Examining Hydroelectricity's Potential Role in the Alberta Market:

Impacts of Market Structure and Economics

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PRESENTED BY

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Agenda

Does the Alberta Electricity Market Design Fail to Support New Hydro Generation?

The Challenging Economics of Hydro Generation

Policy Options for Supporting New Hydro Generation

Impacts of Out-of-Market Support for New Hydro Generation

When Would Alberta Need New Hydro Generation?

The Bottom Line

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Does the Alberta Market Design Support Hydro?

Myth: The energy-only design of Alberta's wholesale electricity market does not support the development of new hydro generation

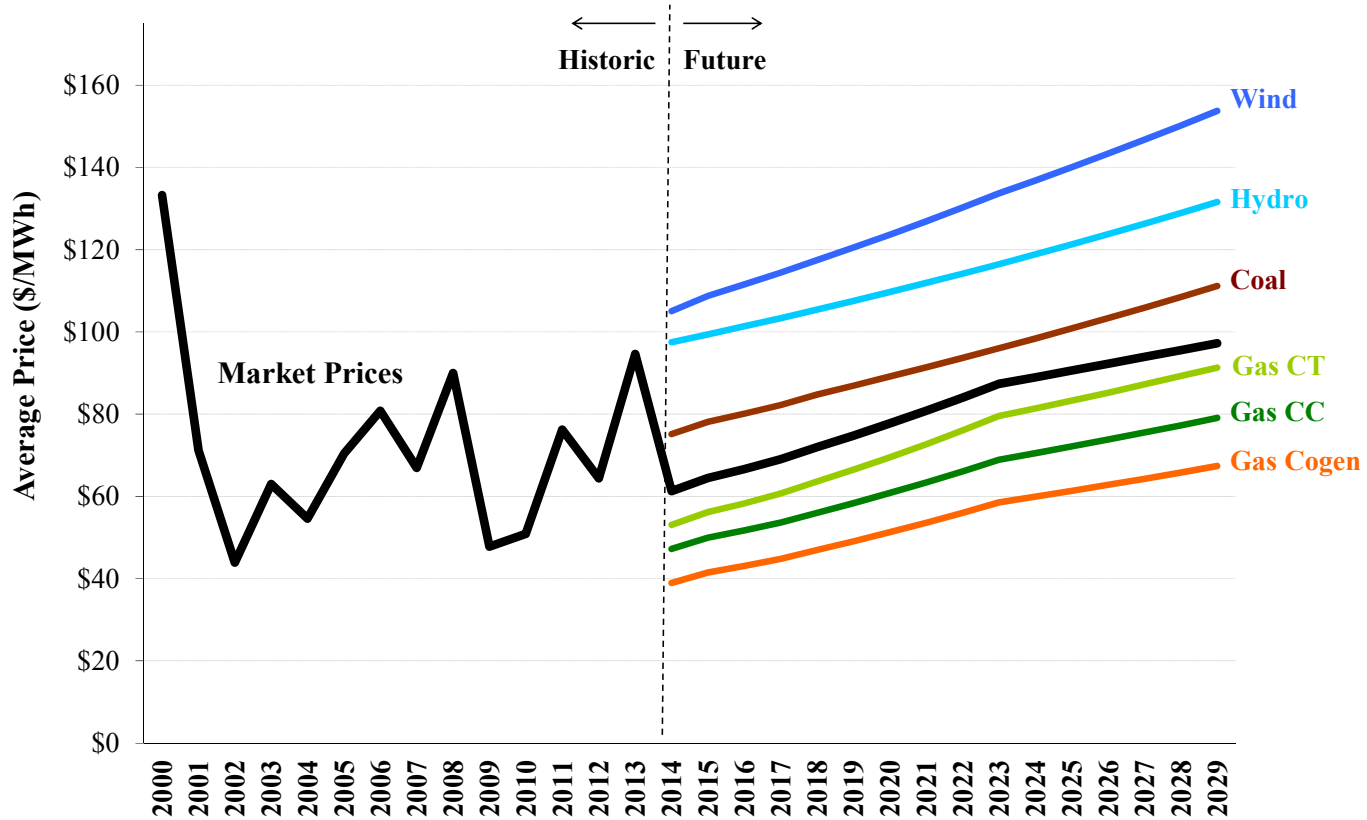
- Perception that Alberta's market design creates volatile energy prices, lack of long-term contracts, and risks too high to allow financing of new hydro plants
- Would need redesign that includes a combination of capacity market or long-term contracts, debt guarantees, or crown corporation financing advantage

