

Alberta Power Symposium

Renewables: Removing Myth from Reality

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About Us



Alberta's Climate Leadership

- Earlier today, Shannon Phillips, Minister of Environment & Parks and Minister Responsible for the Climate Change Office announced that the Government of Alberta will:
 - Target a minimum of 30% of Alberta's annual electricity demand being met by renewables in 2030.
 - Support the deployment of the first 5,000 MW of renewable generation capacity in the province.
- In addition, a new policy and regulatory framework is under development for small-scale renewable electricity generation (i.e. residential, commercial and community market sectors).

Our Key Message Today

“30% renewables by 2030
is achievable in Alberta both
cost-effectively and without
compromising reliability of supply”

Myths about Wind & Solar Electricity

“Is there some place where we can get the best of these three things — the lowest cost, the lowest emissions and the highest reliability because you’re not going to get them all at once, you’re going to trade off between them,”

- Calgary Herald (January, 2016)

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Cost Effectiveness

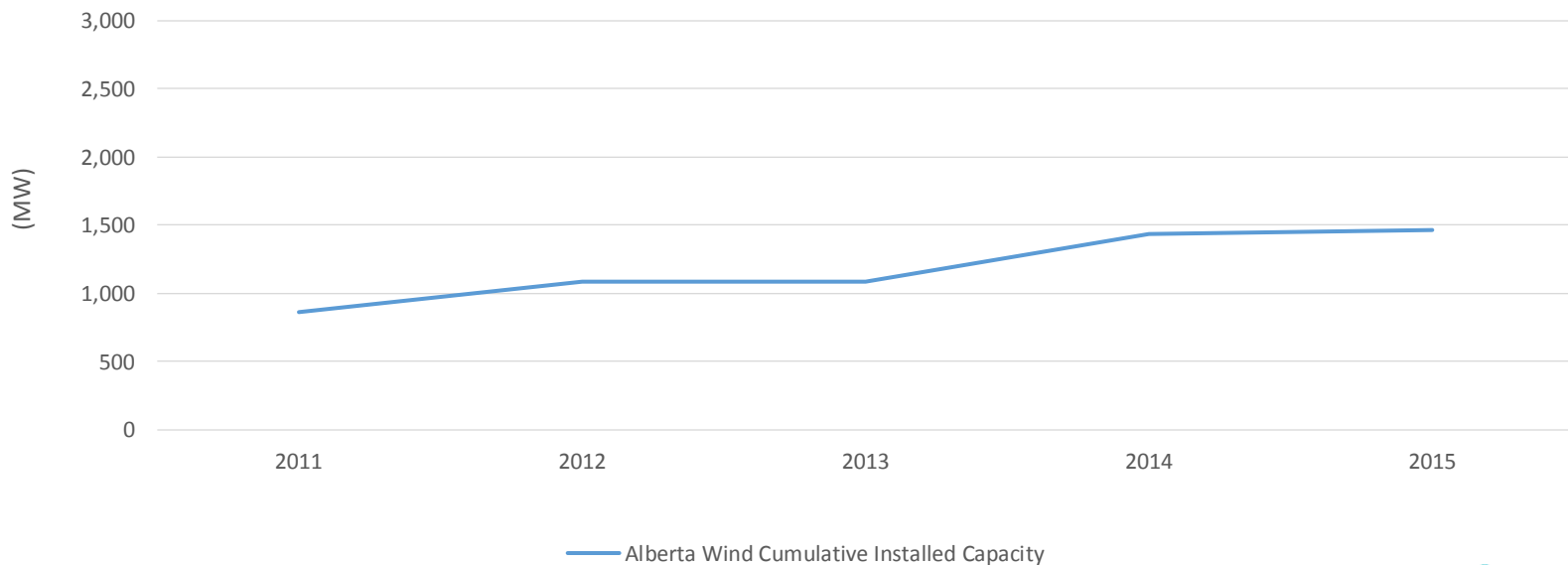
30% renewables by 2030
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cost-effectively

