

# The Opportunity and Need for Renewables in Heritage Buildings

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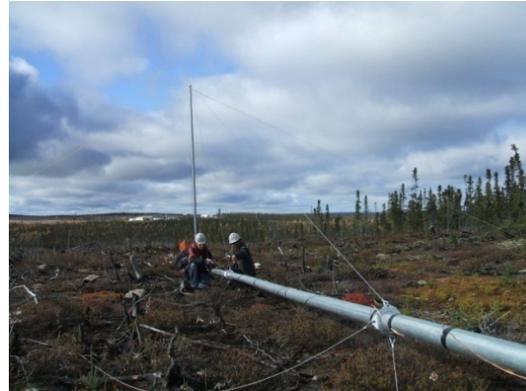


# Presentation Outline

- **Climate change challenges**
- **The need for heritage buildings to be a part of the solution**
- **Opportunities**
  - **Efficiency, CHP, Solar, etc**
- **Heritage buildings as a showcase for clean energy**
  - **Edmonton's Whyte Ave project – goals, partners and progress to date**
- **Ontario's Green Energy Act**

# About Tim

- Professional Engineer
- Director of renewable energy and energy efficiency research
- M.Sc. research on ice adhesion to wind turbine blades
- Ph.D. research on remote wind power



# About Pembina

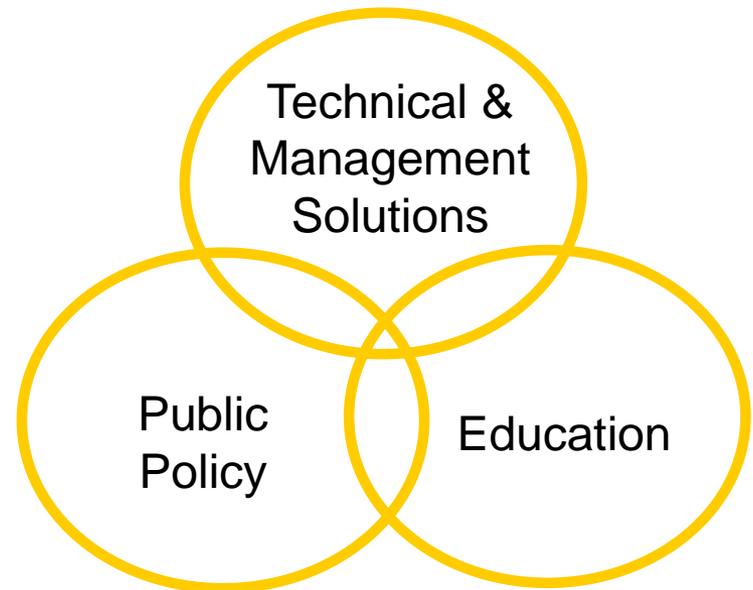
The Pembina Institute is a *Sustainable Energy Think Tank* with the goal of:

*“advancing sustainable energy solutions through research, education, consulting and advocacy.”*

- Non-profit
- Independent
- Non-partisan

Offices:

Gatineau, Toronto, Calgary,  
Canmore, Drayton Valley,  
Edmonton, Vancouver, Yellowknife



# Communities Program

## Yukon

1. Old Crow
2. Pelly Crossing

## British Columbia

6. Kwadacha FN
7. Tsay Keh FN
8. Gitga'at FN
9. Oweekeno FN
10. Ka:'yu:'k't'h' /  
Che:k:tl'es7et'h' FN
11. Hupacasath FN
12. Bowen Island
13. Tsleil-Waututh FN
14. Douglas FN
15. Xeni Gwet'in FN
16. Quesnel
17. Uchucklesaht FN
18. Ehattesaht FN
19. Kluskus FN
20. Kitasoo FN
21. Tsawatanaieuk FN
22. Dawson Creek
55. Skatin FN
56. Samahquam FN
69. Abbotsford
70. Hudon's Hope
71. Salmon Arm

## Alberta

23. Little Red River Cree FN
24. Chipewyan Prairie FN
25. Tallcree FN
26. Driftpile FN
27. Beaver Lake FN
28. Kikino Metis Settlement
29. Alexander FN
30. Enoch FN
31. Samson FN
32. Blood FN
54. Tsuu T'ina FN

## Saskatchewan

33. Fond du Lac FN
34. Black Lake FN
35. Hatchet Lake FN
36. Waterhen FN
37. Ahtakakoop FN
38. Beardy's and  
Okemasis FN
39. Red Pheasant FN
40. James Smith FN
41. Gordon FN
42. Cowessess FN
43. Flying Dust FN
44. Kinistin FN
45. Birch Narrows FN

