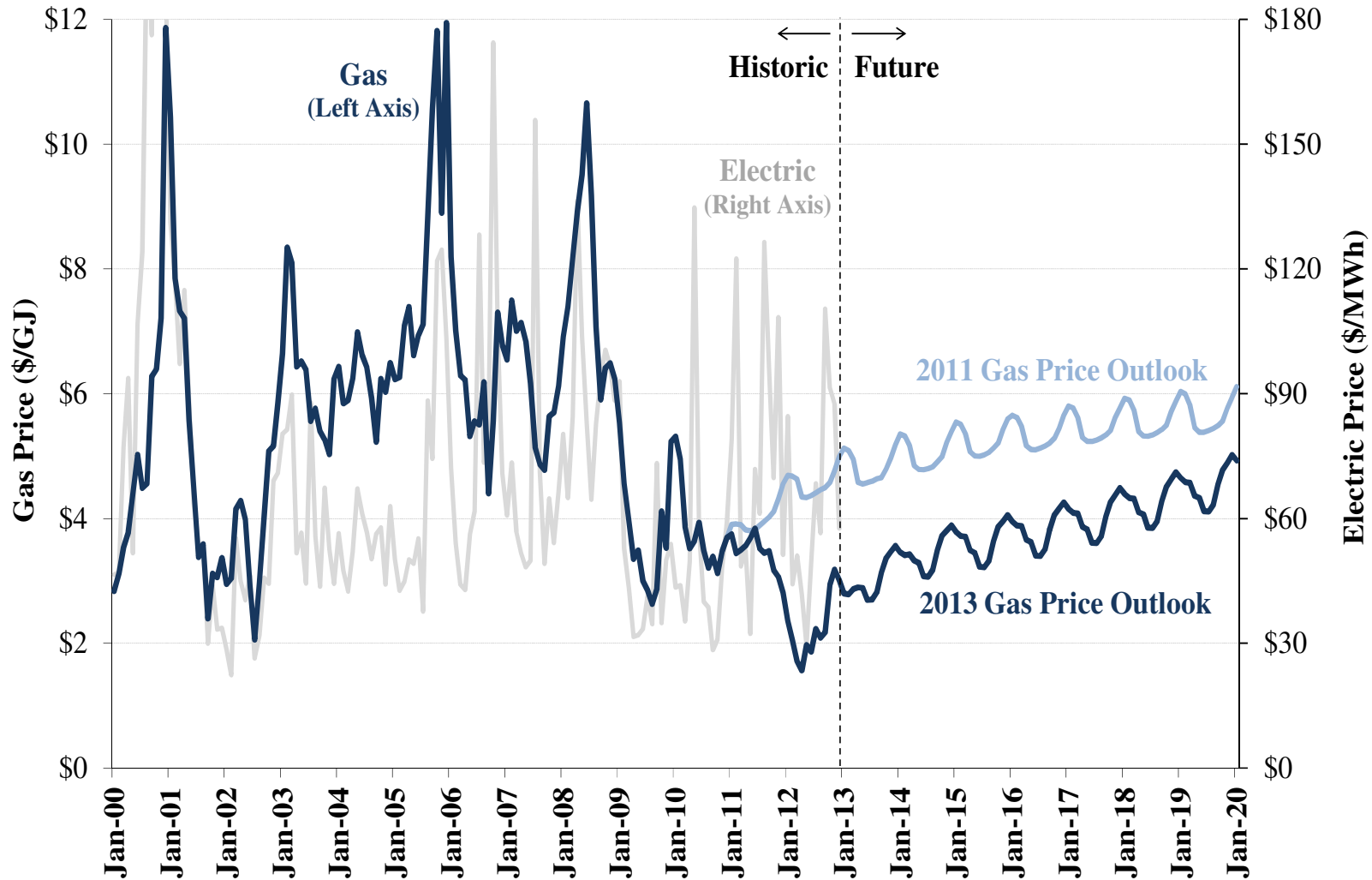
- AESO has mandate to build a mostly **unconstrained system**
- **No transmission rights** (only hourly opportunity service)
- No generation and transmission interconnection charges or rights
- **Few load-pocket constraints:**
  - Mostly Northwestern Area (about 8% of load and 4% of generation); binding during 4,000-8000 hours a year
  - Constrained-on generation addressed through “TMR” contracts and “DDS” to dispatch down in-merit generation elsewhere
- **Mostly small generation-pocket constraints:**
  - Generation-rich regions (e.g., Ft. McMurray, Southwest Wind)
  - 80-95% of the market (load and generation) is downstream from the constraints; binding during approx. 200-1,000 hours/year
  - Upstream generation receives pool price if dispatched, but is exposed to uncompensated pro-rata curtailments
  - Single clearing price based on in-merit generation downstream from the constraint (i.e., the “correct” price for 80-95% of the market)