Overview of Cost-Effectiveness Discussion

1. What is the current installed capacity of wind and solar?
2. What are the LCOE and pricing trends for wind and solar?

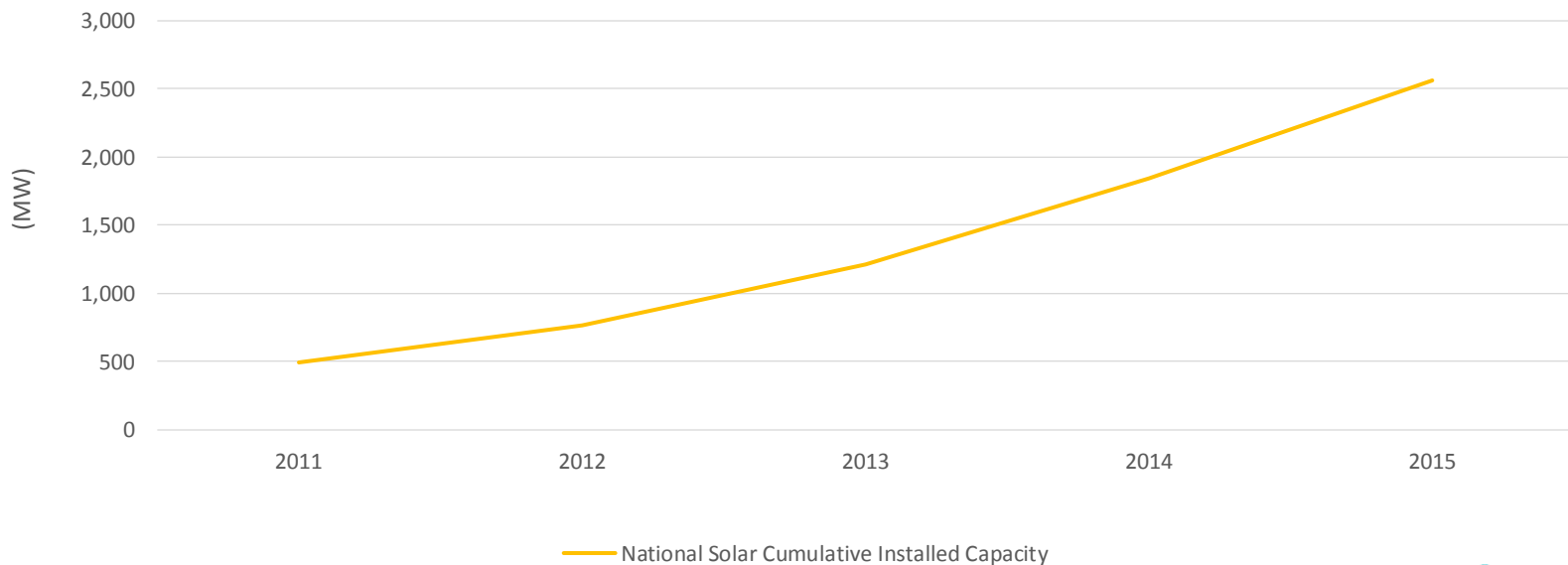
Wind Installed Capacity in Alberta

- Alberta currently has ~1,500 MW of wind installed capacity in operation today.

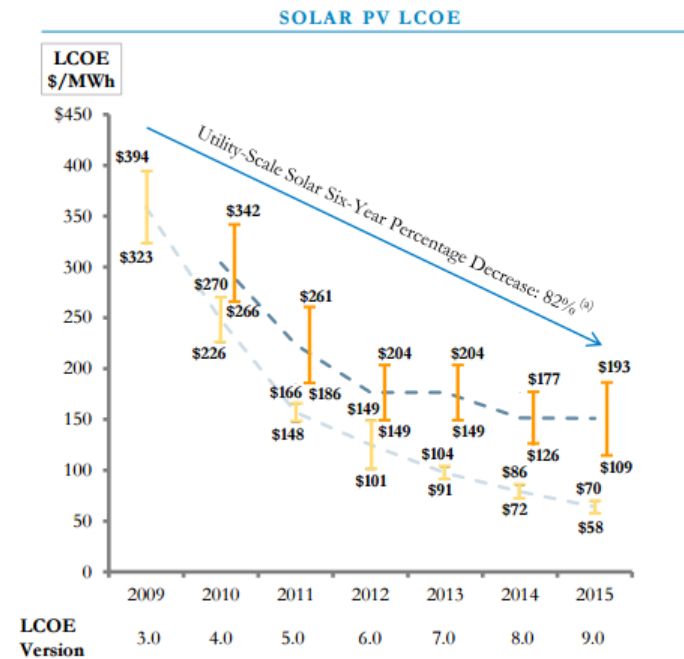
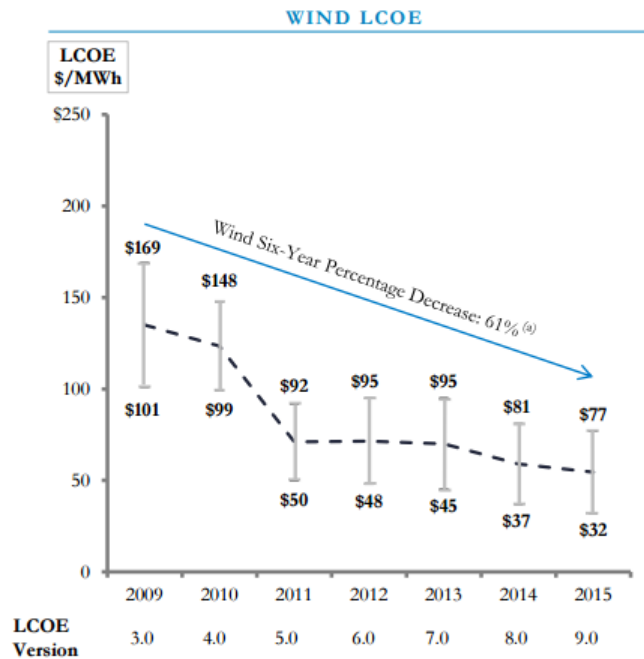