## Manitoba

46. Mistawasis FN
47. Montreal Lake FN
48. Barren Lands FN
49. Skownan FN
50. Rolling River FN
51. Peguis FN
52. Manto Sipi FN
53. Bunibonibee FN
54. Wasagamack FN
55. Red Sucker Lake FN
56. St. Theresa Point FN
57. Garden Hill FN
58. God's Lake FN

## Ontario

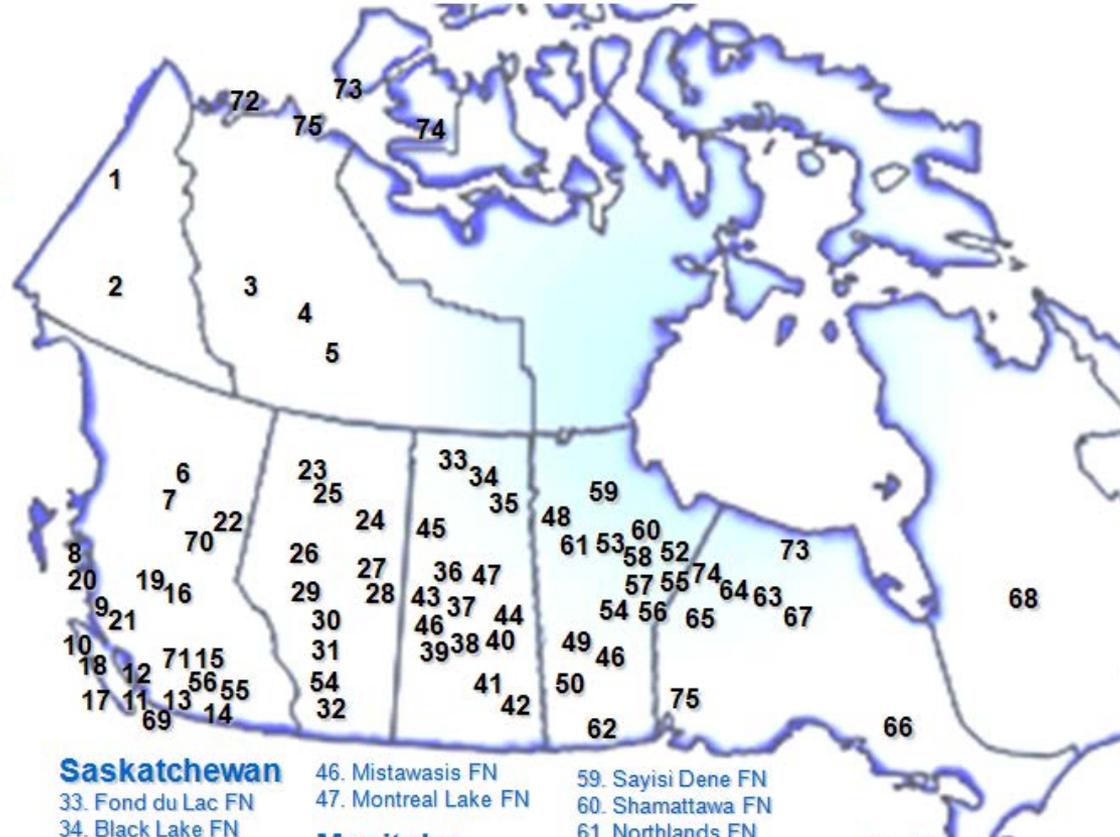
59. Sayisi Dene FN
60. Shamattawa FN
61. Northlands FN
62. Swan Lake FN
63. Wapekeka FN
64. Kitchenuhmaykoosib  
Innuwug FN
65. Keewaywin FN
66. Pic Moberg FN
67. Kasabonika Lake FN
73. Weenusk, FN
74. Muskrat Dam, FN
75. North Spirit Lake, FN

