

# Renewable Energy in Rural Alberta

## Opportunities & Obstacles





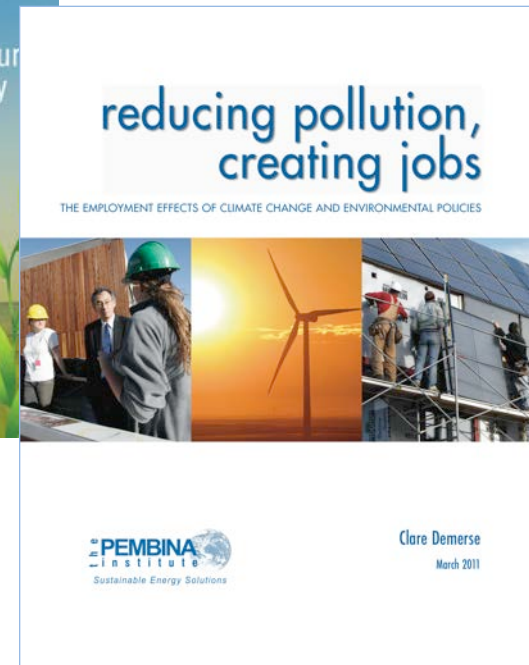
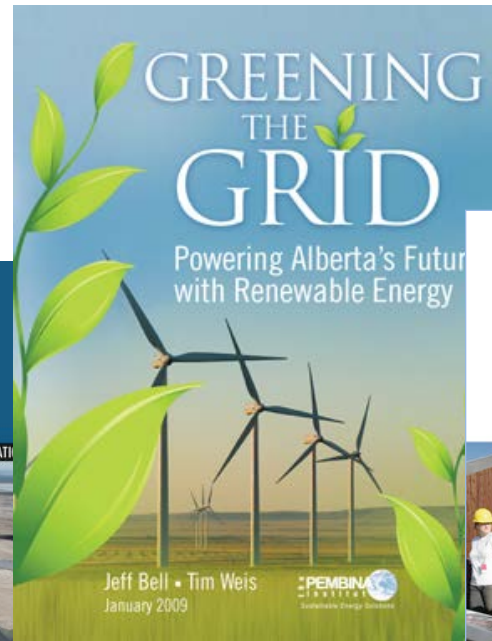
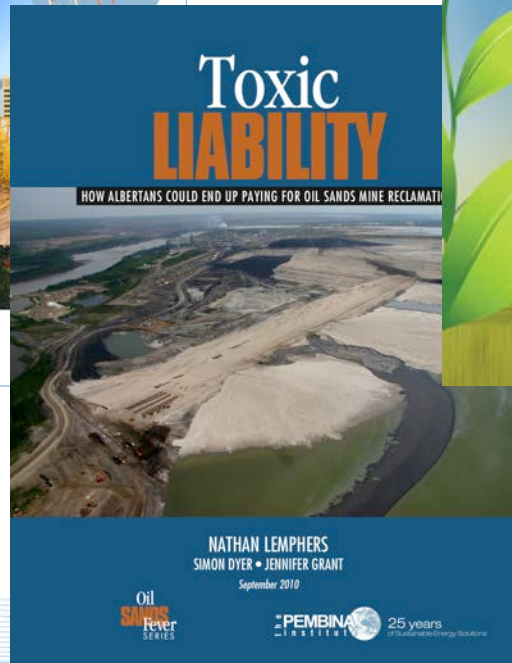
# About Pembina



