Energy Supply Management
&
Impact of Alberta Climate Leadership Plan

March 17, 2016

Michelle McCarry
<table>
<thead>
<tr>
<th>Company</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government of Alberta</td>
<td>Marmot / Sunshine / Lake Louise Ski Resorts</td>
</tr>
<tr>
<td>City of Lethbridge</td>
<td>Calgary Board of Education</td>
</tr>
<tr>
<td>West Edmonton Mall</td>
<td>Northlands</td>
</tr>
<tr>
<td>Loblaws</td>
<td>WinSport Canada</td>
</tr>
<tr>
<td>Calgary Stampede</td>
<td>Mullen Group</td>
</tr>
<tr>
<td>Suez North America</td>
<td>Hines Canada</td>
</tr>
<tr>
<td>Pure Canadian Gaming</td>
<td>YMCA</td>
</tr>
</tbody>
</table>
Alberta’s Energy Market Situation – Uncertainty!

- Creating Wholesale & Retail Electricity Competition (1996) changed nothing *physically*

- 2016 *Climate Change Leadership Plan* changes *everything*
Alberta’s Climate Leadership Plan – 4 Core Aspects

1. **Ending Coal Pollution** - *Accelerate* the phase-out of coal-fired electricity
   - Transition to generation mix where $1/3$ of coal-fired generation is replaced by **natural gas generators** and $2/3$ by **renewable energy (@ 4,200 MW)**
   - No pollution from coal-fired plants by 2030
   - **30% by 2030**: By 2030, renewable sources will account for up to **30% of electricity generation**
   - How? Incentives for renewable generation driven by policy! E.g. Ontario & Germany

2. **Economy-Wide Carbon Pricing** – @ $20-$30/tonne starting in 2017
   - Carbon revenue fully invested in clean technology, renewables and energy efficiency
   - Subsidies to families, small businesses, indigenous communities
   - Intended to reduce emissions at the lowest total cost to the economy & drive markets for new products
Alberta’s Climate Leadership Plan

3. **Capping Oil Sands Emissions**
   - Current SGER levy based on individual facility historical emissions irrespective of efficiency (GHG per barrel produced)
   - Legislated emissions limit of a maximum of 100 Mt of CO$_2$ with provisions for cogeneration and facility upgrades
   - Intended to remove more carbon emissions from every oil barrel produced

4. **Reducing Methane Emissions**
   - The most serious greenhouse gas pollution - methane is 20 times more powerful than CO$_2$ as heat-trapping agent
   - Reduce methane emissions to 45% below 2014 levels by 2025
   - Canada is 4$^{th}$ largest oil and gas methane emitter in the world
Commodity Price = 100%

Shaping/Credit Risks (7%) & Margin (1%) = 8%

UFG/E Losses & Trading Margin = 2%

Wholesale OTC & Forward Trading Market = 90%

Retailer X

Wholesaler X (OTC Marketer)

Spot Market(s)

Ask & Bid

OTC Marketer 1

OTC Marketer 2

OTC Marketer 3

OTC Marketer 4

Flow-Thru

Consumer

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Wholesale OTC Natural Gas Market @ March 17/2016

<table>
<thead>
<tr>
<th>Term</th>
<th>Flat Mid-Market Price ($/GJ)</th>
<th>12-Month High</th>
<th>12-Month Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL17</td>
<td>$2.49</td>
<td>$3.41</td>
<td>$2.38</td>
</tr>
<tr>
<td>CAL18</td>
<td>$2.65</td>
<td>$3.63</td>
<td>$2.51</td>
</tr>
<tr>
<td>CAL19</td>
<td>$2.78</td>
<td>$3.81</td>
<td>$2.58</td>
</tr>
<tr>
<td>CAL20</td>
<td>$2.92</td>
<td>$3.96</td>
<td>$2.74</td>
</tr>
<tr>
<td>CAL21</td>
<td>$3.13</td>
<td>$3.56</td>
<td>$2.92</td>
</tr>
</tbody>
</table>