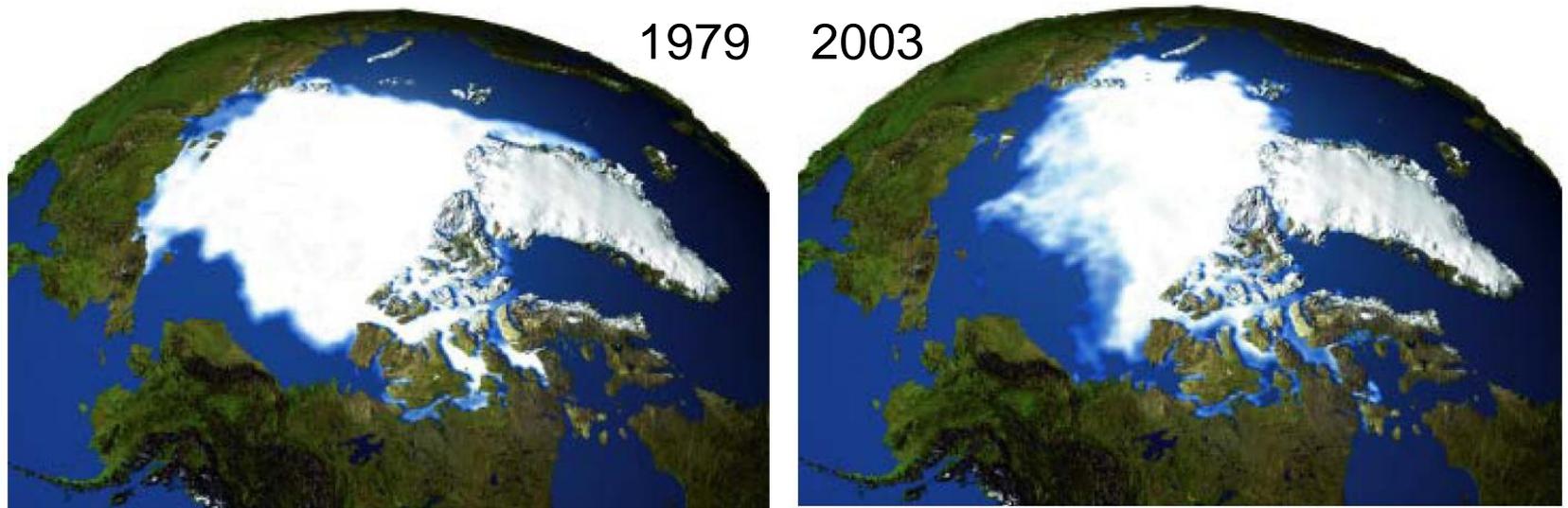
## Québec

68. Nemaska FN

## NWT

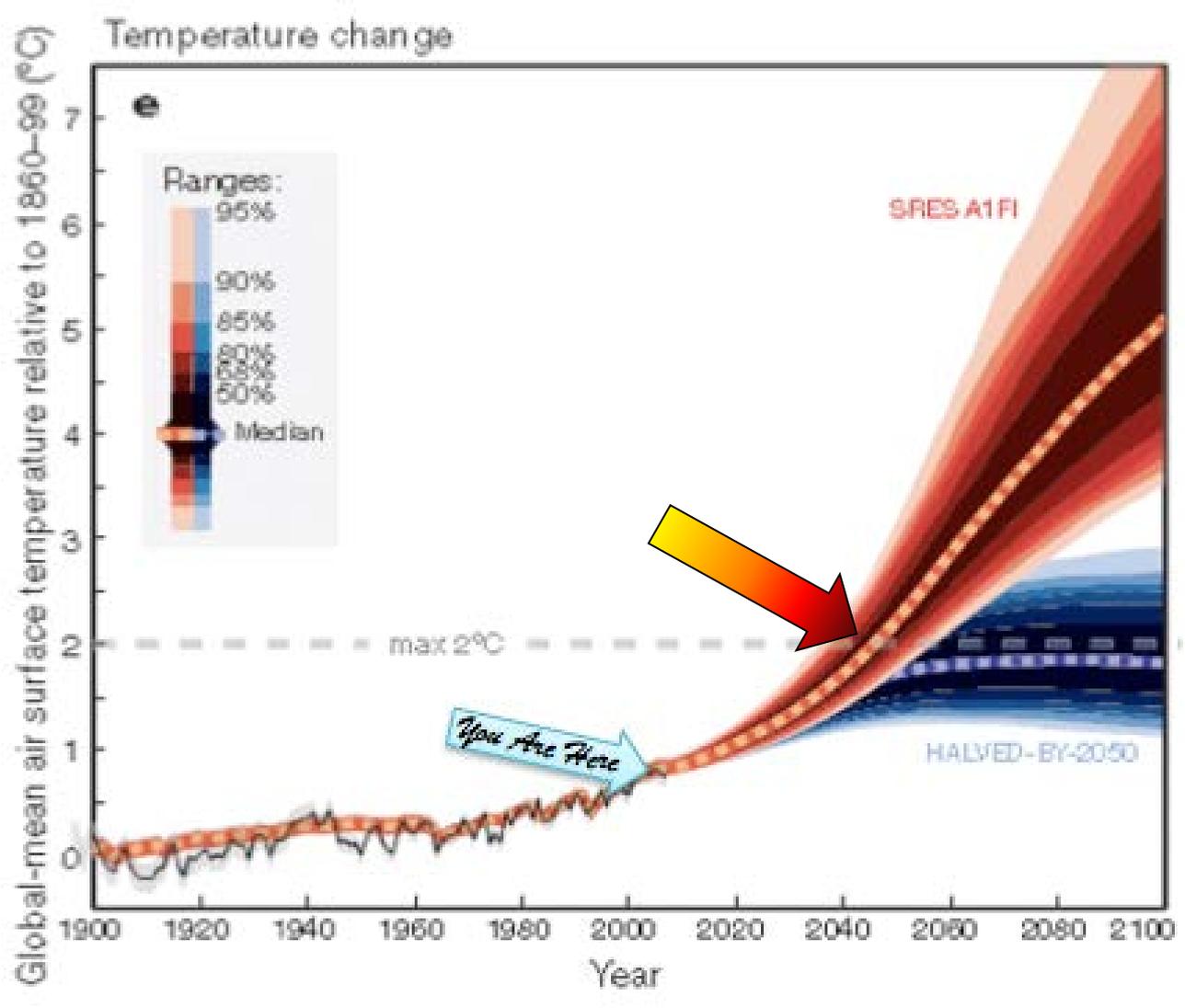
3. Norman Wells
4. Wha Ti
5. Yellowknife
72. Tuktoyaktuk
73. Sachs Harbor
74. Ulukhtuk
75. Paulatuk