Reality: It's the economics of hydro generation (not the Alberta market design) that does not support the development of new plants

- Due to high/increasing costs, new hydro generation is uneconomic under current and near-term projected market conditions – **irrespective of market design**
  - $90-150/MWh for hydro generation
  - $60-100/MWh for wholesale market prices
  - $50-80/MWh for new natural gas-fired generation
- Development of new hydro generation thus requires either
  - Shift in market conditions (carbon prices or much higher natural gas prices)
  - Financial support (i.e., subsidies, guaranteed cost recovery)

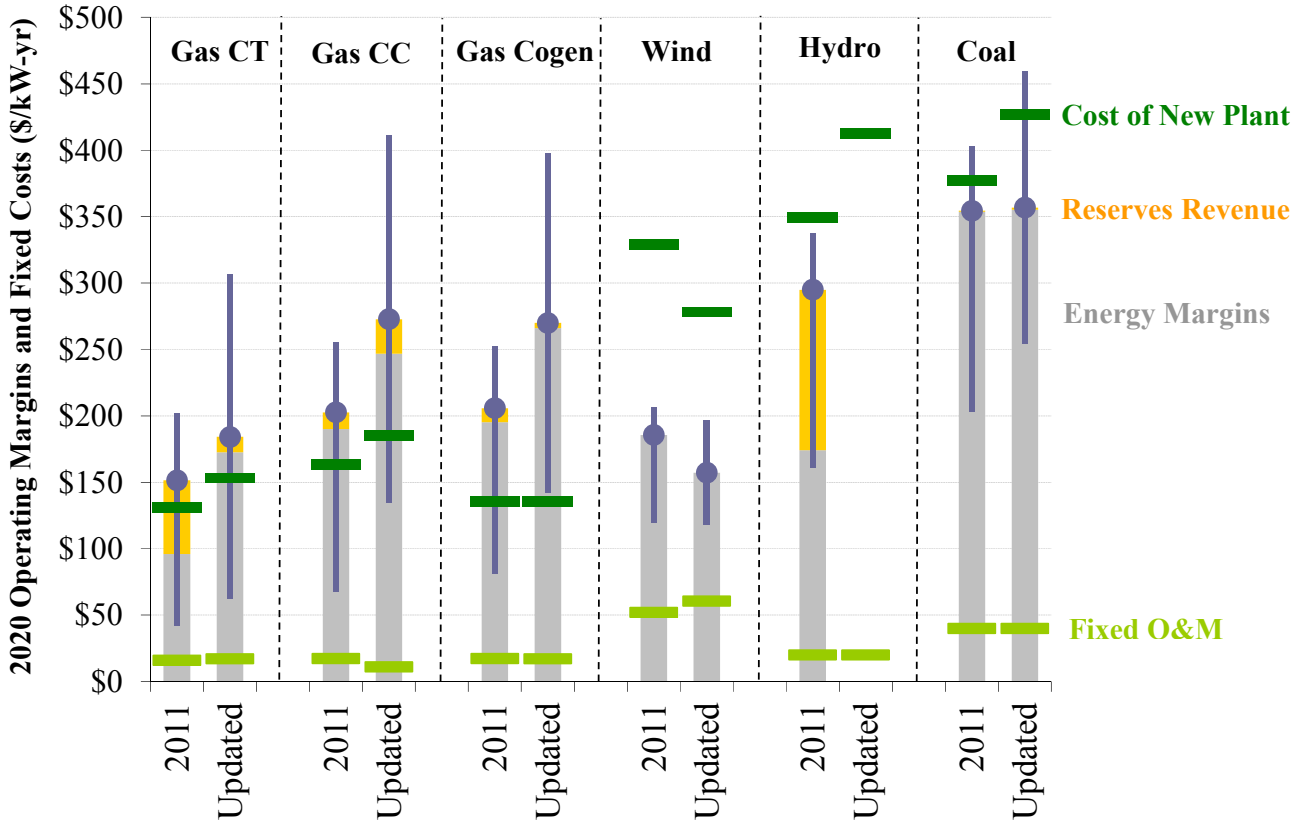
The Challenging Economics of Hydro Generation