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



# Publications

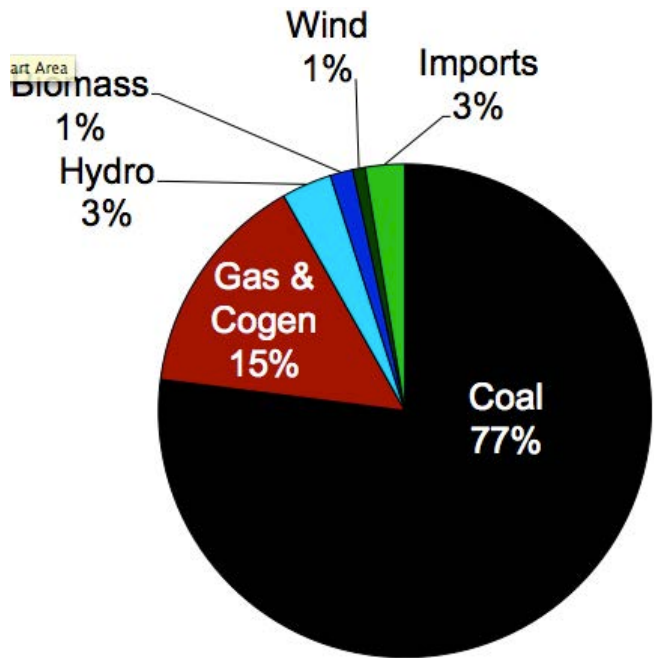




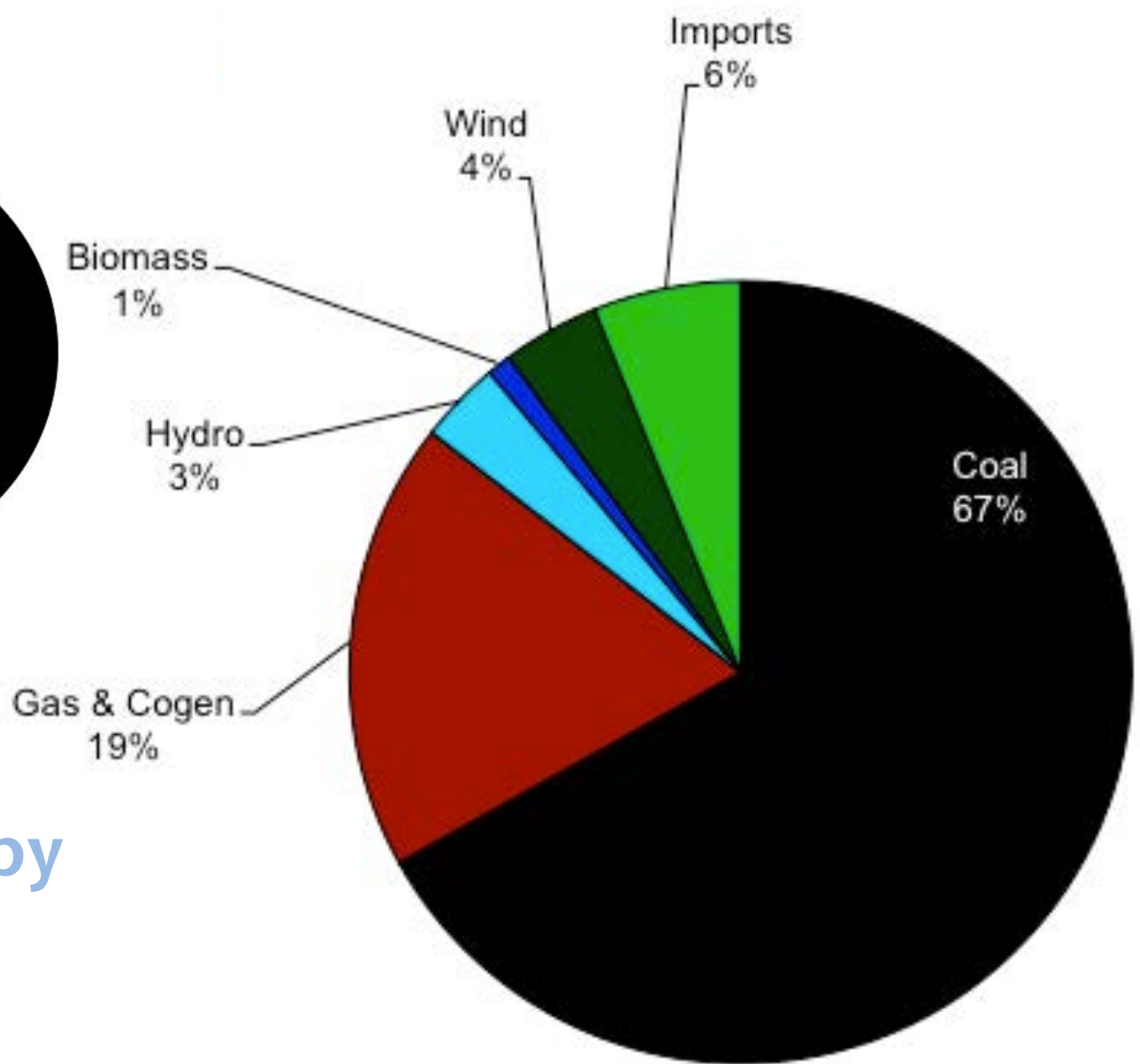
# The Current Reality



Sundance Generating Station



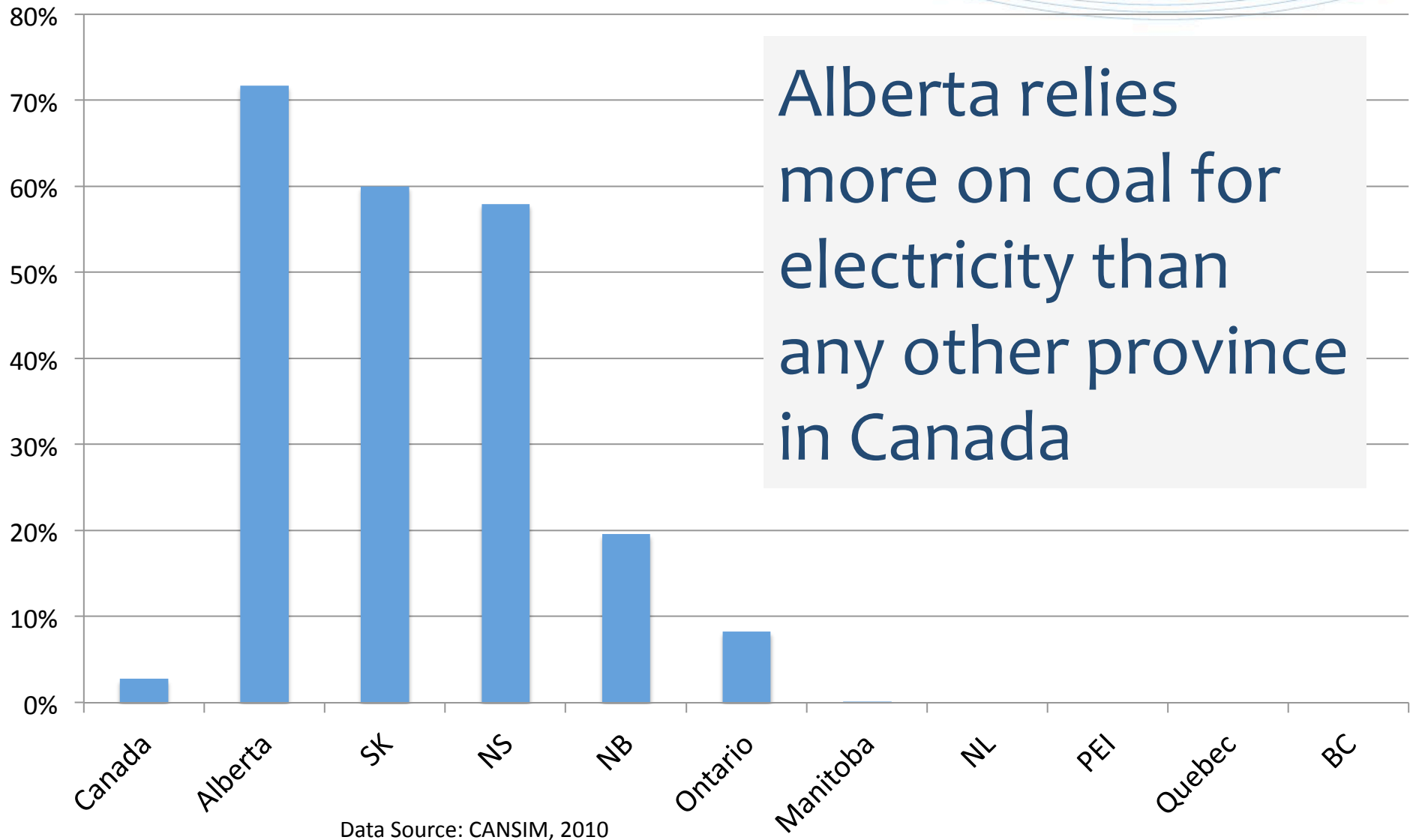
2006



2011

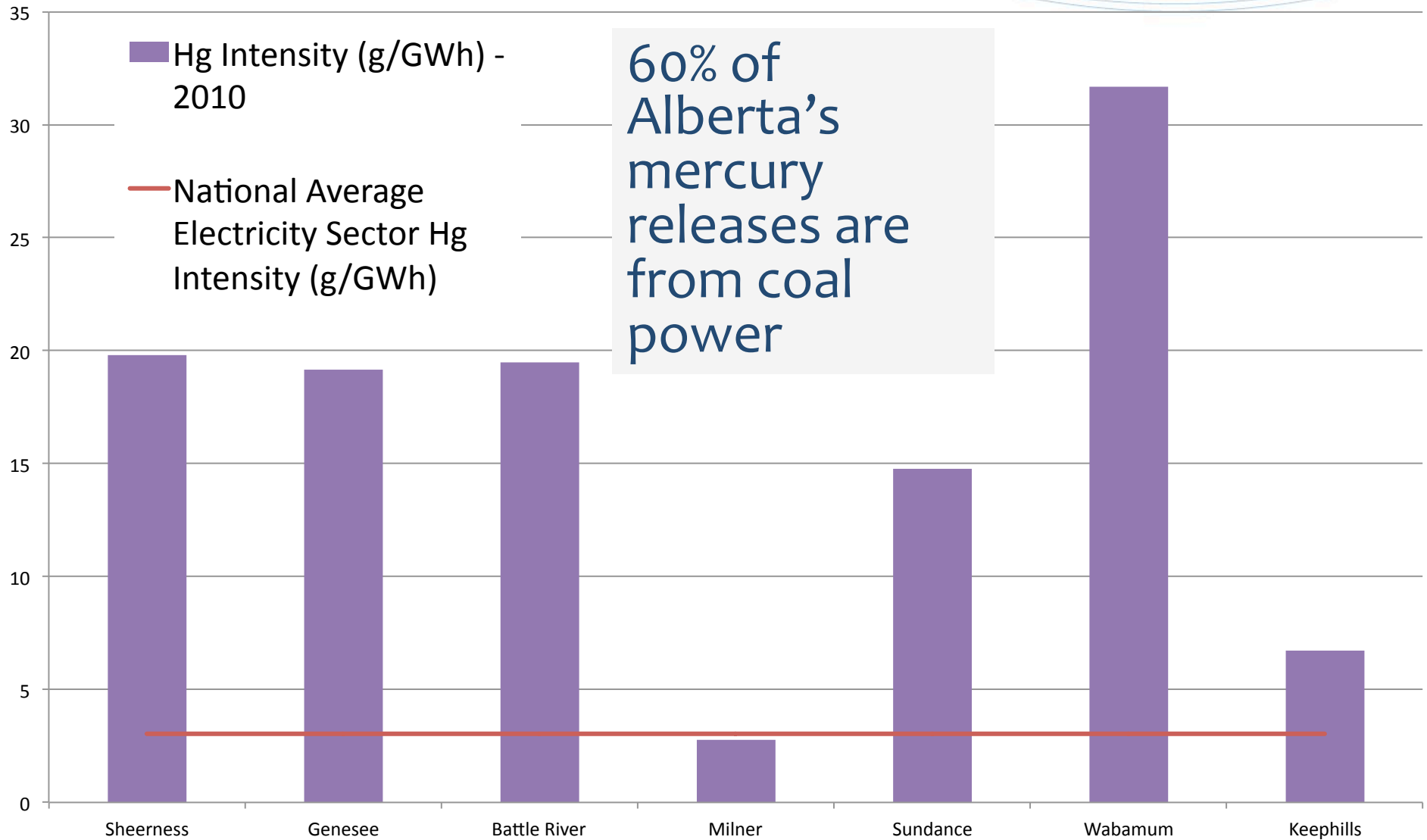
## Generation by Fuel Type

# Dependence on Coal



# Pollution

Data source: Environment Canada, 2010

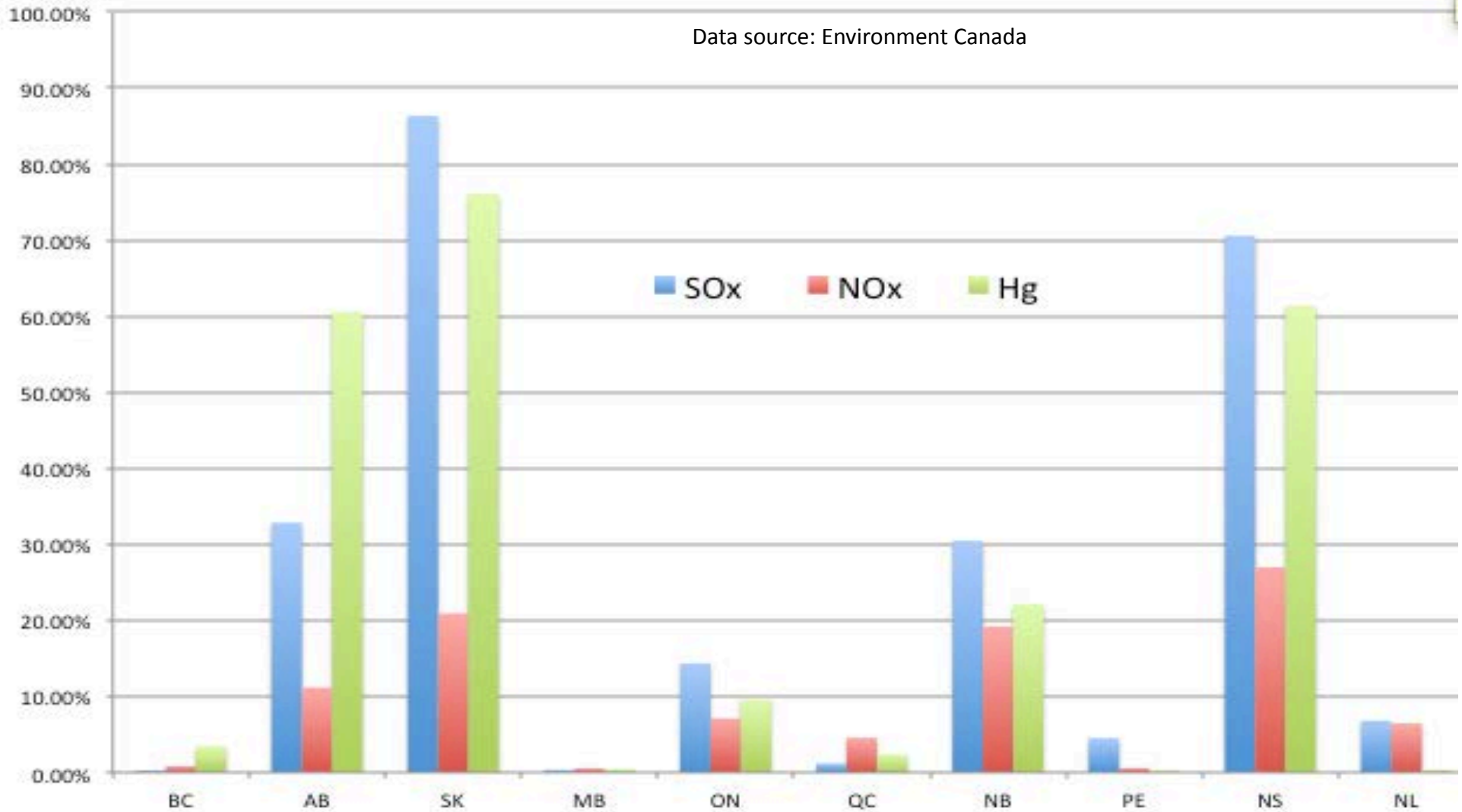




# Pollution

## 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 NO<sub>x</sub> and SO<sub>2</sub> 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

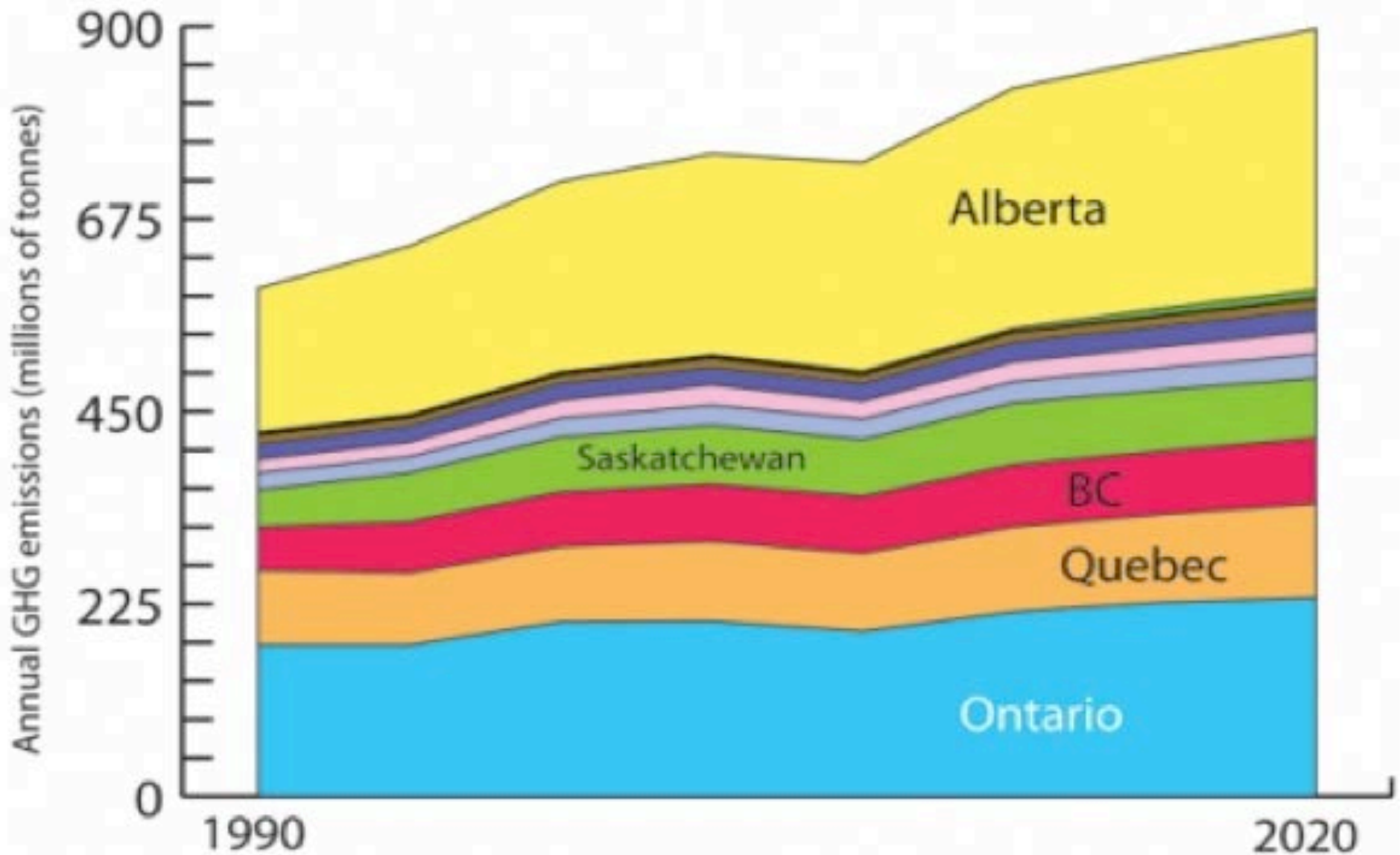
# Greenhouse Gases: Top 15 Emitters

Source: Environment Canada, 2010 data