# Update to Market Challenges Analyzed in 2011

Challenge	Comments
<b>Low Natural Gas Prices</b>	Appears less important now than in our previous review because peak period prices increased substantially since 2009 and 2010, causing a net increase in earnings for natural-gas-fired power plants
<b>Expiration of PPAs</b>	We are less concerned that many units with PPAs could retire in 2018 to obtain regulated decommissioning cost recovery due to increase of compliance age from 45 to 50 years in Federal Regulations and positive economics relative to unfunded costs
<b>Alberta and Federal Environmental Regulations</b>	We anticipate that resource adequacy needs associated with retirements from environmental regulations can and will be addressed by market-based investments in gas plants
<b>Increased Wind Penetration</b>	Downward pressure on market prices due to wind does not appear to be large enough to accelerate retirements of existing fossil fleet or deter new entry from natural gas plants
<b>Expanded Interties with Neighboring Markets</b>	While expanding intertie capacity potentially reduces Alberta prices in the short-term and increases investment risks in the long-term, this does not appear to be a significant concern at the current level of (or even modestly expanded) intertie capacity

# Natural Gas Price Outlook Declined since 2011

## Historical Gas and Pool Prices vs. Gas Price Outlook



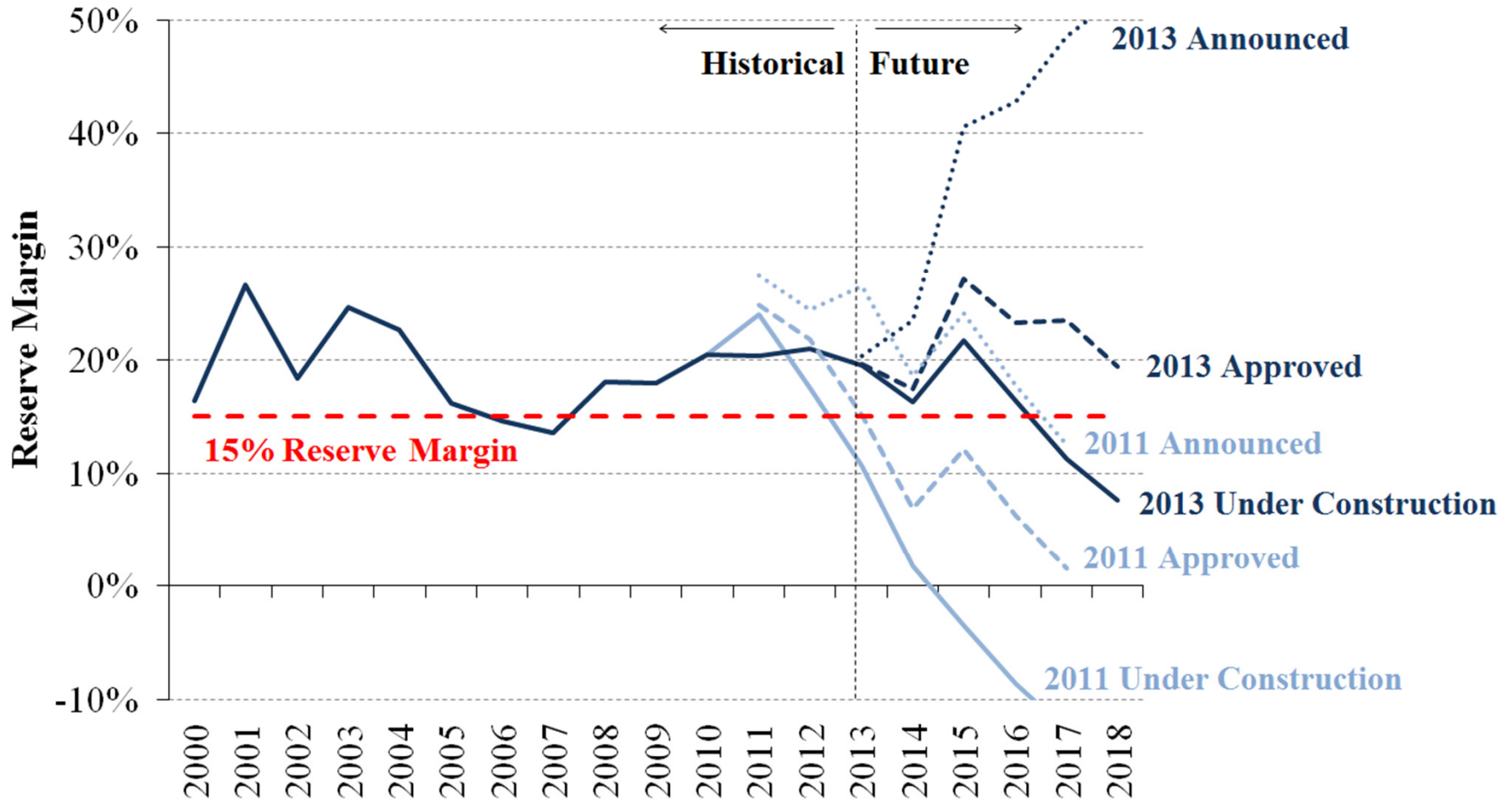
# Financing New Generation Projects in Alberta

**We are optimistic about the ability of the Alberta market to attract financing, even if it is not suitable for smaller investors or companies dependent on significant amount of project financing**

- ◆ Financing costs have declined since 2011
- ◆ The Alberta market, like other deregulated power markets, does not support investment cost recovery through long-term PPAs or regulated retail rates; suppliers must bear the risk that a particular investment will be uneconomic
- ◆ Alberta's market therefore is not a suitable environment for project developers heavily reliant on **“project financing”** (non-recourse debt) that needs to be supported by revenue certainty of long-term contracts
- ◆ Instead, Alberta has to attract investments primarily from larger, more diversified companies that can employ **“balance-sheet financing”** for their projects
- ◆ Our view is consistent with findings in 2012 MSA report