- Average bid/ask spread @ $0.20/GJ
- 2014 AECO Average @ $4.25/GJ; 2015 AECO Average @ $2.59/GJ; 2016 YTD Average @ $1.87/GJ
- NDP Climate Change Leadership Plan’s Carbon Tax Equivalent @ $1.12/GJ in 2017 & $1.68/GJ in 2018; which traces to the point where carbon is burnt!
Wholesale OTC Electricity Market @ March 17/2016

<table>
<thead>
<tr>
<th>Term</th>
<th>Mid-Market Price ($/MWh)</th>
<th>12-month High</th>
<th>12-month Low</th>
<th>Price Adjusted for Carbon Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL17</td>
<td>$31.50</td>
<td>$51.00</td>
<td>$29.00</td>
<td>$46.62</td>
</tr>
<tr>
<td>CAL18</td>
<td>$41.50</td>
<td>$58.00</td>
<td>$38.75</td>
<td>$68.04</td>
</tr>
<tr>
<td>CAL19</td>
<td>$48.50</td>
<td>$61.00</td>
<td>$47.50</td>
<td>$78.24</td>
</tr>
<tr>
<td>CAL20</td>
<td>$50.50</td>
<td>$62.00</td>
<td>$49.50</td>
<td>$80.24</td>
</tr>
<tr>
<td>CAL21</td>
<td>$56.50</td>
<td>$59.50</td>
<td>$56.25</td>
<td>$87.08</td>
</tr>
</tbody>
</table>

- Average bid/ask spread @ $3.00/MWh
- Wholesale production cost for electricity @ $63/MWh from a coal-plant (w/o CCS)
- Carbon tax impact based on equivalent increase of $1.12/GJ in 2017 & $1.68/GJ in 2018; economic heat rates traded in the wholesale OTC markets
Facts @ 2017:

- Alberta will more coal-fired generation @ $63/MWh w/o CCS/GHG Offsets
- Replaced by combined cycle gas-fired generation @>$80/MWh
- Wind @ $90/MWh – current capacity 1,500 MW; capacity factor @ 30%
Considerations for Replacing 2/3 of Coal-Fired Supply with Renewables

Reliability:

- Coal @ 90% capacity factor (of maximum energy output)
- Wind @ 30% capacity factor (generally not available during the hottest & coldest days)
- Solar @ 15-17% capacity factor (seasonal)
- The 4,200 MW question: are we replacing coal-fired **capacity** or energy **output**?

Economics:

- Average wind energy production cost @ $90/MWh
- Capital Investment of $25 billion @ $2.5 million/MW to replace coal output
- Carbon Tax revenues estimated @ $3 billion/year (fund renewables and subsidies)
- Can Alberta afford it? E.g. Ontario – renewables long-term PPAs
Alberta Climate Leadership Plan
Considerations for Replacing 2/3 of Coal-Fired Supply with Renewables

Transmission:

- In 2014, 2/3 of wind output (@ 1,000 MW) was produced at 10% of time; extra 500 MW of transmission was 90% unused
- Building transmission lines to carry maximum renewables will result in significant increase in Delivery costs
- More natural gas fired generation required to fill in the “gaps” when renewables not available; more transmission assets required which was built traditionally closer to coal-sources
- Current bulk transmission cost @ $2B/year with stranded DC assets from Brooks-Edmonton
Wholesale electricity prices driven by volatility in trading – impacted by financial/equity/currency/other energy markets (oil/gas). Timing is key!

Volume is irrelevant!
Town of Stettler

**Electricity Product Quote Summary**

Lowest priced quotes are bolded and highlighted in green. Pricing is firm, based on electricity supplier offers as of April 14, 2015 @ 10:30 am MST.