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

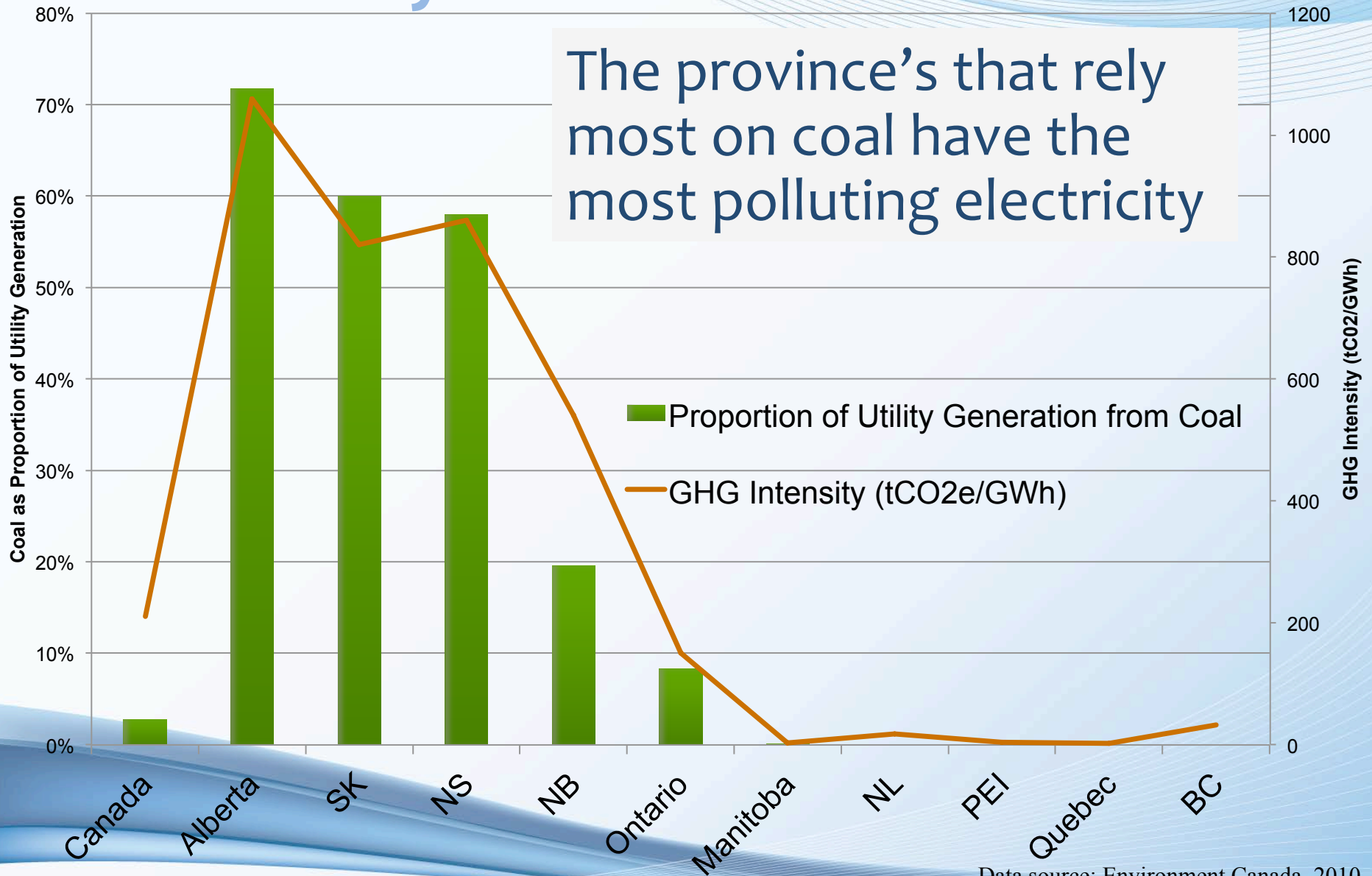
Facility	Prov	tCO <sub>2e</sub>
Sundance Thermal Electric Power Generating Plant	AB	15,791,372
Mildred Lake and Aurora North Plant Sites	AB	12,707,889
Genesee Thermal Generating Station	AB	9,123,656
Nanticoke Generating Station	ON	8,601,215
Suncor Energy Inc. Oil Sands	AB	8,554,881
Kepphills Thermal Electric Power Generating Plant	AB	6,827,028
Boundary Dam Power Station	SK	6,748,986
Battle River Generating Station	AB	4,979,983
Dofasco Hamilton	ON	4,973,457
Sheerness Generating Station	AB	4,911,007
Cold Lake	AB	4,500,607
Poplar River Power Station	SK	4,334,066
Lingan Generating Station	NS	3,690,562
Lambton Generating Station	ON	3,330,461
Long Lake Project	AB	3,266,914