# Updated Supply and Demand Outlook

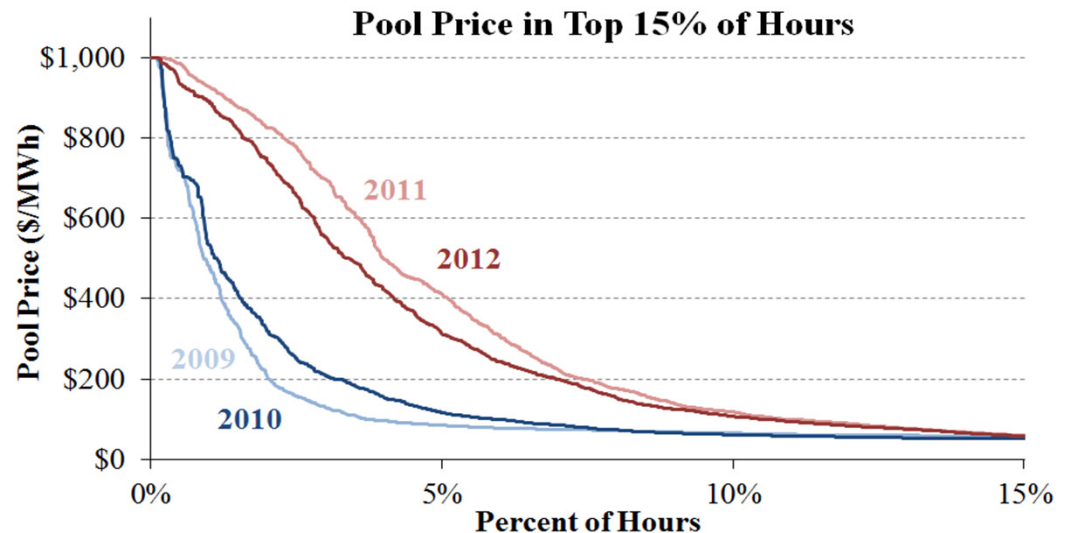
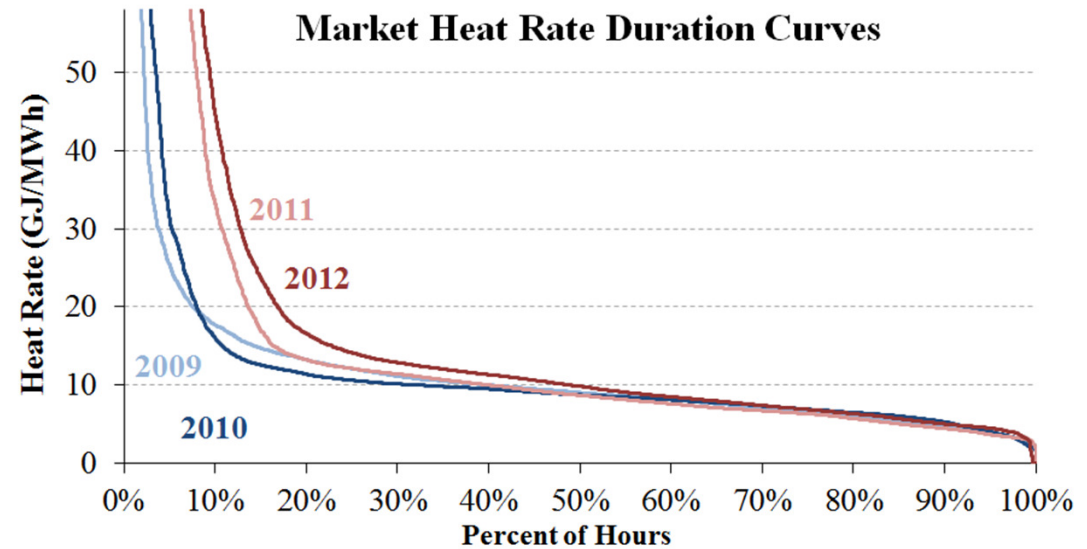
## Historical and Projected Reserve Margins