The majority of scientific models and predictions to date have under-estimated the scale and pace of warming we are already seeing

# 2C "safe" limit



# Responsibility as a Canadian

- Per Capita Emissions ( $t_{CO_2}/\text{year}$ )

- USA – 20.4
- Canada – 19.0
- Australia – 16.3
- Germany – 9.8
- Sweden – 6.5
- China – 4.1
- India – 1.1
- Bangladesh – 0.3
  
- Global 'safe' limit – 1.2

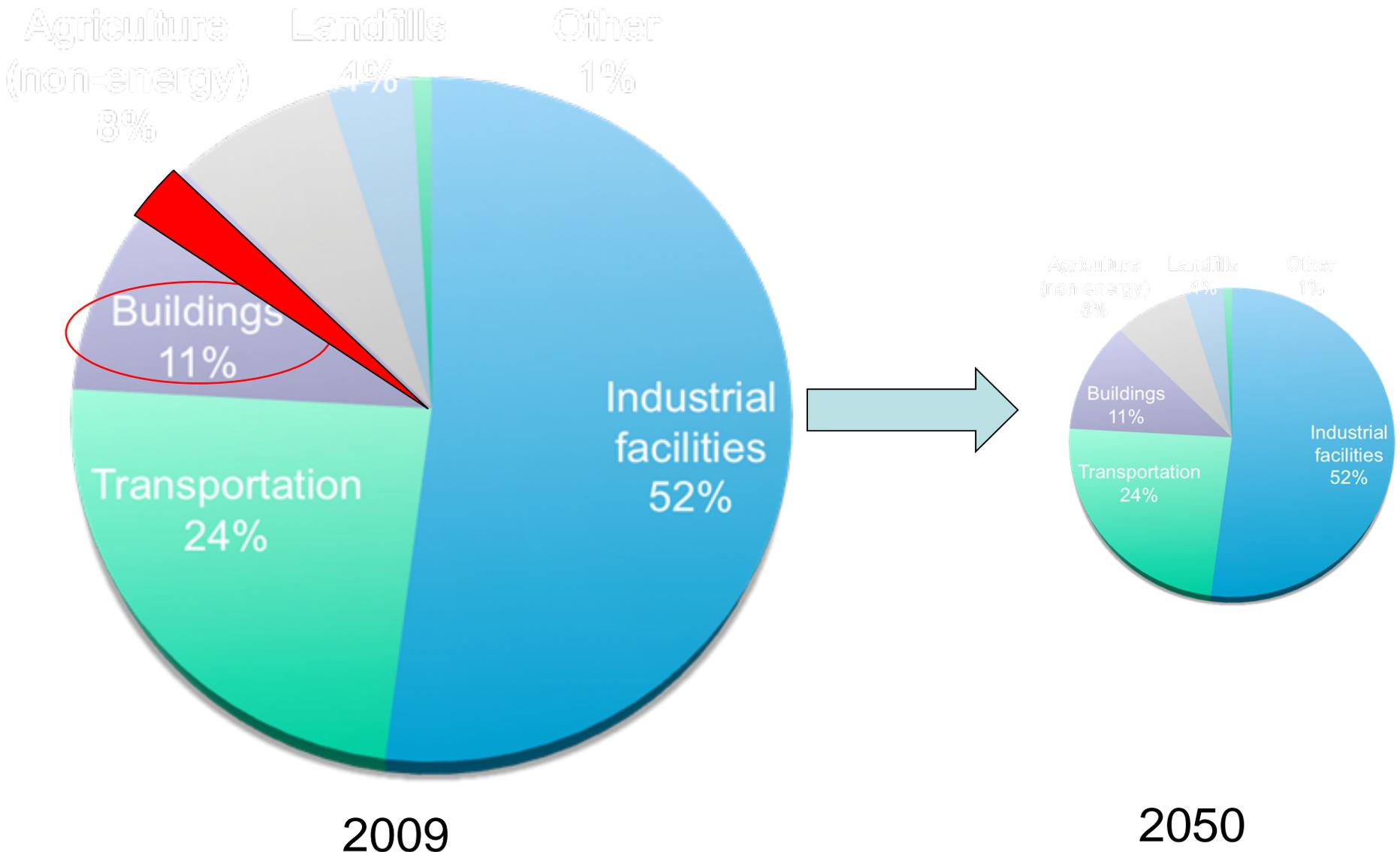
Source: US Department of Energy Information Administration