# Canada's Greenhouse Gas Emissions





# Coal Power & Grid Intensity



# Renewable Opportunity



Photo: Ben Thibault, Pembina Institute

# Renewable energy has come of age

Wind Power, Existing World Capacity, 1996–2008

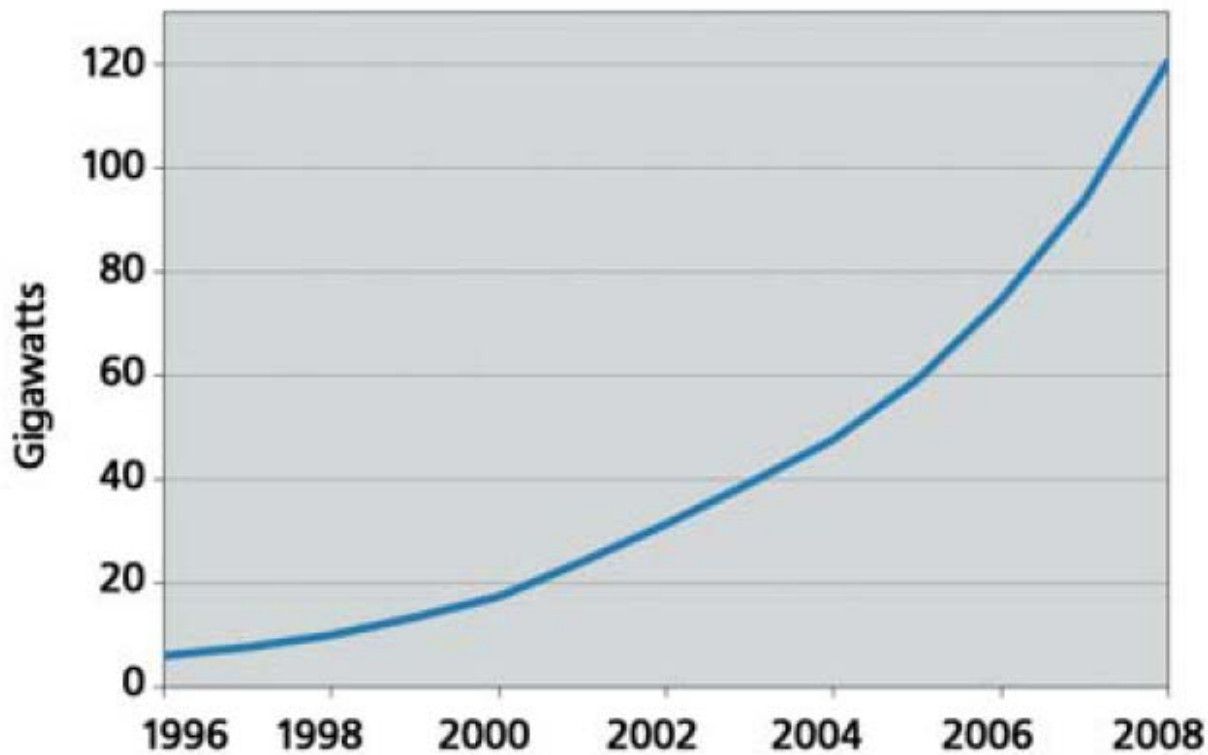


Photo: David Dodge, Pembina Institute



# The pace of green growth

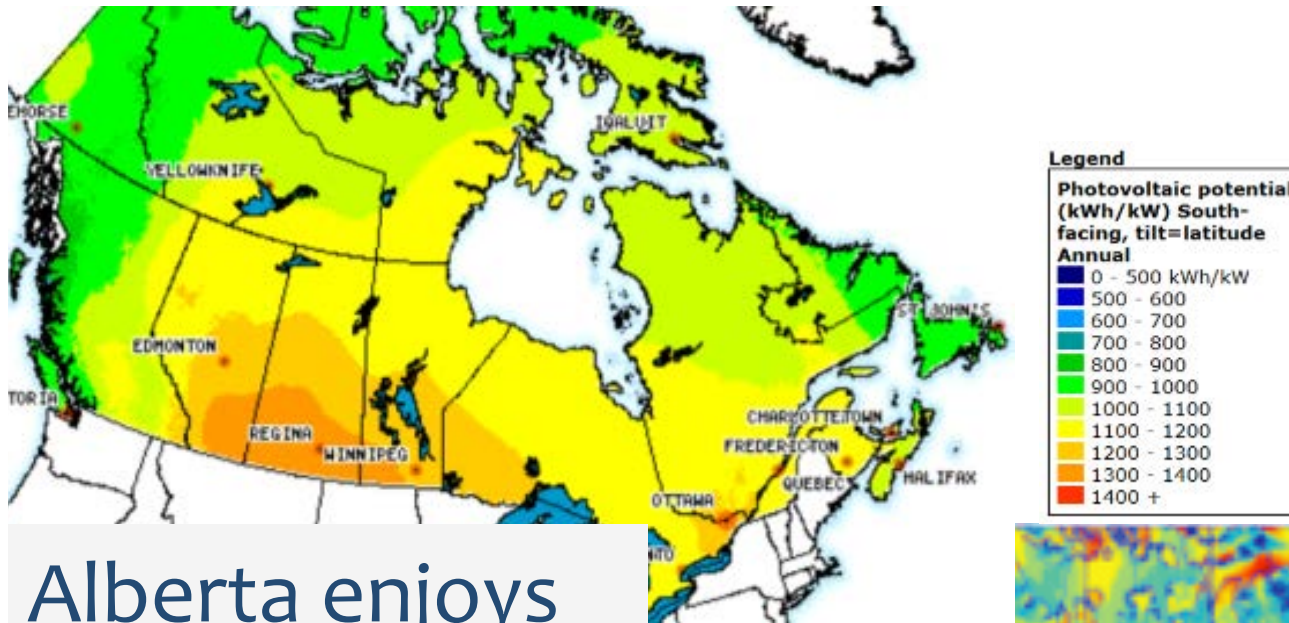
“between 2004 and 2007, global investments in renewable energy more than doubled.... If large hydropower is included, 2008 was the first year in which renewable power generation attracted more investment than traditional fossil fuel generation.”

— Pew Center on Global Climate Change, *Clean Energy Markets: Jobs and Opportunities*