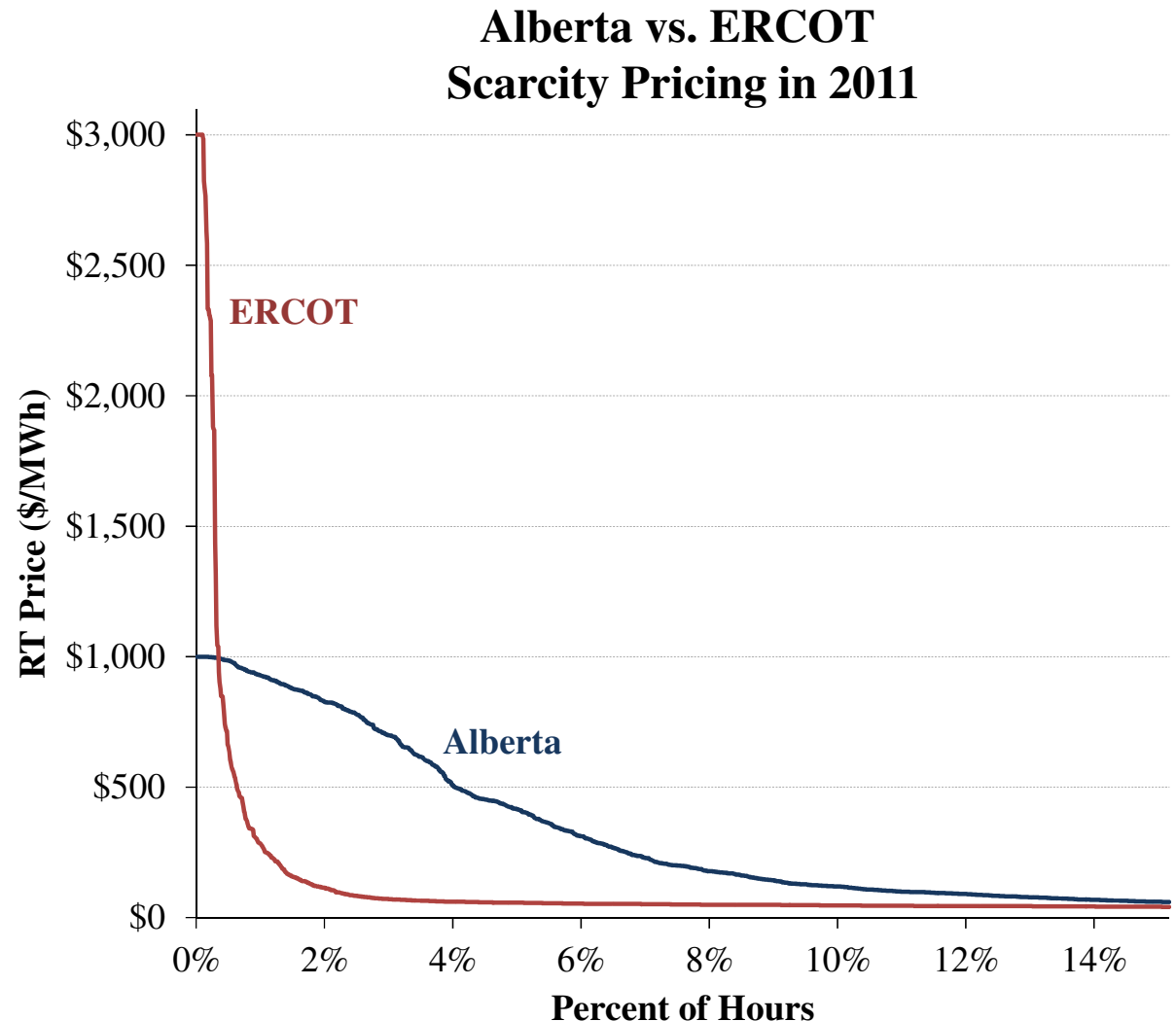
# Change in Market Heat Rates and Pool Price Levels

- ◆ Market heat rates and pool prices for 2011 and 2012 similar to prior years in the bottom 80% of hours
- ◆ But pronounced increase in prices and heat rates in the top 10% to 20% of hours
  - ◆ MSA: due to change in generator bidding behavior
  - ◆ Improves economics of new investment
  - ◆ But uncertainty about stability of these margins likely dampens investment response



# Alberta vs. ERCOT Scarcity Pricing

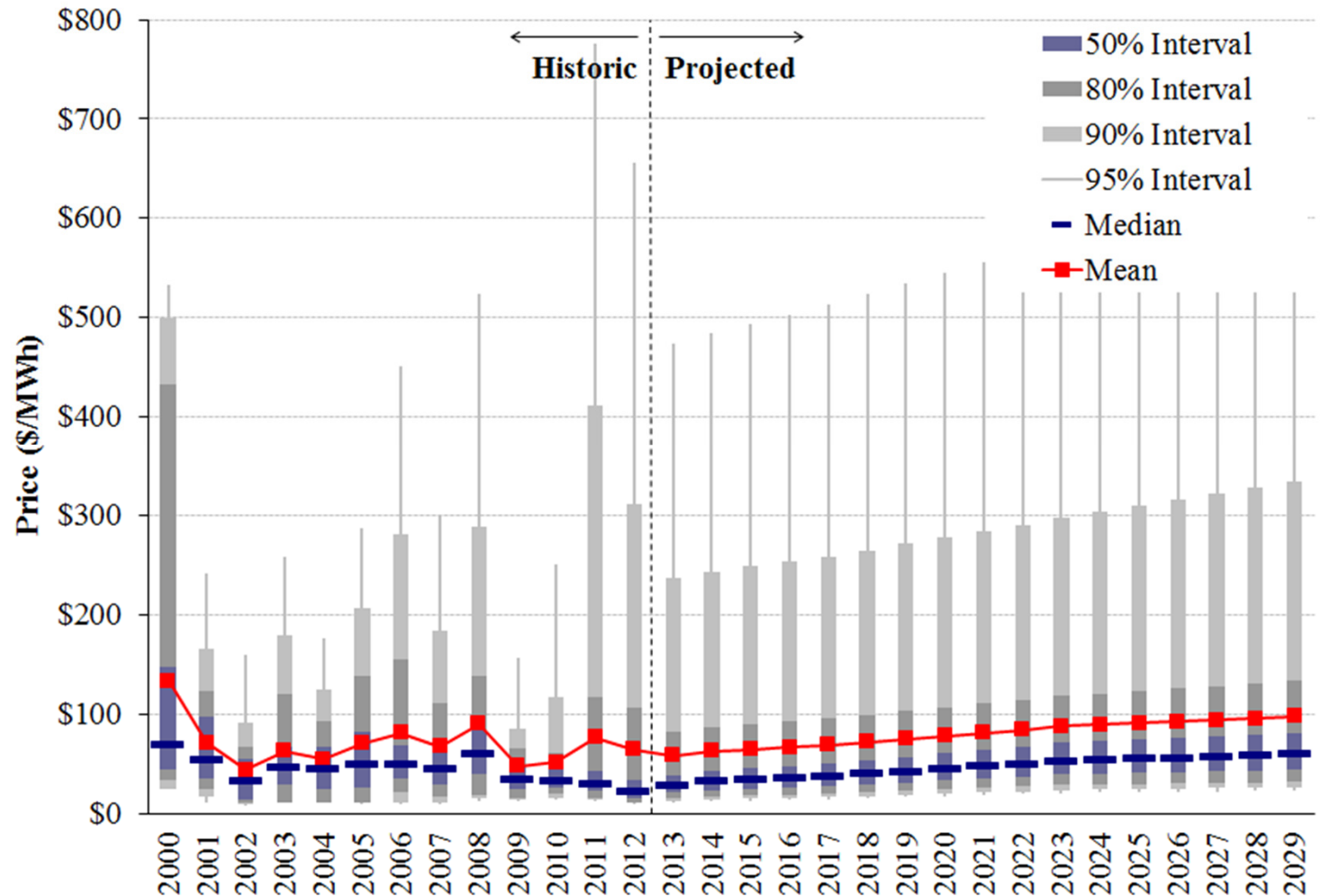
- ◆ Scarcity pricing is a critical component of both markets
- ◆ Scarcity prices in Alberta are less extreme, but much more frequent
- ◆ The impact on annual average prices and generators' margins is much greater in Alberta
- ◆ Scarcity prices in Alberta are driven primarily by supplier offers



