Renewable Energy in Rural Alberta

Opportunities & Obstacles
About Pembina

2010 marked the 25th anniversary of the Pembina Institute – born in the wake of the Lodgepole Sour Gas blowout.
The Current Reality

Sundance Generating Station
Alberta relies more on coal for electricity than any other province in Canada.
Pollution

Data source: Environment Canada, 2010

60% of Alberta’s mercury releases are from coal power
Pollution

Proportion of Emissions from Electric Power Generation (2010)

Data source: Environment Canada
Pollution

- Prior slide shows that provinces, like Alberta, that rely on coal have the dirtiest power in the country.
- Pollution, like NOx and SO2 can lead to respiratory illnesses, asthma attack, cardiovascular illness and smog.
- Mercury is linked to neurological development problems, lower IQ in children, and heart disease.
- The four biggest mercury emitters in Alberta are coal plants.
Greenhouse Gases: Top 15 Emitters

- 10 of Canada’s top 15 greenhouse gas emitters are coal plants.
- 5 of the top 10 are in Alberta

<table>
<thead>
<tr>
<th>Facility</th>
<th>Prov</th>
<th>tCO₂e</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sundance Thermal Electric Power Generating Plant</td>
<td>AB</td>
<td>15,791,372</td>
</tr>
<tr>
<td>Mildred Lake and Aurora North Plant Sites</td>
<td>AB</td>
<td>12,707,889</td>
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<tr>
<td>Genesee Thermal Generating Station</td>
<td>AB</td>
<td>9,123,656</td>
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<td>Nanticoke Generating Station</td>
<td>ON</td>
<td>8,601,215</td>
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<tr>
<td>Suncor Energy Inc. Oil Sands</td>
<td>AB</td>
<td>8,554,881</td>
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<tr>
<td>Keephills Thermal Electric Power Generating Plant</td>
<td>AB</td>
<td>6,827,028</td>
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<tr>
<td>Boundary Dam Power Station</td>
<td>SK</td>
<td>6,748,986</td>
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<tr>
<td>Battle River Generating Station</td>
<td>AB</td>
<td>4,979,983</td>
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<td>Dofasco Hamilton</td>
<td>ON</td>
<td>4,973,457</td>
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<td>Sheerness Generating Station</td>
<td>AB</td>
<td>4,911,007</td>
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<td>Cold Lake</td>
<td>AB</td>
<td>4,500,607</td>
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<td>Poplar River Power Station</td>
<td>SK</td>
<td>4,334,066</td>
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<td>Lingan Generating Station</td>
<td>NS</td>
<td>3,690,562</td>
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<td>Lambton Generating Station</td>
<td>ON</td>
<td>3,330,461</td>
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<tr>
<td>Long Lake Project</td>
<td>AB</td>
<td>3,266,914</td>
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</table>

Source: Environment Canada, 2010 data
Canada’s Greenhouse Gas Emissions
The province’s that rely most on coal have the most polluting electricity

Data source: Environment Canada, 2010
Renewable Opportunity

Photo: Ben Thibault, Pembina Institute
Renewable energy has come of age

Wind Power, Existing World Capacity, 1996–2008

Photo: David Dodge, Pembina Institute
The pace of green growth

"between 2004 and 2007, global investments in renewable energy more than doubled... If large hydropower is included, 2008 was the first year in which renewable power generation attracted more investment than traditional fossil fuel generation."

— Pew Center on Global Climate Change, *Clean Energy Markets: Jobs and Opportunities*
Alberta enjoys some of the best solar and best on-shore wind resources in Canada.
High levels of wind are possible

- Supply from wind
  - Saskatchewan 5%
  - Iowa – 8%
  - Germany – 9%
  - Spain – 15%
  - Denmark – 22%
“[W]e said that the electricity system could not function if wind power increased above 500 MW. Now we are handling almost five times as much. And I would like to tell the Government that we are ready to handle even more, but it requires that we are allowed to use the right [policy] tools to manage the system.”