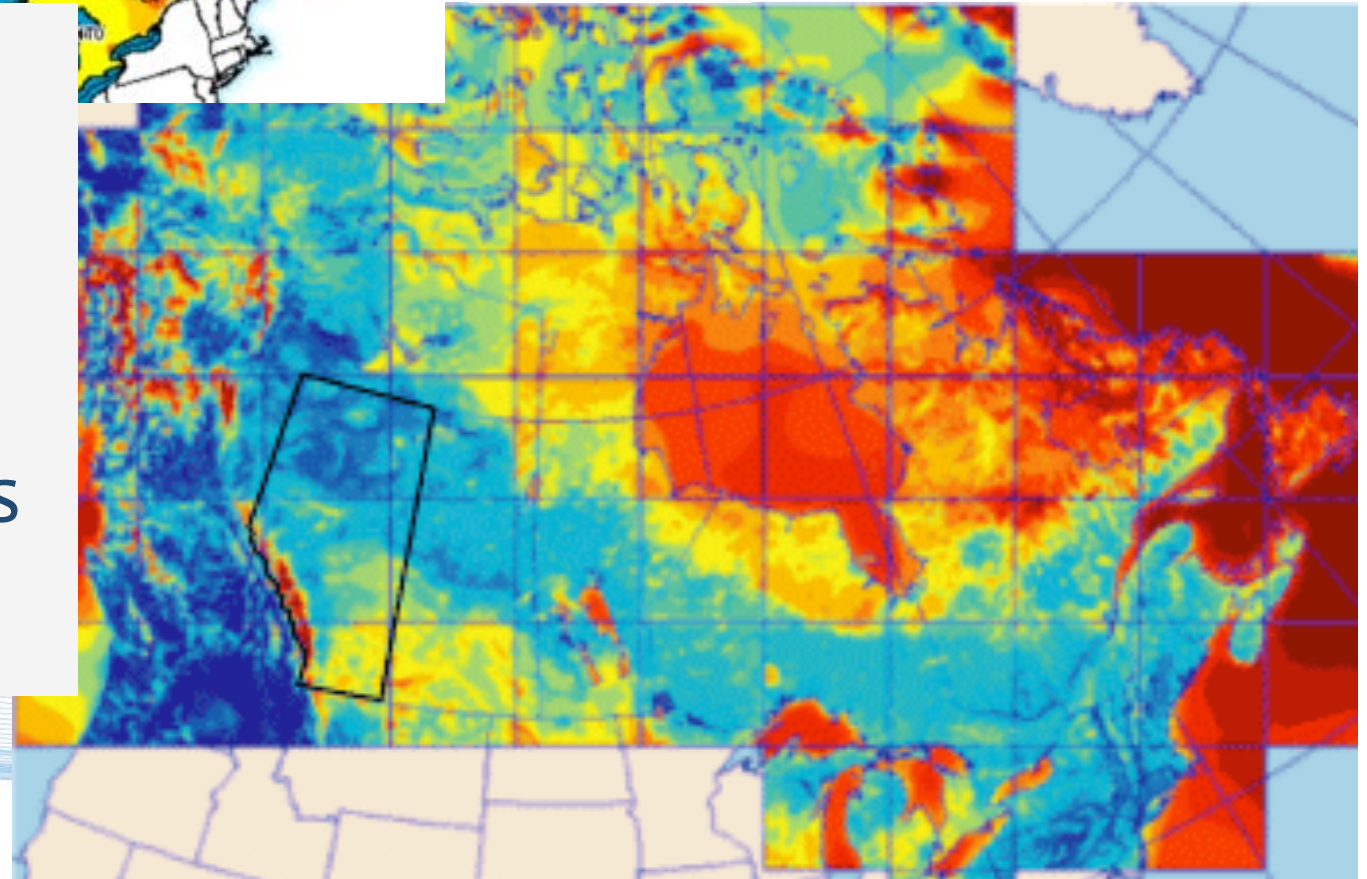


Photo: Paul Gipe

# Alberta's Renewable Bounty



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%



# Denmark

Centralized System of the mid 1980's

More Decentralized System of Today



“[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>

## Landowners' Guide to Wind Energy in Alberta

Tim Weis • Alex Doukas • Kristi Anderson  
(Appendix by Gordon Howell)

August 2010

# Wind Energy Technology

- **Commercial Scale**

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

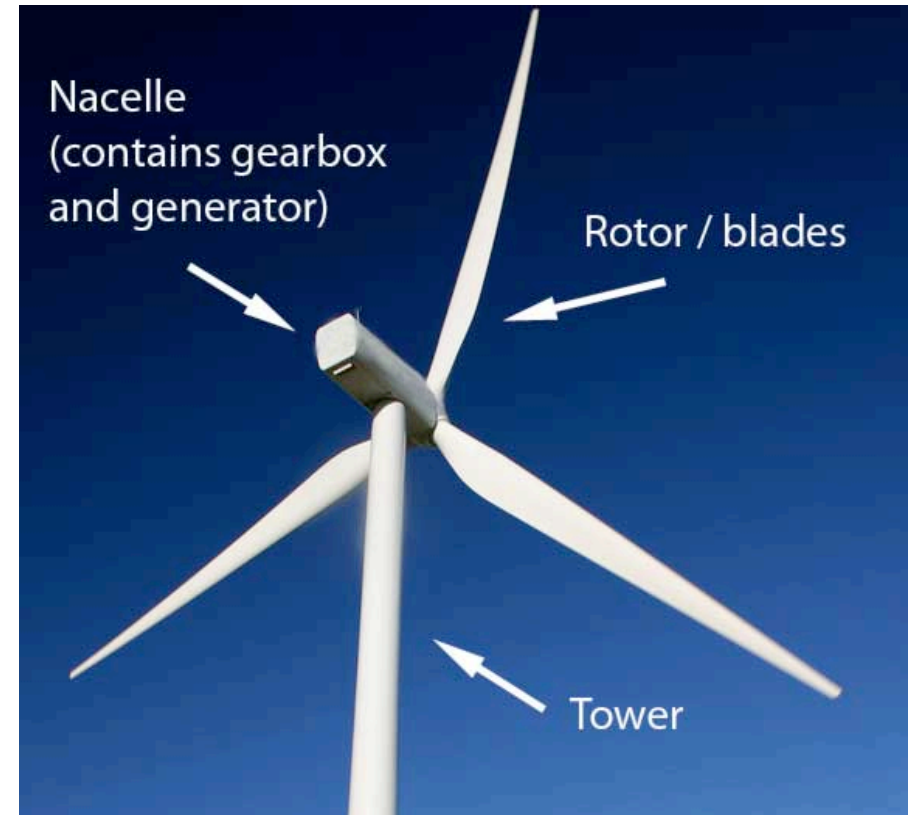


Photo: David Dodge, The Pembina Institute



# 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



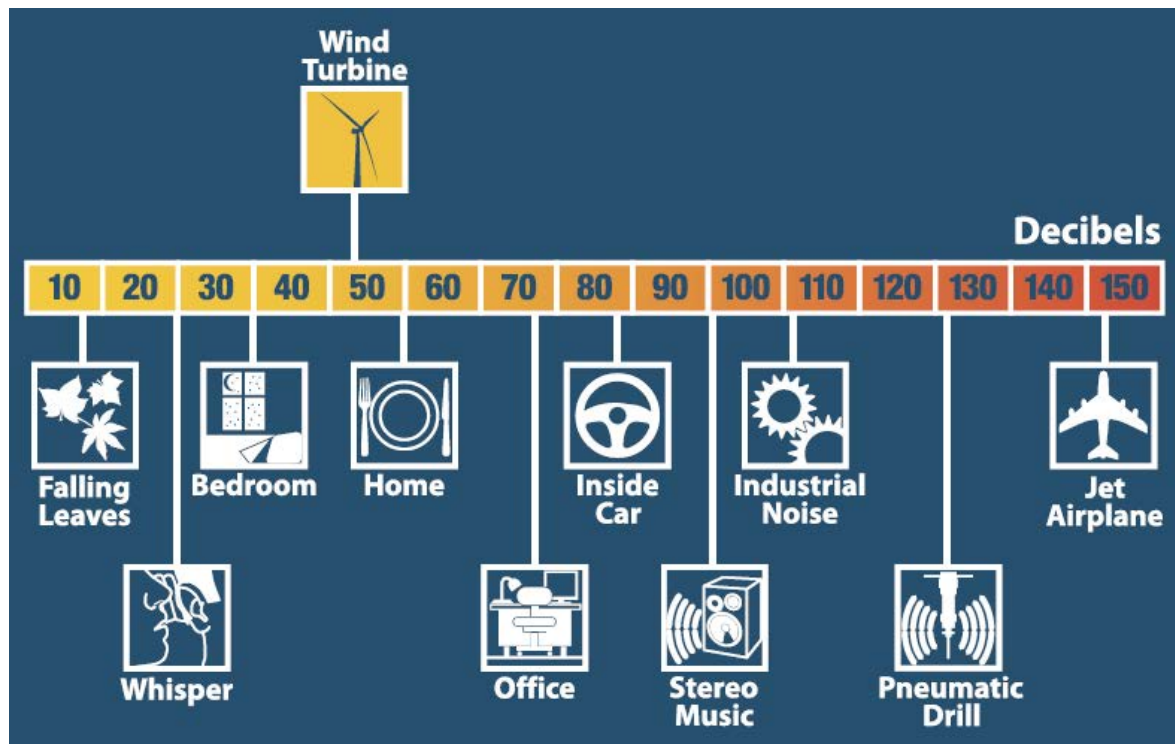
# Wildlife Concerns

	Relative Risk Level for Potential Harm to Wildlife					
Electricity Fuel Source	Resource Extraction	Fuel Transportation	Construction of Facility	Electricity Generation	Transmission and Delivery	Decommissioning of Facility
<b>Coal</b>	Highest Potential	Lower Potential	Lower Potential	Highest Potential	Moderate Potential	Lower Potential
<b>Oil</b>	Higher Potential	Highest Potential	Lower Potential	Higher Potential	Moderate Potential	Lower Potential
<b>Natural Gas</b>	Higher Potential	Moderate Potential	Lowest Potential	Moderate Potential	Moderate Potential	Lowest Potential
<b>Nuclear</b>	Highest Potential	Lowest Potential	Lowest Potential	Moderate Potential	Moderate Potential	Lowest Potential
<b>Large Scale Hydro</b>	None	None	Highest Potential	Moderate Potential	Moderate Potential	Higher Potential
<b>Wind</b>	None	None	Lowest Potential	Moderate Potential	Moderate Potential	Lowest Potential
<b>Building Mounted Solar PV</b>	None	None	Lowest Potential	Lowest Potential	Moderate Potential	Lowest Potential