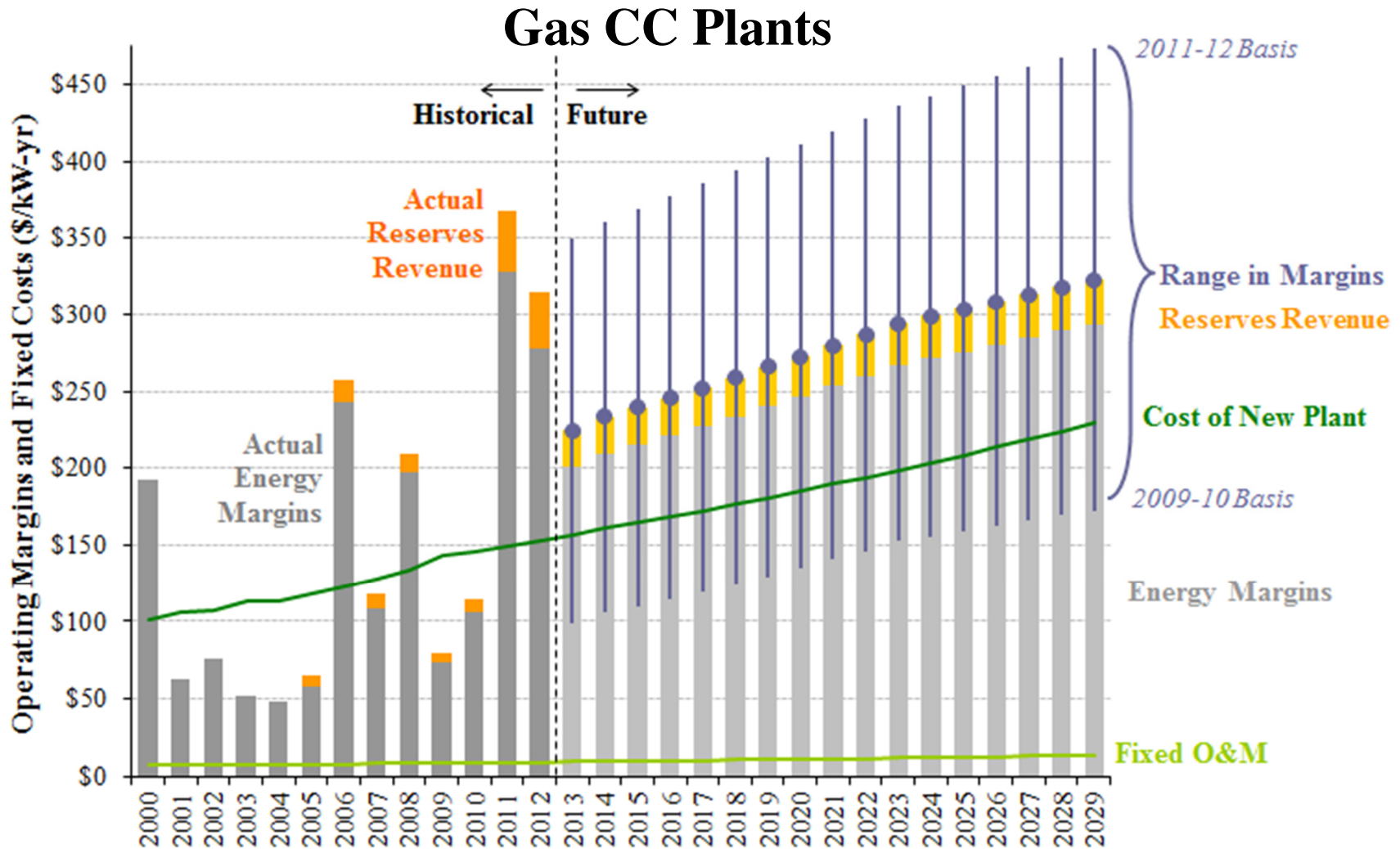
# Projected Pool Prices

Projected pool prices (not a forecast!) using market-heat-rate duration curve approach developed for 2011 Report