- Canada is among the top 10 global emitters – both per capita AND in absolute

# Where are we now?

- Canada is reviewing its national approach
  - Three plans in three years
  - Emissions on significant upward trend
  - Cap and trade system?
- Current Federal target of just 3% below the 1990 level by 2020
  - Kyoto goal was 6% below 1990 by 2012
- IPCC shows that we need serious emissions reductions very soon or it will be too late:
  - global peak within 10-15 yrs,
  - Canada needs to be 25-40% below 1990 levels by 2020

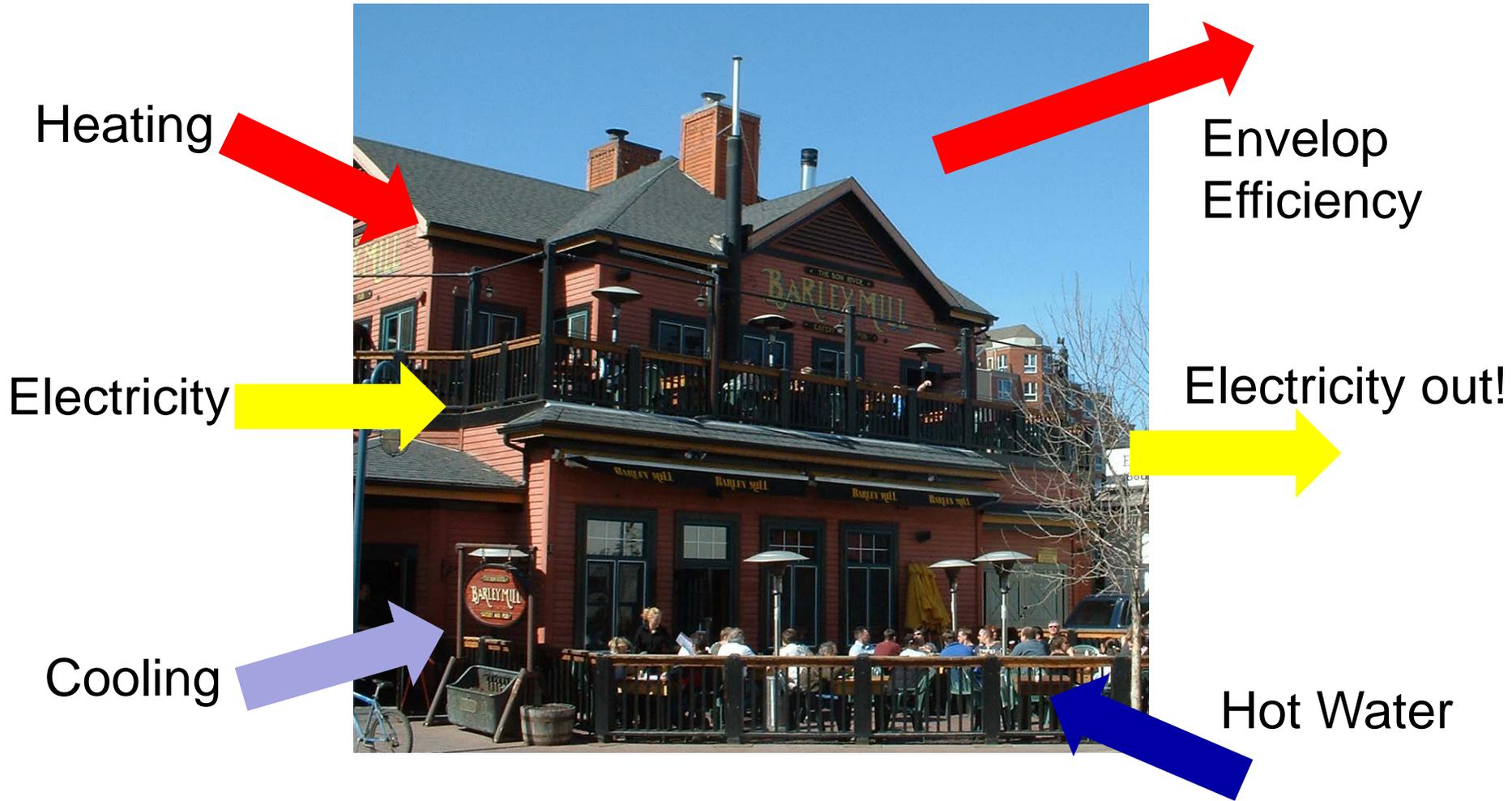
# Emissions in Canada



2009

2050

# Savings opportunities



# Savings opportunities

- Building efficiency
  - Insulation
  - Windows
  - Operations
- Heating source
  - High efficiency furnace
  - Ground source heat pump
  - District heating
  - Combined heat and power
- Buying Green power



# Savings opportunities

- Hot Water
  - Solar hot water
  - High efficiency boilers
- Electricity generation
  - Combined heat and power
  - Solar photovoltaics



# When is a building not worth saving?

- Savings need to be targeted at 50-80% reductions
  - Is this achievable?
  - What features of the building needs to be preserved?
  - What ones can be retrofitted?
  - What role can on-site generation play?
- Embodied energy can be 5-15 years of heating energy
  - May/may not be enough to justify avoiding major reconstruction
- Opportunity to use as a showcase?