Solar Installed Capacity in Canada

- Alberta represents a fraction of Canada's solar (>2,500 MW):
 - However, 600 MW in AESO Connection Queue (projects >5 MW) and significant potential for projects < 5 MW.



LCOE Trends for Wind and Solar



Source: Lazard Levelized Cost of Electricity Analysis 9.0, 2015

Pricing Trends for Wind and Solar

- Since 2015 competitive procurements have contracted utility-scale wind and solar without subsidy at low levels.

Solar		Wind	
Jurisdiction	Cost (US\$/MWh)	Jurisdiction	Cost (US\$/MWh)
Dubai	30	Morocco	30
Mexico	39	Mexico	43
California	41	Quebec	63
Peru	48	US (2015 avg)	61

Sources: Bloomberg New Energy Finance; Berkeley Lab; Canadian Wind Energy Association

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Ensuring Reliability

30% renewables by 2030
is achievable in Alberta
without compromising
reliability of supply.

Reliability Section Overview

- How does 30% by 2030 compare with other jurisdictions?
- What changes will this bring for our electricity system?
- What are the myths about variable generation?
- How can variable generation be reliably integrated?

Comparison to other jurisdictions

- Canada leads in renewable electricity globally (>65% in 2016).
 - Wind meets ~5% of annual demand.
 - Solar ~0.3% but growing rapidly.
 - AB, ON and SK expected to contract >2 GW in 2016/17.
- It will not be uncommon for global jurisdictions to be meeting annual electricity needs with >20% wind or with >2% solar by 2020.

Comparison to other jurisdictions

- Global leaders already passing these milestones in 2015:
 - Denmark: 42% wind (target of 50% by 2020, 84% by 2035).
 - United States: 8 states met >15% from wind (Iowa #1 at 31%).
 - Germany: 33% renewable (wind ~12%, solar ~6%, 35% by 2030).
 - 20 – 30 countries meet >1% with solar energy (Italy #1, 8.5%).
- Every jurisdiction has different resource availability, supply and demand outlook, need for infrastructure investment etc.

Comparison to other jurisdictions

- Alberta's 30% by 2030 target is being demonstrated as possible by global leaders today.
- Alberta has the benefit of learning from these experiences and lessons learned (and from the cost declines).
- The degree of the success in meeting the 30% by 2030 target will be driven by approaches to system integration.