Used average market heat rate duration curve for 2009-2012 to average across different generator bidding behaviors

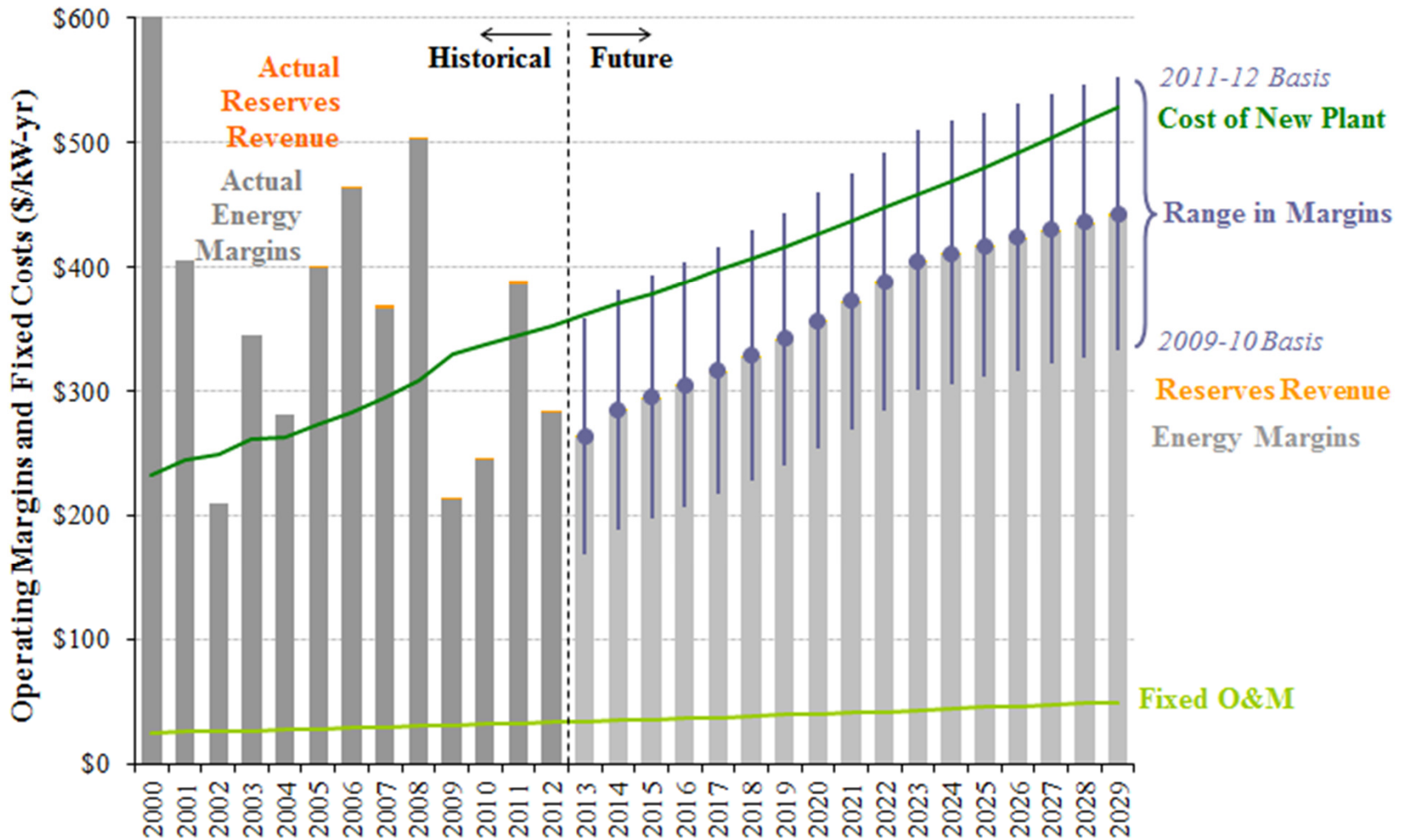


# Projected Generator Operating Margins vs. Fixed Costs



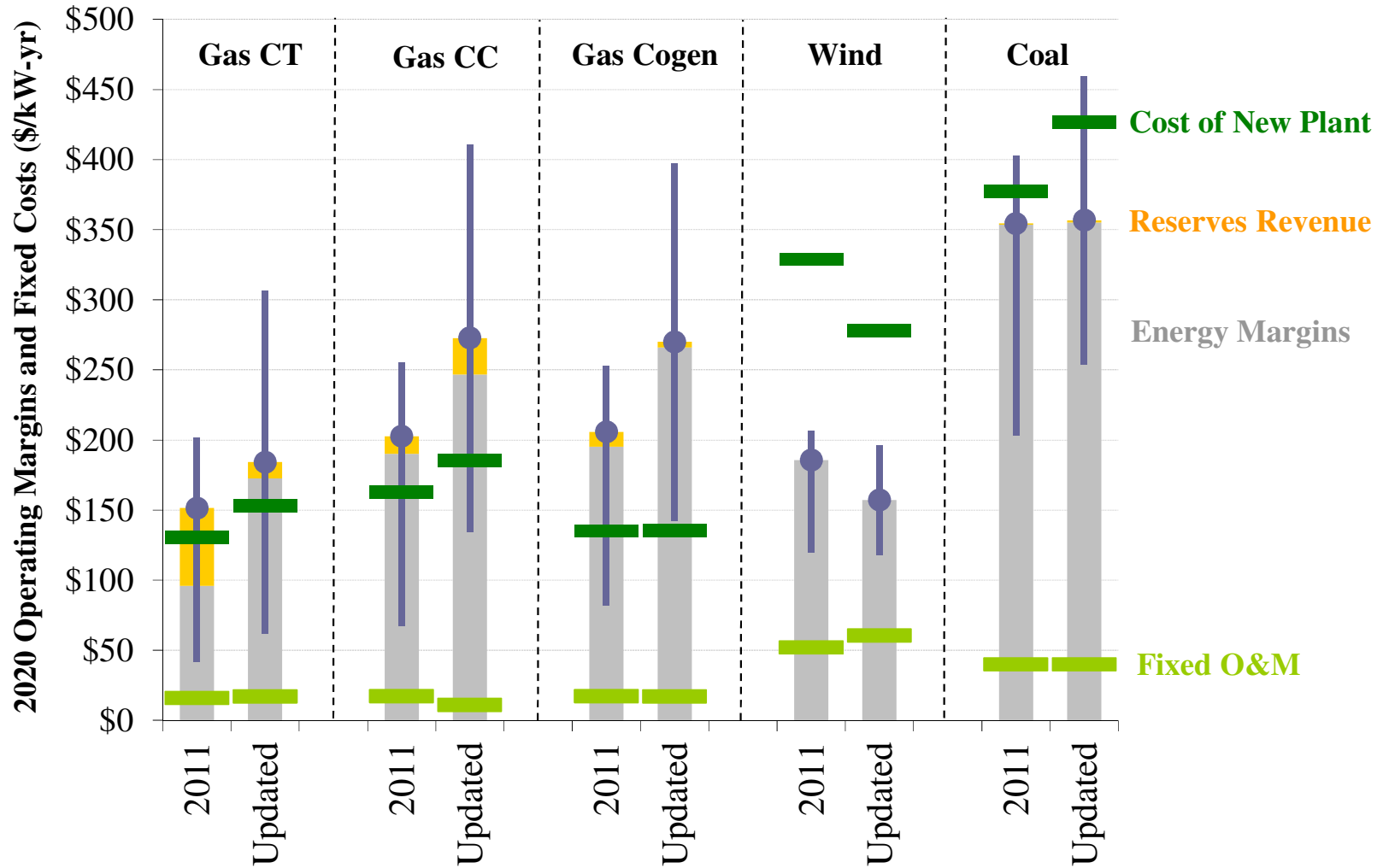