- Even when assuming an installed cost of only $4,500/kW (may be above $7,000/kW), new hydro generation is significantly more expensive than power from new fossil plants.
- Requires carbon price of at least $30/ton or natural gas prices above $8/GJ before hydro generation is economic compared to conventional resources



The Challenging Economics of Hydro Generation

- Economics of natural gas generation has improved over the last few years
- Economics of base-load resources (coal, hydro) has worsened
- Flexible hydro with (at least daily) storage will be more valuable by generating more during peak-price periods and by selling ancillary services



Policy Options for Supporting New Hydro

Setting aside economics, at least several out-of-market options exist to "support" development of new hydro resources in Alberta:

- **Subsidize new hydro generation as a policy objective, irrespective of current economics**
  - Financing guarantees
  - Long-term contracts with out-of-market cost recovery
  - Subsidized financing through crown corporation
- **Provide additional revenues for all "green" generation technologies**
  - Implement clean-energy mandates, renewable portfolio standards, tax credits
  - Allow new hydro generation to compete with all other green technologies (e.g., wind, solar, coal plus carbon capture and storage, energy efficiency)
- **Only support development of option for faster market-based entry**
  - Subsidize the development/permitting effort so that a new plant could be built more quickly
  - Decide to construct the plant only if/when market conditions support it
  - Fully market-based recovery of construction costs