# Location, location, location



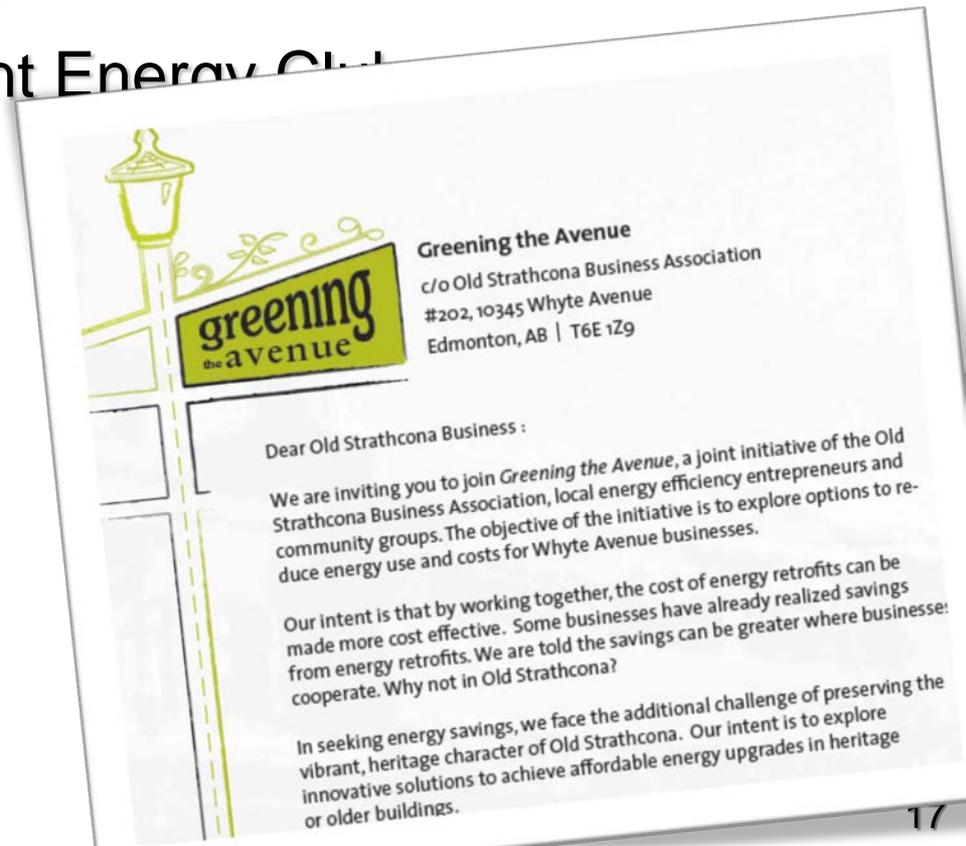
Photo: Toronto Renewable Energy Co-op

# Whyte (82<sup>nd</sup>) Avenue - Edmonton

- Old Strathcona
- Buildings dating from 1891
- Tourist destination
- Night life
- Farmer's market
- Pedestrian stores
- “Blue mile”



- Old Strathcona Business Association
- Old Strathcona Foundation
- City of Edmonton (CO2RE)
- University of Alberta Student Energy Club
- City of Edmonton
- EcoAmmo
- Carbon Busters
- Sustainable Works
- Solar Energy Society
- Pembina Institute
- Linda Duncan, Federal MP



# Greening the Ave Association

- Look at accessible examples of what can be done:
  - reduce their carbon footprint
  - increase their energy savings
  - showcase opportunities in highly visible and busy public area
  - economies of scale opportunities
  - spin-off opportunities – LED Xmas lights
  - “certify” (recognize) participating businesses

# Greening the Ave

- Scoping meeting – July 2009
- Partnership – August 2009
- Public meeting – Fall 2009
- Questions being discussed:
  - What constitutes recognition?
  - Levels of participation?
  - Technologies to be showcased? Where?
  - Seeking financial support
  - How owners and tenants can make win-win investments?

# Barriers to renewables on buildings

- Legality
  - City bylaws
    - Zoning for electricity/heritage status
  - Navigating various provincial electricity laws
- Business case
  - \*Ontario's Green Energy Act\*
    - Feed-in Tariff unique in Canada
- Diminished urban resources
  - Turbulence, Shading

# Barriers to renewables on buildings

- Access/Orientation
  - South facing roof/façade
  - Ability to access the ground
- Human capacity
  - Quantifying resource
  - Selecting appropriate technology
    - Selecting high quality supplier
    - Selecting high quality installer
  - Proper O&M training
- Financing

# Ontario's Green Energy Act

- Canada's most progressive renewable energy law
- Enables access to the grid
- 20-year guaranteed contracts for production
  - 80 ¢/kWh for rooftop solar less than 10 kW
- Combined heat and power & solar hot water not included
  - 2 year review?
- [www.powerauthority.on.ca/fit](http://www.powerauthority.on.ca/fit)

# Conclusions

- Heritage buildings need to be a part of solution
- Major reductions required likely go beyond embodied energy in most cases
- Balancing the preservation of heritage look/use with future energy realities
- Renewables can play an important role in helping buildings become net zero, or even producers
  - Need the right policies
  - Need to understand the technology options and realities

# Conclusions

- “I skate to where the puck is going to be...” – Wayne Gretzky

# Thank You

La fièvre des **SABLES bitumineux**

FICHE D'INFORMATION

LES CONSÉQUENCES ÉCOLOGIQUES DE LA RUÉE VERS LES SABLES BITUMINEUX DU CANADA



## L'envers du décor

La ruée vers les sables bitumineux risque de dilapider des ressources publiques et de laisser la dégradation de l'environnement en héritage.

Plusieurs sont choqués la première fois qu'ils voient les mines de sables bitumineux au nord de Fort McMurray. Et des mines comme celles-là pourraient finir par couvrir une superficie de 3000 km<sup>2</sup>, actuellement occupée par la forêt boréale.

Malheureusement, cette projection ne comprend que les mines des sables bitumineux. Quand on y ajoute les infrastructures nécessaires à l'exploitation des sables bitumineux, on arrive à un total de 13 millions de barils par jour de sables bitumineux, soit environ 10% de la production mondiale de pétrole.

En 1995, on poursuivait l'objectif de produire à partir des sables bitumineux un million de barils de pétrole par jour avant l'an 2020.