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.*

Source: Canadian Geographic Magazine

# 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

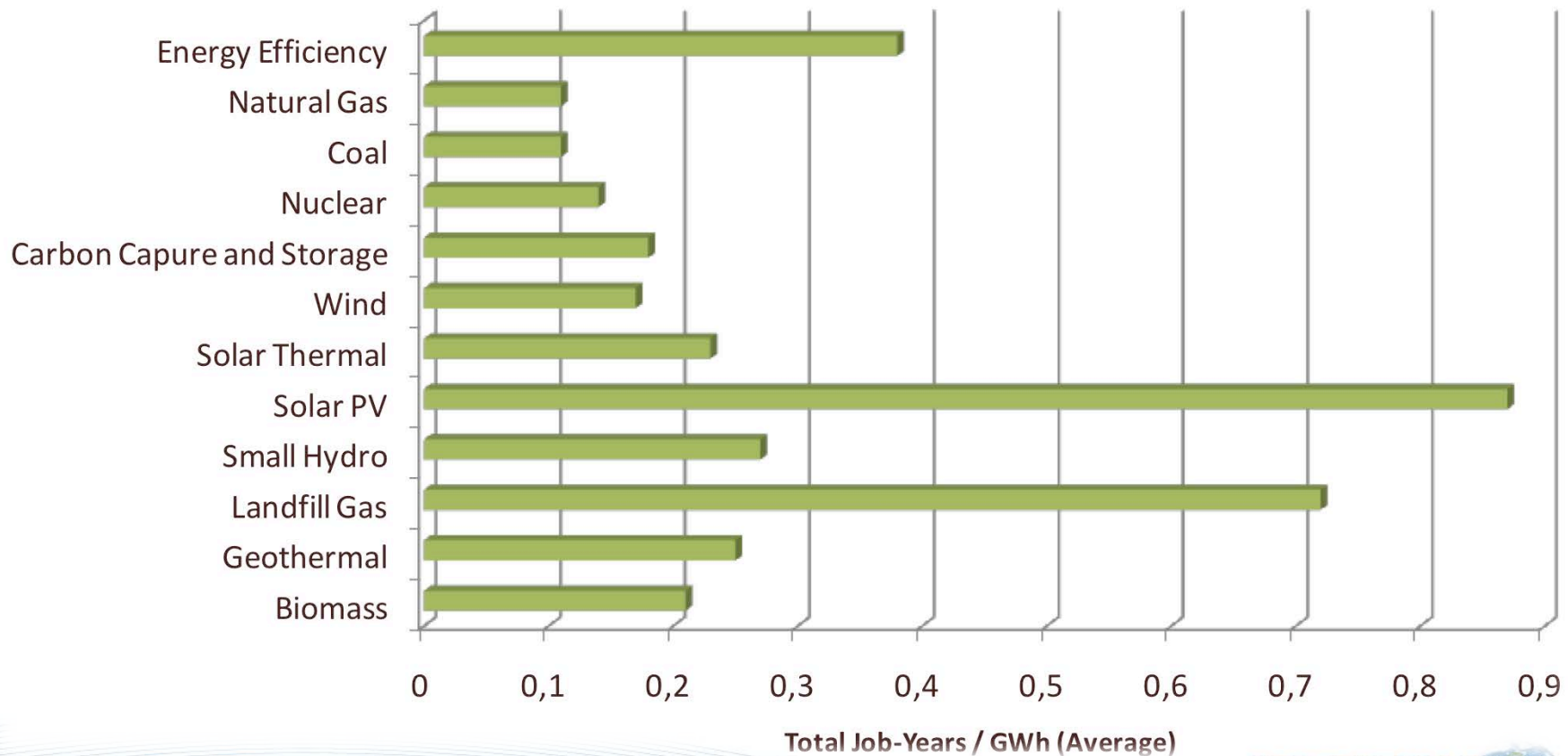
# Employment

- 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

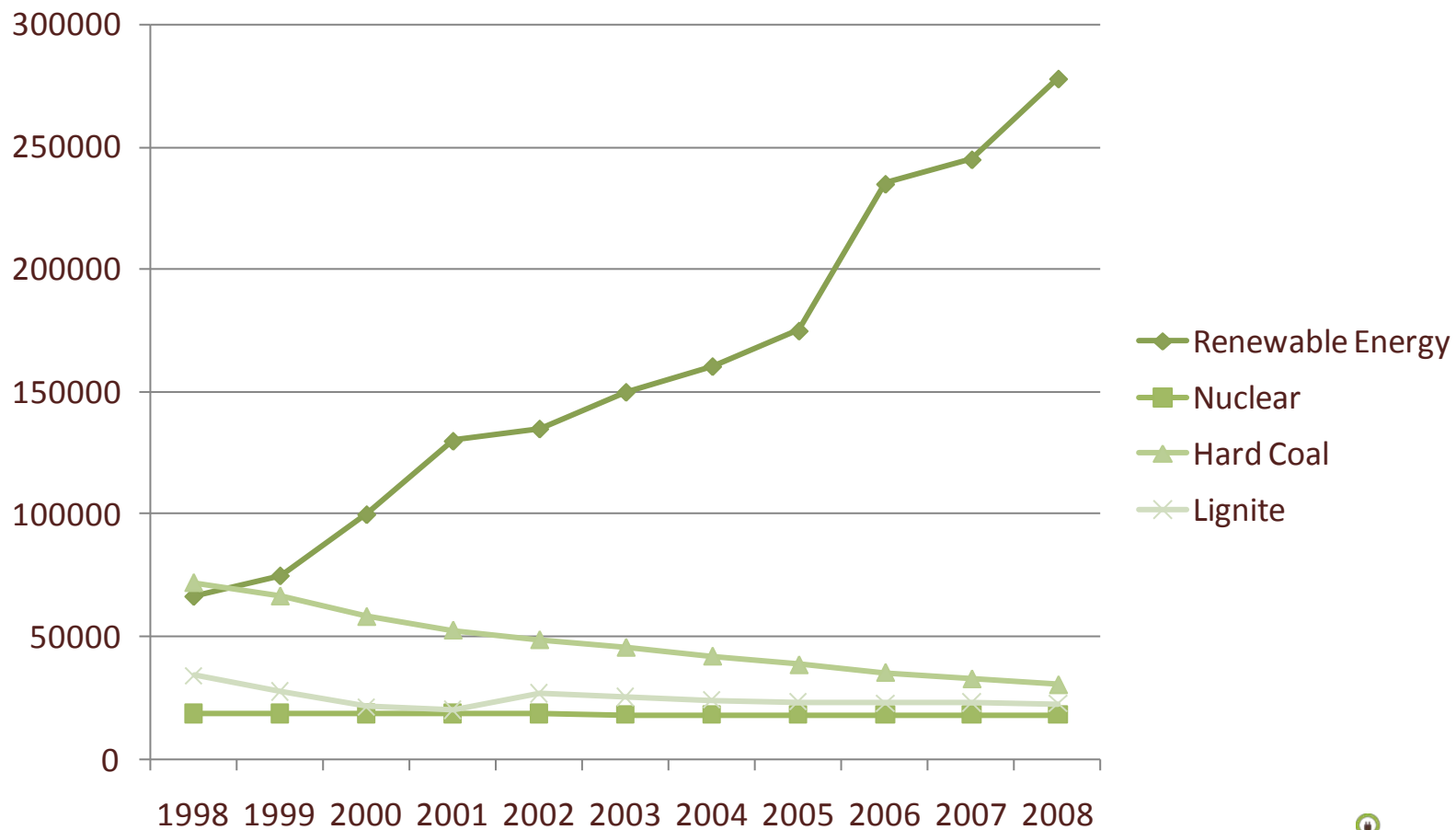
Total Job-Years/GWh per Energy Technology in the U.S.