-Chairman, ELTRA (system operator)
Wind Energy Intro & How to Get Involved

http://www.pembina.org/re/wind-guide-alberta
Wind Energy Technology

• Commercial Scale
  • Tower height: 80 – 100 m
  • Rotor diameter: 80 – >125 m
  • Capacity: 1 – 2.5 MW
  • Free-standing
  • Tubular tower

Photo: David Dodge, The Pembina Institute
Alberta’s Electricity Market

• “Deregulated” – decreased role of government, firms exposed to competition
• Electricity prices set by real-time demand
• Wind developers can enter the market at any time (no need to wait for an RFP)
• Electricity is dispatched by the Alberta Electric System Operator (AESO)
Wildlife Concerns

Causes of Human Related Bird Fatalities
Number per 10,000 Fatalities

- Buildings/Windows: 5820
- High Tension Lines: 1370
- Cats: 1060
- Vehicles: 850
- Pesticides: 710
- Communication Towers: 50
- Wind Turbines: <1
### Wildlife Concerns

#### Relative Risk Level for Potential Harm to Wildlife

<table>
<thead>
<tr>
<th>Electricity Fuel Source</th>
<th>Resource Extraction</th>
<th>Fuel Transportation</th>
<th>Construction of Facility</th>
<th>Electricity Generation</th>
<th>Transmission and Delivery</th>
<th>Decommissioning of Facility</th>
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</thead>
<tbody>
<tr>
<td>Coal</td>
<td>Highest Potential</td>
<td>Lower Potential</td>
<td>Lower Potential</td>
<td>Highest Potential</td>
<td>Moderate Potential</td>
<td>Lower Potential</td>
</tr>
<tr>
<td>Oil</td>
<td>Higher Potential</td>
<td>Highest Potential</td>
<td>Lower Potential</td>
<td>Higher Potential</td>
<td>Moderate Potential</td>
<td>Lower Potential</td>
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<tr>
<td>Natural Gas</td>
<td>Higher Potential</td>
<td>Moderate Potential</td>
<td>Lowest Potential</td>
<td>Moderate Potential</td>
<td>Moderate Potential</td>
<td>Lowest Potential</td>
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<tr>
<td>Nuclear</td>
<td>Highest Potential</td>
<td>Lowest Potential</td>
<td>Lowest Potential</td>
<td>Moderate Potential</td>
<td>Moderate Potential</td>
<td>Lowest Potential</td>
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<tr>
<td>Large Scale Hydro</td>
<td>None</td>
<td>None</td>
<td>Highest Potential</td>
<td>Moderate Potential</td>
<td>Moderate Potential</td>
<td>Higher Potential</td>
</tr>
<tr>
<td>Wind</td>
<td>None</td>
<td>None</td>
<td>Lowest Potential</td>
<td>Moderate Potential</td>
<td>Moderate Potential</td>
<td>Lowest Potential</td>
</tr>
<tr>
<td>Building Mounted Solar PV</td>
<td>None</td>
<td>None</td>
<td>Lowest Potential</td>
<td>Lowest Potential</td>
<td>Moderate Potential</td>
<td>Lowest Potential</td>
</tr>
</tbody>
</table>

Source: New York State Energy Research and Development Authority and Gordon Howell
Health Considerations

“The scientific evidence does not demonstrate any direct causal link between wind turbine noise and adverse health effects”, Dr. Arlene King, Chief Medical Officer of Ontario, May 2010.

[Diagram showing decibels for various noises including wind turbines, falling leaves, bedroom, home, inside car, industrial noise, office, stereo music, pneumatic drill, and jet airplane.]
1650 MW Wind in S.E. AB

• Construction phase:
  • Direct: 1,757 job-years
  • Indirect: 4,950 job-years
  • Municipal: $16.5 million

• Operations phase
  • Direct: 132 job-years
  • 518 job-years
  • Municipal: taxes: $10.8 million
  • Lease payments to landowners: $7.9 million

Source: Canadian Tourism Research Institute, 2006
Employment

• **Wind Energy Jobs**
  • United States – 90,000
  • Germany – 80,000
  • Spain – 60,000
  • Canada – 4,500
• **Direct Renewable Energy Jobs in Germany**
  • 400,000+
Renewable energy jobs require more labor than other industries

Source: Wei, Patadia and Kammen 2010
Renewable energy jobs in Germany

Total jobs growth in Germany (1998-2008)

Source: BMU 2010, FH Wiesbaden 2008
Ontario as a case study

- Phase-out of coal power by end of 2014
- Retirement of Pickering nuclear plant
- Rebuilding/refurbishment of nearly all of Ontario’s remaining nuclear reactors
- Expansion of renewable power
- Significant investment in transmission and distribution systems
- What will it cost???
Change is on the way

Half of Ontario’s generating capacity will need to be replaced by 2022
Comparing Price Impacts

Results show prices will increase in both scenarios, with virtually no price difference between them (prices in 2010 $Cdn).