Changes for the electricity system

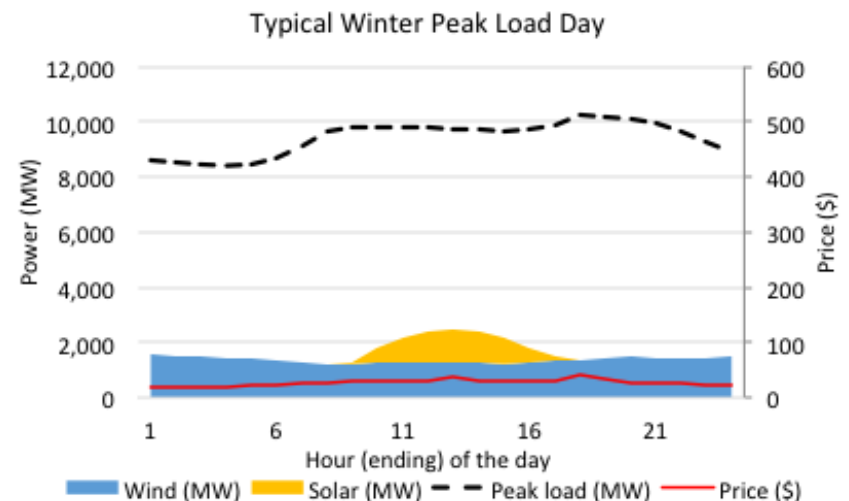
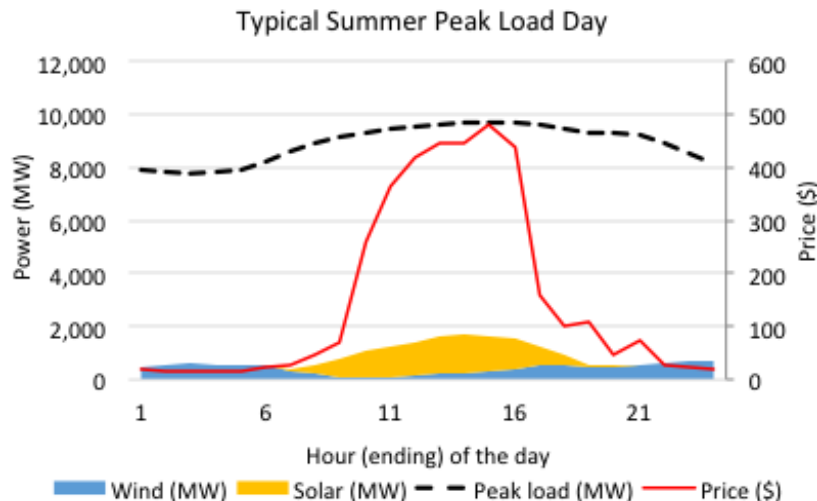
- As the penetrations of variable generation on a system increase:
 - Demand: Load patterns shift (i.e. net load decreases).
 - Distribution: Grid stability and interface flows.
 - Balancing: Increased generator cycling.
- The most common misconception related to reliability concerns is that variable generation is “intermittent.”

Myths About Variable Generation

- Solar and wind electricity are variable not intermittent:
 - Variable: Adj. “apt or liable to vary or change”.
 - Intermittent: Adj. “alternately ceasing and beginning again”.
- The key difference between centralized generation and solar and wind is that instead of one power plant you have many:
- Variability is smoothed by:
 - Geographic dispersion of resources (in same way as for load).
 - Diversity of variable and non-variable renewables.

Solar and Wind are Complimentary

- Generation profiles of solar and wind in Alberta are very complimentary, combination smoothes variability.



Pan-Canadian Wind Integration Study

- The Pan-Canadian Wind Integration Study involved CanWEA, NRCan and TFO's from across Canada and the United States:
 - Developed wind data database for potential sites across Canada.
 - Explored operational challenges and opportunities.
 - Defined operational and production costs and benefits.
- A key finding of the study was that for scenarios with 1,500 to 18,000 MW of installed capacity in Alberta:
 - Only 1.5 to 2.4% of installed wind capacity would be needed as additional regulating reserve to “firm-up” wind.

The Solar Eclipse in Germany

- On March 20th 2015, Germany experienced the extreme “stress-test” for solar electricity generation with a solar eclipse.
- Blue skies were forecast thus the maximum loss of solar generation was possible (i.e. 18 of a total load of 72 GW).
- Accurate forecasting and planning ensured no critical events:
 - Imbalances were no greater than during normal operation.
 - Deviation from nominal frequency remained within range.
 - Primary reserves barely used.

Solutions for reliable integration

- Balancing Supply and Demand:
 - Increase reserves and margins.
 - Improve inter-jurisdictional interties.
 - Accurate forecasting.
 - Storage and load flexibility.
- Grid Stability:
 - Smart Inverters and Smart Grid.
 - Accurate forecasting.
 - Storage and flexible loads.
- Other Considerations:
 - Market design.

Conclusion

“30% renewables by 2030 is achievable in Alberta both cost-effectively and without compromising reliability of supply”.

Upcoming Wind & Solar Events

- CanSIA:
 - Solar West 2016, Edmonton, Oct. 5 – 7
 - Solar Canada 2016, Toronto, Dec. 5 - 6
- CanWEA:
 - Annual Conference & Exhibition, Calgary, Nov. 1 – 3

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