Source: Wei, Patadia and Kammen 2010

# Renewable energy jobs in Germany

## Total jobs growth in Germany (1998-2008)



arepo consult

Source: BMU 2010, FH Wiesbaden 2008



# Ontario as a case study

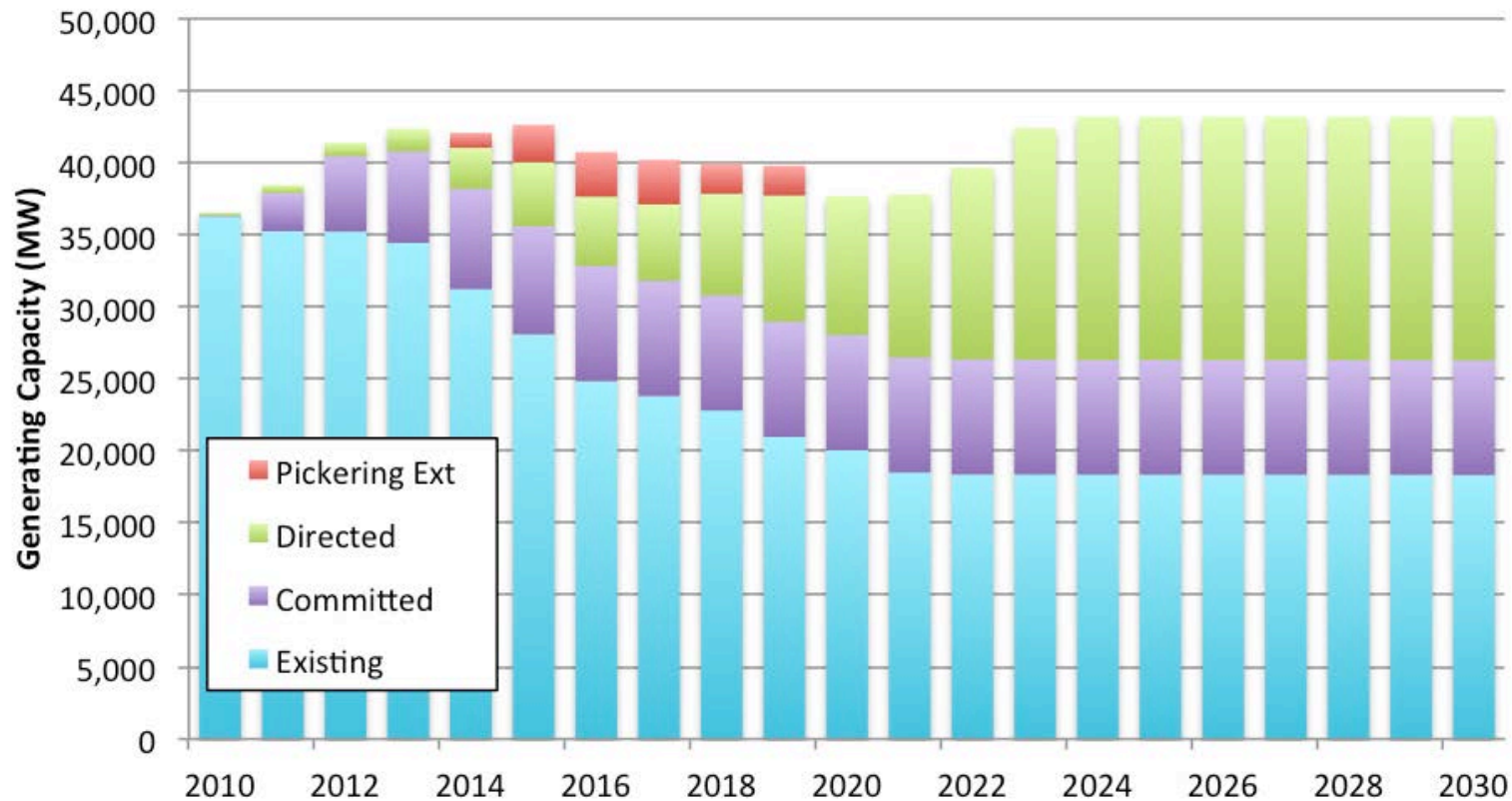
- Phase-out of coal power by end of 2014
- Retirement of Pickering nuclear plant
- Rebuilding/refurbishment of nearly all of Ontario's remaining nuclear reactors
- Expansion of renewable power
- Significant investment in transmission and distribution systems
- What will it cost???





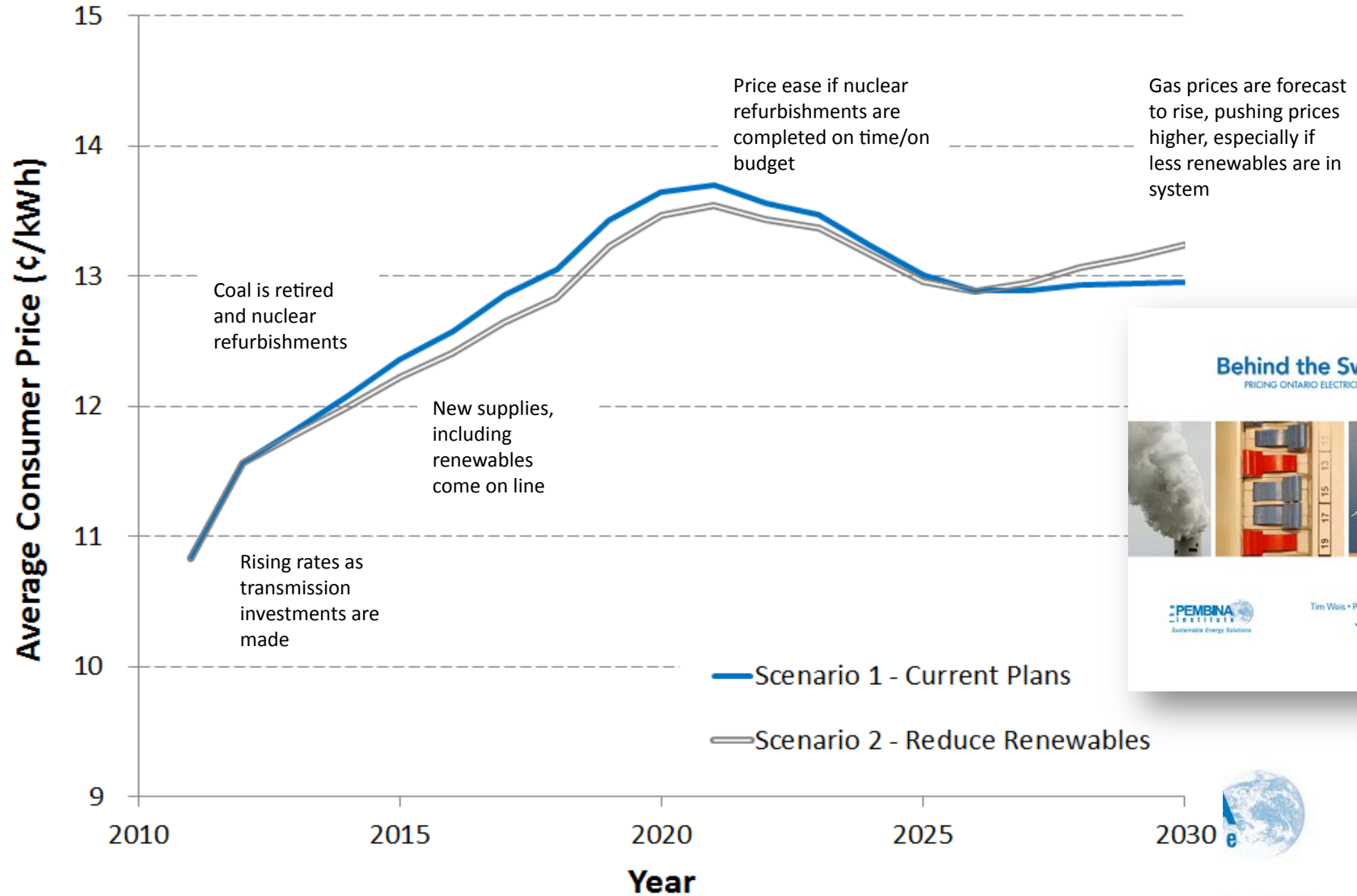
# Change is on the way

*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).