# Projected Generator Operating Margins vs. Fixed Costs

## Coal Plants



# Comparison of 2011 Report and 2013 Update

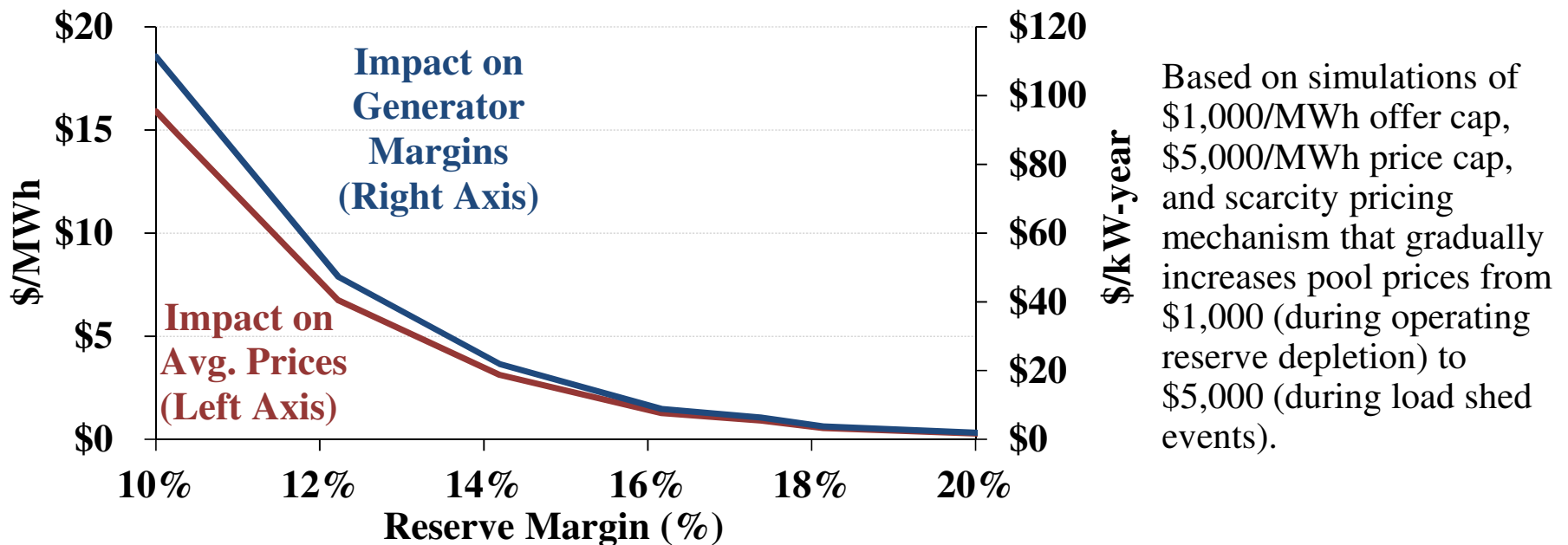
## Projected 2020 Operating Margins vs. Fixed Costs



