Cogeneration & Carbon Management

Key Issues in the Design of Carbon Management Policies and Regulations in Alberta

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Paula McGarrigle
Managing Director
Solas Energy Consulting Inc.
Suite 119, 2137 33 Avenue S.W.
Calgary Alberta T2T 1Z7
T: (403) 542-9463
E: pmcgarrigle@solasenergyconsulting.com
Overview

- History of Cogeneration in Alberta
- Drivers behind Cogeneration development in Alberta
- Economics of Cogeneration
- The future of Cogeneration in Alberta
Defining Cogeneration

Cogeneration produce electricity and steam. Facilities often integrate waste energy into the production of power or steam. Facilities are built to either match steam or match power requirements.
Alberta has experienced significant growth in Cogeneration
4,588 MW of installed capacity ~ 30% of total generation capacity

Oil Sands development & Cogen
Represents 67% of total installed Cogen capacity

Other applications for Cogen in AB
Chemical industry, conventional oil and gas, pulp and paper as well as hospitals, educational institutions
Alberta’s Cogen focused on Oil Sands in the North East

Ownership & Location of Cogen

Geographic Area

NE 78%
Central 12%
South 7%
Edmonton 1%
NW 2%

Cogeneration Capacity (MW) by Owner

21 owners

REF: AESO

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Cogen driven by 3 main factors

1. Regulatory changes,
2. Improved economics, and
3. Demand growth requiring reliable power sources
Changing Regulatory Landscape

Alberta Upgrading Capacity (MBPD)

Alberta SAGD Production (MBPD)

Electricity market deregulation, and “industrial site designation” were major drivers

Alberta Cogeneration (MW)

Additions (MW)

Deregulation

Class 43.2

SGER

#1

Additions (MW)
Improved Economics

**Federal Tax Changes**
Accelerated capital cost depreciation;
Class 43.2 - depreciation rate increased to 50% until 2020.

**High Heat Rates**
Alberta’s market heat rates have been above cogeneration physical heat rate and therefore cogeneration facilities have generated positive cash flow.

**Industrial Site Designation**
Reduction in the ancillary service costs associated with power generation or load

Alberta Specified Gas Emitters Regulation (SGER) – Emissions Performance Credits
- SGER compares stand alone cogeneration to a reference technology. The use of the reference technology method has resulted in EPCs for cogeneration facilities.
- Combined Cycle electricity plant is compared to a target of 0.418 tonnes CO$_2$e/MWh.
- No reduction target is placed on the emissions associated with the electricity generated.
- The baseline for heat calculation assumes an 80% efficient boiler.
Cogen concentrated in industries with high power demand

Oil Sands upgrading, Steam Assisted Gravity Drainage (SAGD) and the chemical industry in Alberta have significant requirements for steam and power.

SAGD has experienced exponential growth CAGR of 34.2%

Oil Sands upgrading has more than doubled since 2001
Cogeneration has the lowest levelized costs compared to alternatives in Alberta. (2016)
Levelized cost of energy from a new cogeneration facility is higher than the Alberta forward power pool price.
• Carbon revenue is positive (reducing levelized costs) however is not a significant factor.
• ISD’s calculate their tariff using “net generation” and this creates savings compared to a standalone generation facility.
**Oil Sands Growth** Alberta’s cogeneration development is indirectly dependent on Canada’s climate change regulatory regime, because Oil sands growth is dependent on market access that is linked to climate policy.

**Transmission Availability/Reliability/Cost**
Northern AB could be susceptible to transmission contingencies. Delay in the Fort McMurray to Edmonton 500 kV Transmission line may increase the interest in self-generation, with cogen preferred.

Transmission costs and therefore DTS charges are on the rise. This may stimulate additional cogeneration ISDs to reduce the cost of delivered power.

**Regulatory Treatment**
Potential changes in the treatment of cogeneration at the Provincial or Federal level may have profound impacts on size and continued investment in cogeneration.

**Air Quality**
Regional air shed limitations (Lower Athabasca) may impede extensive cogeneration development. Additional cogeneration in the region may tax the currently strained air shed.
Cogen Long Term Outlook (2012)

Cogeneration capacity additions by 2022 are expected to total 6,200 MW or 29 percent of supply mix. – Same as current mix.
Cogeneration treatment under SGER is critical for Alberta compliance.

Cogeneration represents approximately 40 per cent (14,850 kT/39,930 kT) of the total avoided emissions since the SGER program was created.
Future AB SGER Treatment

• Current treatment uses the following as baseline.
  – 0.418 tonnes CO2e/MWh (Assumption for Electricity)
  – 80% boiler efficiency

• Discussion on changing the assumptions
  – 0.375 tonnes CO2e/MWh
  – 85% boiler efficiency

• Impact
  – Reduced compliance or “avoided emissions”
  – Reduction in economics of cogeneration.
Federal Greenhouse Gas Emissions Regulations

- Cogeneration is considered a cross cutting issue since the technology is applied in multiple sectors.
- Treatment, or reduction required may vary by the type of industry that cogeneration is a part of.
- May result in cogeneration facilities also having an obligation to reduce emissions.
Key Questions to Consider

- Are EPC’s critical for incenting cogeneration in the Oil Sands industry?

- Is cogeneration business as usual?

- If cogeneration is considered business as usual what are the implications for SGER and cascading ramifications such as oil sands economics and Alberta’s greenhouse gas emission reduction plan?

- Does the new Lower Athabasca Regional Plan (“LARP”) and pending federal air quality regulations restrict CCGT facilities as viable alternatives for oil sands upgrading and SAGD?

- Should Alberta policy makers consider emphasizing higher efficiency heat and power generation technology? - Fuel cells?

- Should renewable energy integration in oil sands be incented through policies directed at further reducing air quality and GHG emissions?
Recommendations

• Integrity of the system is paramount.
  – Evaluate if cogeneration meets business as usual.
  – If so, look to include cogeneration into the baseline.
  – If not, ensure baseline used for cogen is representative.