En 2007, on prévoit une production de 2,7 millions de barils par jour d'ici 2015 et 5 millions de barils par jour d'ici 2030. Il devient donc encore plus urgent de se

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RENEWABLE ENERGY

The utility of energy storage to improve the economics of wind–diesel power plants in Canada

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**Abstract**

Wind energy systems have been considered for Canada's remote communities in order to reduce their costs and dependence on diesel fuel to generate electricity. Given the high capital costs, low-generation wind–diesel systems have been typically found not to be economic. High-generation wind–diesel systems have the benefit of increased economics of scale, and displacing significant amounts of diesel fuel, but have the disadvantage of not being able to capture all of the electricity that is generated when the wind turbines operate at a rated capacity.

Two representative models of typical remote Canadian communities were created using HOMER, an NREL micro-power simulator to model how a generic energy storage system could help improve the economics of a high-generation wind–diesel system. Key variables that affect the optimum system are average annual wind speed, cost of diesel fuel, installed cost of storage and a storage system's efficiency. At an avoided cost of diesel fuel of 0.30 \$/GJ/kWh and current installed costs, wind generation is suitable in remote Canadian communities only when an average annual wind speed of at least 6.0 m/s is present. Wind energy storage systems become a consideration when average annual wind speeds approach 7.0 m/s, if the installed cost of the storage system is less than 1000 \$/GJ/kWh and is capable of achieving at least a 75% overall energy conversion efficiency. In such cases, energy storage systems can enable additional 50% of electricity from wind turbines to be delivered.

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**Keywords:** Wind–diesel; Remote community; High-generation; HOMER micro-power; Electricity storage

Under-Mining the **ENVIRONMENT**

FACT SHEET

JANUARY 2008

ENVIRONMENTAL MANAGEMENT • LAND • AIR • WATER • CLIMATE CHANGE



## The Oil Sands Report Card

In *Under-Mining the Environment, The Oil Sands Report Card*, nine of Alberta's 10 operating, approved and applied for oil sands mines get a failing environmental grade. The average score among all oil sands

Oil sands mines were ranked on 20 different environmental indicators in five categories: environmental management, land impacts, air pollution, water use, and management of greenhouse gases. Companies were invited to complete the survey questionnaire and provided with

**Feeding the grid**

RENEWABLE FACT SHEET

MAKING RENEWABLE ENERGY A PRIORITY



THE **PEMBINA** institute

www.pembina.org

July 2004

## When the Government is the Landlord

Economic Rent, Non-renewable Permanent Funds, and Environmental Impacts Related to Oil and Gas Developments in Canada

Any Taylor • Chris Severson-Baker • Mark Wisfield • Dan Woyanilowicz • Mary Griffiths

With support from regional partners:



## Making the Case for Small Wind and Federal Small Wind Incentives in Canada

### The Benefits and Opportunities for Small Wind

Final Report

Tim Weis  
Heather Rhoads-Weaver  
Jeremy Moorhouse  
Meg Gluckman  
John Maissan  
Larry Sherwood  
Amy Taylor

July 2007



## How Feed-In Tariffs Maximize the Benefits of Renewable Energy

Renewable energy holds the promise of reducing pollution, creating jobs and diversifying the market while providing a long-term, secure, local energy supply to fuel the economy.

Feed-in tariffs have consistently demonstrated that they are, to date, the most effective mechanism to stimulate a rapid, sustained and diverse deployment of renewable energy.

Germany is considered to be the country most successful at rapidly transitioning toward renewable energy systems through feed-in tariffs. Using feed-in tariffs, Germany currently generates 12.5% of its electricity from renewable sources, while employing more than 215,000 people in the renewable energy sector, according to the German Federal Ministry of Economics and Technology!

Feed-in tariffs exist in more than 20 other countries as well. They are the most common policy for encouraging renewable energy systems, in part because "feed-in mechanisms achieve larger deployment at lower costs" than other policy mechanisms such as quotas, direct incentives or voluntary programs.

Government that are serious about encouraging renewable energy development increasingly understand that feed-in tariffs are the most effective policy instrument at their disposal.

A feed-in tariff is simply a guaranteed price set by the government for anyone who wants to sell renewable electricity to the grid, and a guarantee that they will have access to the grid to do so.

The price, or tariff, is set so that a renewable project is considered, thereby unlocking the collective capital resources of the entire province, state or country to be part of the transition to renewable energy. The additional cost of purchasing renewable power is shared with all consumers.

It's Doable!

1. [www.pembina.org](http://www.pembina.org)

2. [www.nerc.ca](http://www.nerc.ca)

3. [www.nerc.ca](http://www.nerc.ca)

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