Impacts of Out-of-Market Support for New Hydro

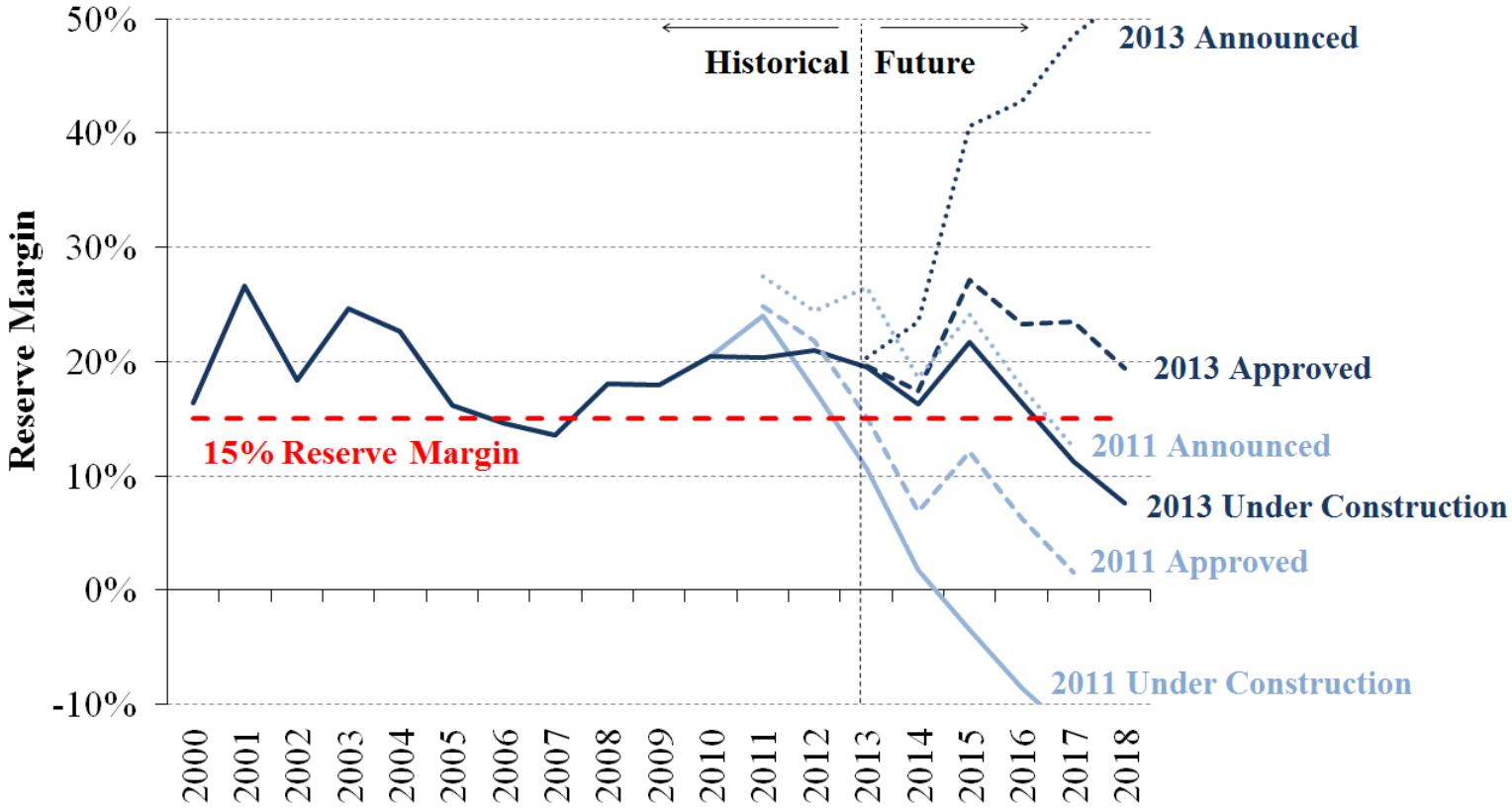
- Increased consumer costs and high risks (costs, lead time)
  - Consumers ultimately pay for the financial support of out-of-market resources that are uneconomic under current market conditions
  - Support will transfer market risks from private investors to consumers
- Alberta's energy-only market design and market-based generation investments likely would become unsustainable :
  - If the amount of out-of-market hydro additions were large relative to the total resource needs in Alberta (e.g., more than a 1000 MW, representing a year or two of load growth plus retirements of existing units)

    Need to leave enough residual need for market-based resources additions to avoid undermining investment signals for all other plants
  - If the total hydro market share (Alberta hydro resources plus hydro-based imports) grew significantly, exposing market-based resources to hydrological risks that are difficult to manage for private investors

    Most markets with significant hydro exposure (e.g., >30-40%) require separate payments for conventional resources (e.g., capacity market)

When Would Alberta Need New Hydro?

- Recent developments show market-based investment in conventional resources is maintaining resource adequacy
- New hydro plants not “needed” in near term
- Allows careful development of public policies and monitoring of market trends to optimize timing of new hydro developments



The Bottom Line

- It's the economics, not the Alberta market design, that currently creates a barrier to the development of new hydro generation
  - Market design makes economics and need for subsidies more transparent
  - High/increasing costs and long lead time create additional risks
  - Carbon or much higher gas prices needed to make hydro economic
- Like other provinces, Alberta has options to financially "support" new hydro as a policy choice
  - Tradeoff: policy objective vs. higher consumer/taxpayer costs and risks
  - Impacts on Alberta electricity market design and market sustainability
- Maintaining the sustainability of Alberta's energy-only market design and market-based generation investments is possible
  - Requires careful (a) sizing of financially-supported new hydro relative to market needs and (b) monitoring of investment implications of Alberta's total hydro exposure
- Create flexible options, but avoid making irreversible firm commitments while economics are poor and future is uncertain

Additional Reading

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Note:

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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

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