- Coal is retired and nuclear refurbishments
- Rising rates as transmission investments are made
- New supplies, including renewables come on line
- Price ease if nuclear refurbishments are completed on time/on budget
- Gas prices are forecast to rise, pushing prices higher, especially if less renewables are in system

![Graph showing price trends over years for two scenarios: Current Plans and Reduce Renewables.](chart.png)
Wind Power in Alberta: A Discount

- Merit order: fill demand bottom-up
- Everyone gets top $ 
- Wind bids in at $0/MWh
- 12 representative hours (high, mid, low)
- Determine the “no-wind” price
- Result: $2 - $5 billion price reduction --~30-50% of total generation revenue
Wind Power in Alberta: A Discount

Source: AESO, 2011
Policy: Overcoming Obstacles
Why do we need policies?

- Market costs do not reflect true costs
  - Health Impacts
    - Ontario estimates coal phase-out will reduce $3 billion/yr in health care costs
  - Climate change
    - Costs are long-term - $100/t CO2
- Competition Incentives
  - Direct – CCS, Nuclear
  - Indirect – Liabilities
Barriers to Clean Energy in Alberta

- Unlevel playing field
  - Subsidies to competing technologies (CCS), transmission to existing coal mines, little recognition of environmental damage/benefits
- Lack of readily available long-term power purchase contracts
- Merchant market pricing uncertainty makes financing extremely challenging
- Global competition for capital
- Policy uncertainty
Shell delivers bad news—Wild Steer Butte project put on hold

By Jamie Rieger

The news came as a jolt to landowners when Shell Wind Energy president, Dick Williams visited Bow Island and the County of Forty Mile last week to announce that the company has opted to put the wind project on hold.

“We are going to put the wind farm on hold for now. The down and dirty of it is we have been developing this project for the past nine years now and you get to the point where you have to make a decision about moving forward,” said Williams.

“You can have the transmission interconnection and you can have the turbines, but you still need to sell the power. We need a power purchase agreement in place and it needs to be a long-term agreement. The Alberta market is a merchant market where you don’t have these long-term agreements,” he added.

Williams also added that there would need to be a sufficient carbon offset program in place, either on the federal or provincial level, or both.

“We will continue to monitor the situation over the next year and will continue with our advocacy work on the carbon offsets,” he said.

In addition to meeting with municipal officials and affected landowners, Williams also held discussions with Cypress/Medicine Hat MLA Len Mitzel and Medicine Hat MP LaVar Payne.

“I want to get the message out there that this is not because of local government or because of the stakeholders. This has been a very hard decision to make. But, we need two things in place to go forward. One, we need a carbon offset program and...”

- Dick Williams, President, Shell Wind Energy
What works?

• Barriers to renewable energy
• Examine renewable energy policies in Canada, USA, Northern Europe and Australia
• Assess their effectiveness in delivering renewable energy projects in rural and remote settings
Key elements in effective policies

• Long-term - predictable
• Linked to desired results
• Transparent process
• One-size doesn’t fit all
• Part of an overall framework (target/goal)
Incentivise Solutions

• Jurisdictional quotas
  • Portfolio standards
• Link incentive to energy production
  • Feed-in tariffs, production incentives
• Capital cost reductions
  • Grants, tax credits
Nova Scotia – 25% RE by 2015

- Legal Renewable Requirements (RPS)
  - 25% by 2015
  - 40% by 2020
- Reduce coal from ~75% to 40% by 2020
- Community-only Feed-in Tariff for wind/biomass/tidal/hydro
- Implemented by amending Electricity Act
Made-in-Alberta: Clean Electricity Standard

- Market-based
- Technology-neutral
Summary:
What Renewable Energy Offers

- Diversifies and grows economy
- Expands options for farm income
- Reduces pollution
- Distributes generation
- Enables local ownership
Summary:
What Renewable Energy Offers

• Improves community resiliency
• Clean solutions are possible - but don’t happen without government leadership
• Renewables are not free – but need to know what you are comparing against
Renewable Energy in Rural Alberta

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