**Load Following Quotes**

Start Date: January 1, 2019

<table>
<thead>
<tr>
<th>Quote</th>
<th>Enmax</th>
<th>Direct Energy</th>
<th>AMSC</th>
<th>Capital Power</th>
<th>Atco Power</th>
<th>TransCanada</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Year Quote</td>
<td>$50.86</td>
<td>$53.98</td>
<td>$50.71</td>
<td>$52.99</td>
<td>$51.24</td>
<td>$49.98</td>
</tr>
<tr>
<td>2 Year Quote</td>
<td>$53.10</td>
<td>$57.55</td>
<td>$53.33</td>
<td>$55.19</td>
<td>$53.17</td>
<td>$52.79</td>
</tr>
<tr>
<td>Administration Fee:</td>
<td>$1.00/ MWh</td>
<td>$3.00</td>
<td>$2.95/ MWh</td>
<td>$0.25/ MWh</td>
<td>None</td>
<td>$1.00/ MWh</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Applies to:</th>
<th>Excess Volumes</th>
<th>Per Site Per Month</th>
<th>All Volumes</th>
<th>Greater of contract or actual volumes</th>
<th>N/A</th>
<th>All Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Cost: 1 Year</td>
<td>$399,616</td>
<td>$320,696</td>
<td>$316,111</td>
<td>$313,637</td>
<td>$301,855</td>
<td>$300,323</td>
</tr>
<tr>
<td>Annual Cost: 2 Year</td>
<td>$312,812</td>
<td>$341,727</td>
<td>$331,545</td>
<td>$326,597</td>
<td>$313,224</td>
<td>$316,877</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threshold Variance</th>
<th>Plus/ Minus 20%</th>
<th>Plus/ Minus 25%</th>
<th>Plus/ Minus 10%</th>
<th>Plus/ Minus 30%</th>
<th>Plus/ Minus 20%</th>
<th>Plus/ Minus 20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applies to:</td>
<td>Monthly Volumes</td>
<td>Annual Volumes</td>
<td>Weekly Hourly Profile</td>
<td>Annual Volumes</td>
<td>Monthly Volumes</td>
<td>Monthly Volumes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Notes:</th>
<th>Imbalance volumes settled at load-weighted ASEO price for that month</th>
<th>Imbalance volumes settled at load-weighted ASEO price for the contract year</th>
<th>Product is similar to Shaped Block, but with additional Threshold Variance protection.</th>
<th>Imbalance volumes settled at load-weighted ASEO price for the contract year</th>
<th>Imbalance volumes settled at load-weighted ASEO price for that month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Rank: 1 Year</td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Cost Rank: 2 Year</td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>
Phase 1

STEP 1 - PORTFOLIO REVIEW & STRATEGY
- energy data compilation (commodity + delivery)
- existing supply contracts risk evaluation
- unit supply cost & consumption benchmarking (site and portfolio)
- identify irregularities in product delivery with suppliers
- identify existing & future supply requirements
- identify near & long-term supply cost management opportunities (based on wholesale forward market conditions)
- identify general needs related to energy data reporting for billing, administration & energy management

STEP 2 - PRODUCT DESIGN & RETAIL SERVICES REQUIREMENTS
- design energy products to meet operational and portfolio requirements (site addition/deletion/expansion)
- design retail services – billing, accounts payables, data reporting & customer care

STEP 3 - SUPPLY PROCUREMENT
- design RFP / tender
- design retail services – billing, accounts payables, data reporting & customer care
- RFP release/process management – suppliers/products/contracts evaluation
- firm pricing bid rounds based on wholesale markets

Phase 2

STEP 4 - PORTFOLIO MANAGEMENT
- supply contract management & performance reporting
- energy reporting & benchmarking
- critical wholesale market (opportunity) & regulatory updates
- update portfolio strategy based on wholesale market conditions
- forward market supply transactions (step 2-3)
- energy budget design & forecasting
- utility advocacy – tariff & metering related issues

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Active Portfolio Management = Budget Management Strategy

blend prices = lower budgets
Critical Success Factors – Energy Supply Management & Carbon Risk Mitigation

• Active insights into the wholesale forward & OTC energy markets – monitor & understand trends and fundamentals!

• Know what, when & how to buy energy as a wholesale commodity – opportunity driven vs. contract cycles!

• Take advantage of real-time bid-ask spread in competitive wholesale-market transactions ~ incremental cost savings!

• Robust energy product design – cost vs. price!

• Mitigate contractual risk – counter-party, portfolio changes, unit contingent & carbon tax etc.

• Active engagement in policy input and regulatory events