# Improve Investment Signals by Increasing Price Cap

## Increasing price cap would provide additional certainty

- ◆ Higher price caps and gradual scarcity pricing would help ensure that investment returns rise as reserve margins decline (more frequent scarcity events and prices)
- ◆ Even a \$5,000 price cap (during scarcity events) has only very modest impact at high reserve margins, but significantly improves sustainability below 15% (e.g., due to unexpected plant retirement or abandoned development efforts)
- ◆ Would provide investment signal not sensitive to generator bidding behavior



# Summary of Findings

**From a resource adequacy and generation investment perspective, the market is generally well functioning and sustainable given current market conditions and policies.**

- ◆ The current market design should be able to address identified resource adequacy challenges; there is no compelling need for major design changes
- ◆ Retention of existing resources is likely, except in cases where plants face major capital investment needs
- ◆ The outlook for new generation needed to ensure resource adequacy is encouraging; current market fundamentals support natural gas plants
- ◆ Coal plants and other technologies are unlikely to be economic (with or without carbon pricing/sequestration), which means the mix of new resources will shift from mostly coal toward more natural gas

**Outlook remains sensitive to challenges, uncertainties, and changes in market fundamentals, regulations, and policies**



# Sources of Market Sustainability in Alberta

## **Energy market prices and A/S revenues high enough to support entry of new generation**

- ◆ Peak-period prices increased as reserve margins or gas prices declined
- ◆ Limited long-term contracting allows only small amounts of non-recourse financing (e.g., 30%), but new generation is getting built (on balance sheets)
- ◆ Favorable economics of large cogeneration (oil sands)

## **Higher load factors and less “spiky” peak loads results in more frequent high-priced hours**

## **More permissive market mitigation**

- ◆ Well-specified “Offer Behaviour Enforcement Guidelines”\*
- ◆ Allows for unilateral portfolio bidding and scarcity pricing
- ◆ Prospective intervention if efficiency loss is documented

\* <http://albertamsa.ca/index.php?page=guidelines>

# Recommendations to Improve Sustainability

**To address uncertain future market and policy developments, we offered the following recommendations:**

1. Continue to monitor physical resource adequacy metrics such as the reserve margin and retirement schedules; monitor expected unserved energy (EUE)
2. Continue to monitor economic resource adequacy metrics
  - Trends in market heat rates and generators' operating margins
  - Impact of wind generation and inertia expansion
  - Ability of the market to attract investments
3. Build on recent RRO review to evaluate impact of the regulated rate option impact on efficient forward contracting
4. Avoid regulations and policies that could result in large simultaneous retirements
5. Increase the price cap, reduce the price floor, and introduce more gradual scarcity pricing for operating reserve depletions to set economically efficient prices during reliability events, stimulate demand-response, promote generator performance, and improve investment signals should reserve margins decline

# Additional Reading

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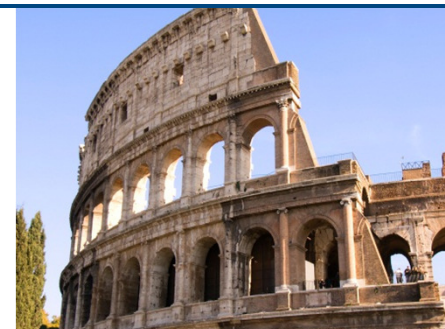
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### Note:

The views expressed in this presentation are strictly those of the presenter and do not necessarily state or reflect the views of *The Brattle Group, Inc.* or our clients.

Johannes (Hannes) Pfeifenberger is an economist with a background in power engineering and over 20 years of experience in the areas of public utility economics and finance. He has published widely, assisted clients and stakeholder groups in the formulation of business and regulatory strategy, and submitted expert testimony to the U.S. Congress, courts, state and federal regulatory agencies, and in arbitration proceedings.

Hannes has extensive experience in the economic analyses of electricity wholesale markets and transmission systems. His recent experience includes reviews of RTO capacity market and resource adequacy designs, testimony in contract disputes, and the analysis of transmission benefits, cost allocation, and rate design. He has performed market assessments, market design reviews, asset valuations, and cost-benefit studies for investor-owned utilities, independent system operators, transmission companies, regulatory agencies, public power companies, and generators across North America.

Hannes received an M.A. in Economics and Finance from Brandeis University and an M.S. in Power Engineering and Energy Economics from the University of Technology in Vienna, Austria