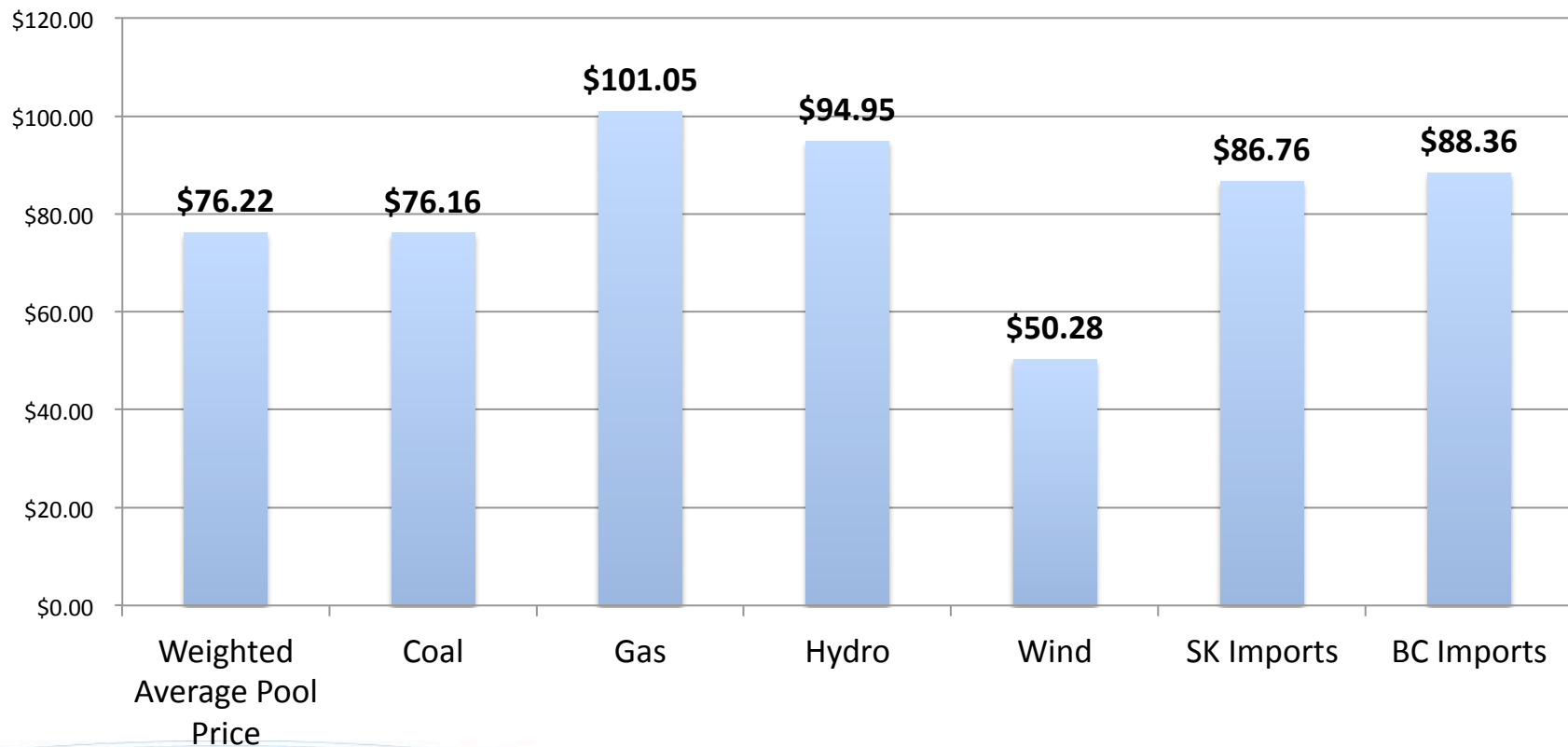
# Wind Power in Alberta: A Discount

- 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

Average Price per MWh



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 CO<sub>2</sub>
- Competition Incentives
  - Direct – CCS, Nuclear
  - Indirect – Liabilities



**New explosion rocks Japanese nuclear plant**



The No.3 nuclear reactor of the Fukushima Daiichi nuclear plant is seen burning DIGITAL GLOBE REUTERS/Digital Globe/Handout after a blast following an earthquake and tsunami in this handout satellite image taken March 14, 2011

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Taiga Uranaka and Ki Joon Kwon, Reuters - Mar. 14, 2011 | Last Updated: Mar. 14, 2011 8:02 PM ET

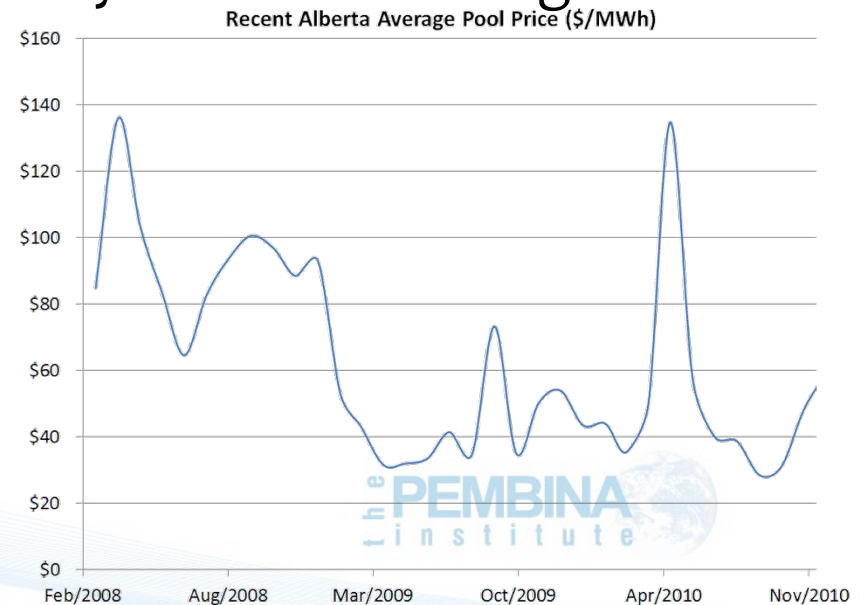
FUKUSHIMA — A fresh explosion rocked a damaged Japanese

[TOOLS](#)



# 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



The Weather Network Full Forecast

Bow Island, AB

29°C NA

city name Search

# The 40-Mile County Commentator

HOME NEWS AGRICULTURE COMMENTARY SPORTS OBITUARIES

## Shell delivers bad news-Wild Steer Butte project put on hold



Written by production

Wednesday, 14 March 2012 19:54

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.

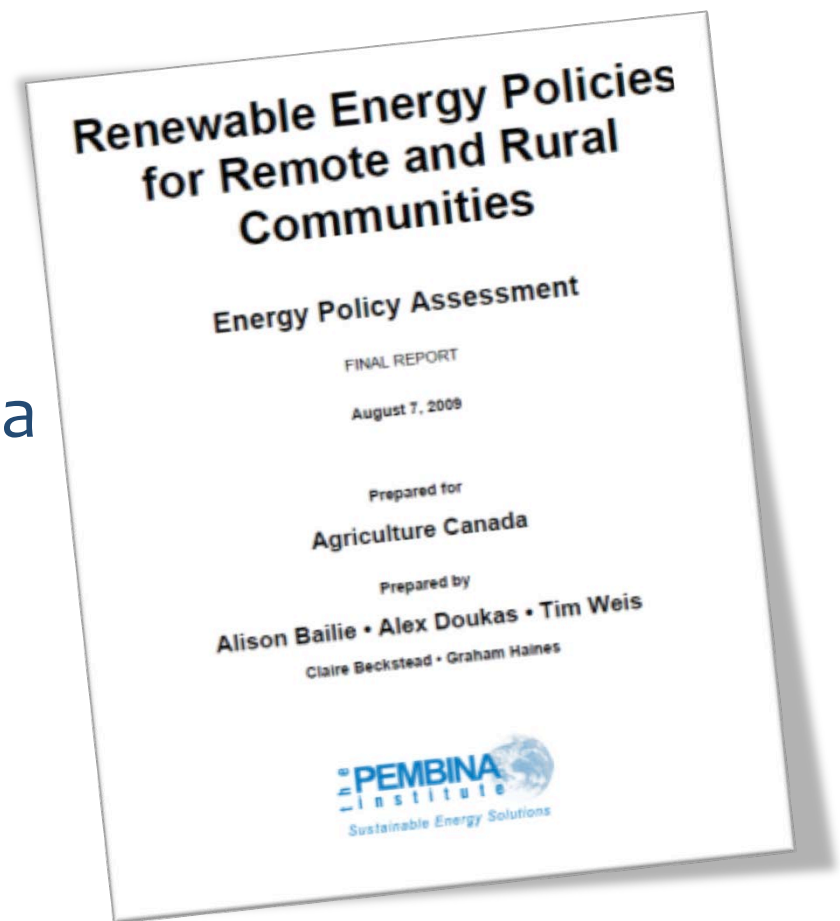
"I want to get the message out there that this is not because of local government or because of the stakeholders. This has been a very hard decision to make. But, we need two things in place to go forward. One, we need a carbon offset program and

"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."  
-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

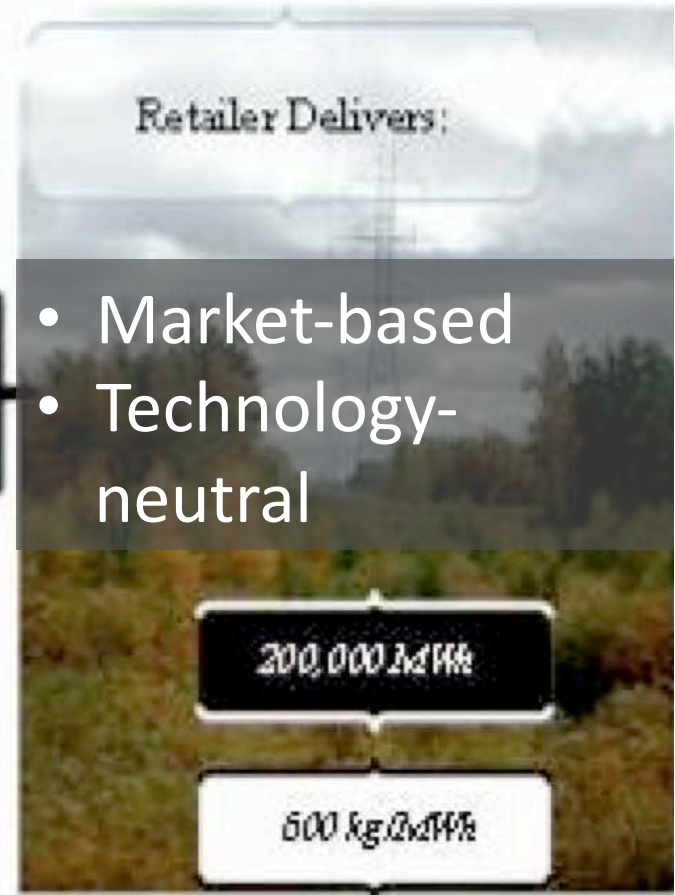


# Nova Scotia – 25% RE by 2015

- 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
  - <http://www.gov.ns.ca/energy/resources/EM/renewable/renewable-electricity-plan.pdf>



# Made-in-Alberta: Clean Electricity Standard



# 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

**PEMBINA**  
i n s t i t u t e

info@pembina.org

With support from:

alberta   
**ecotr**ust

