

# WIND POWER

## *Realities*

Putting  
Wind Power  
Myths into  
Perspective

Photo: Toronto Renewable Energy Co-op

# Canadian Power Sources

- 60% hydro
- 15% coal
- 13% nuclear
- 9% natural gas
- 3% other sources
- **1% wind power**



(Source: National Energy Board 2008)

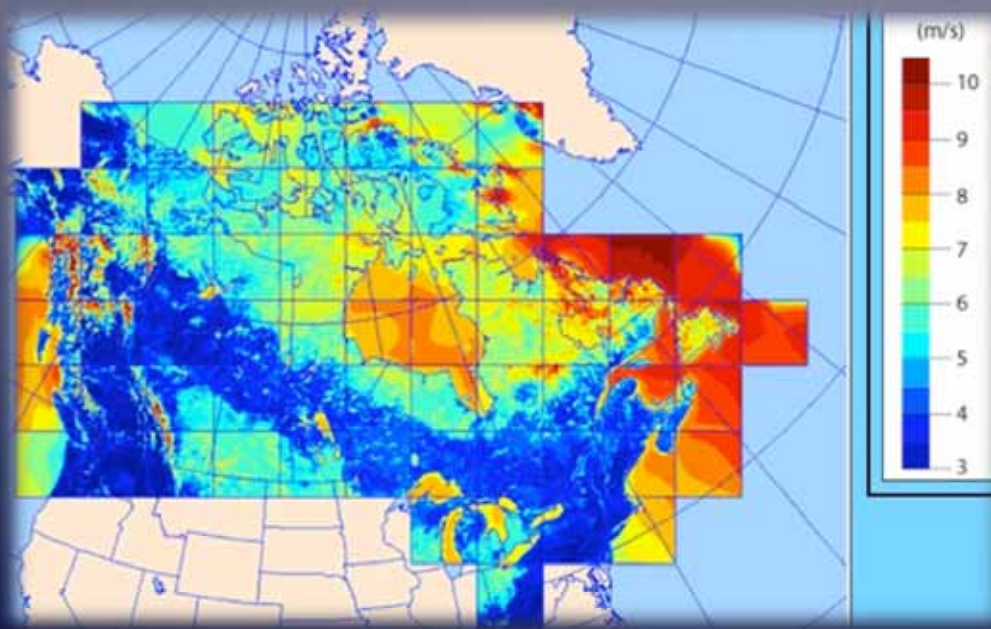


# Getting the Facts Straight

- 1% of energy generated in Canada currently comes from wind power, but there is potential for much more.
- 17% of all greenhouse gas emissions in Canada come from generating electricity – more than from the oil sands or all cars on Canadian roads.
- Energy demand will increase with use of electronics and electric vehicles.

# Canada's Wind Potential

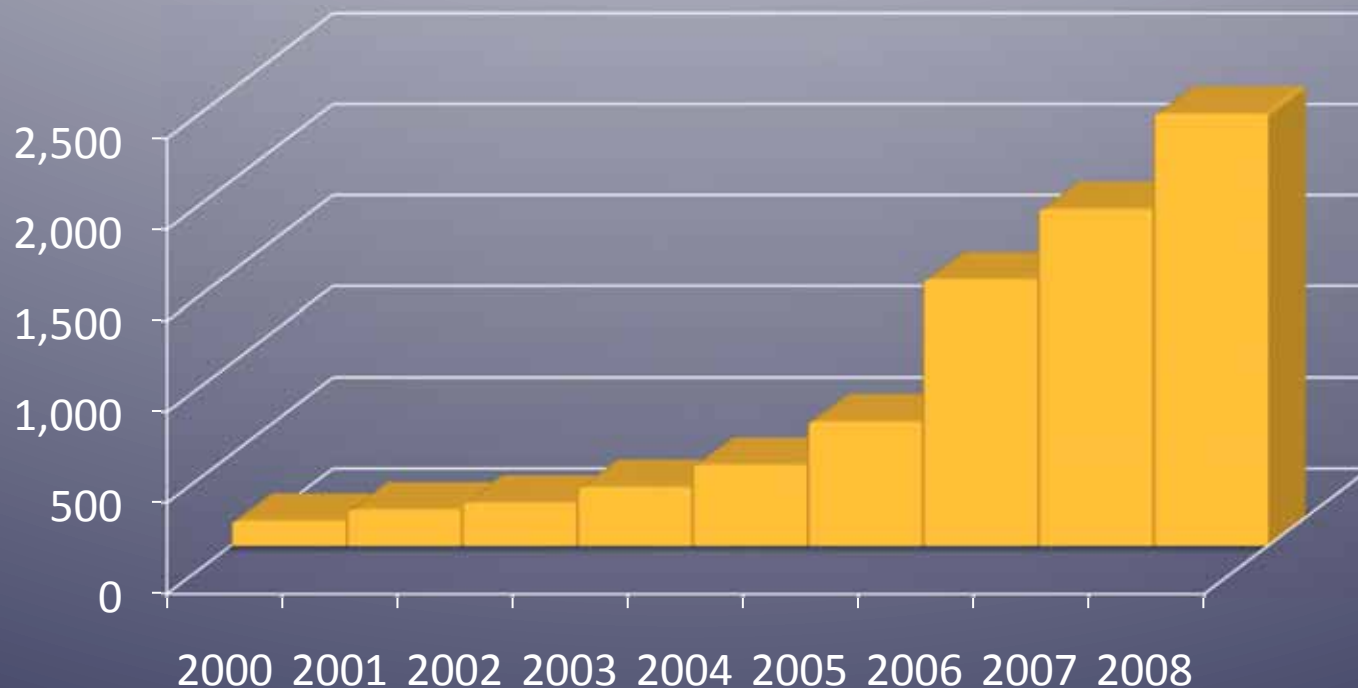
- Canada has the capacity to generate at least 20% of its power from the wind by 2025.
- From 2003 to 2009, Canada's total installed wind energy capacity grew by more than 10 times, from 322 to 3,249 MW.



Source: CanWEA

Source: [www.windatlas.ca](http://www.windatlas.ca)

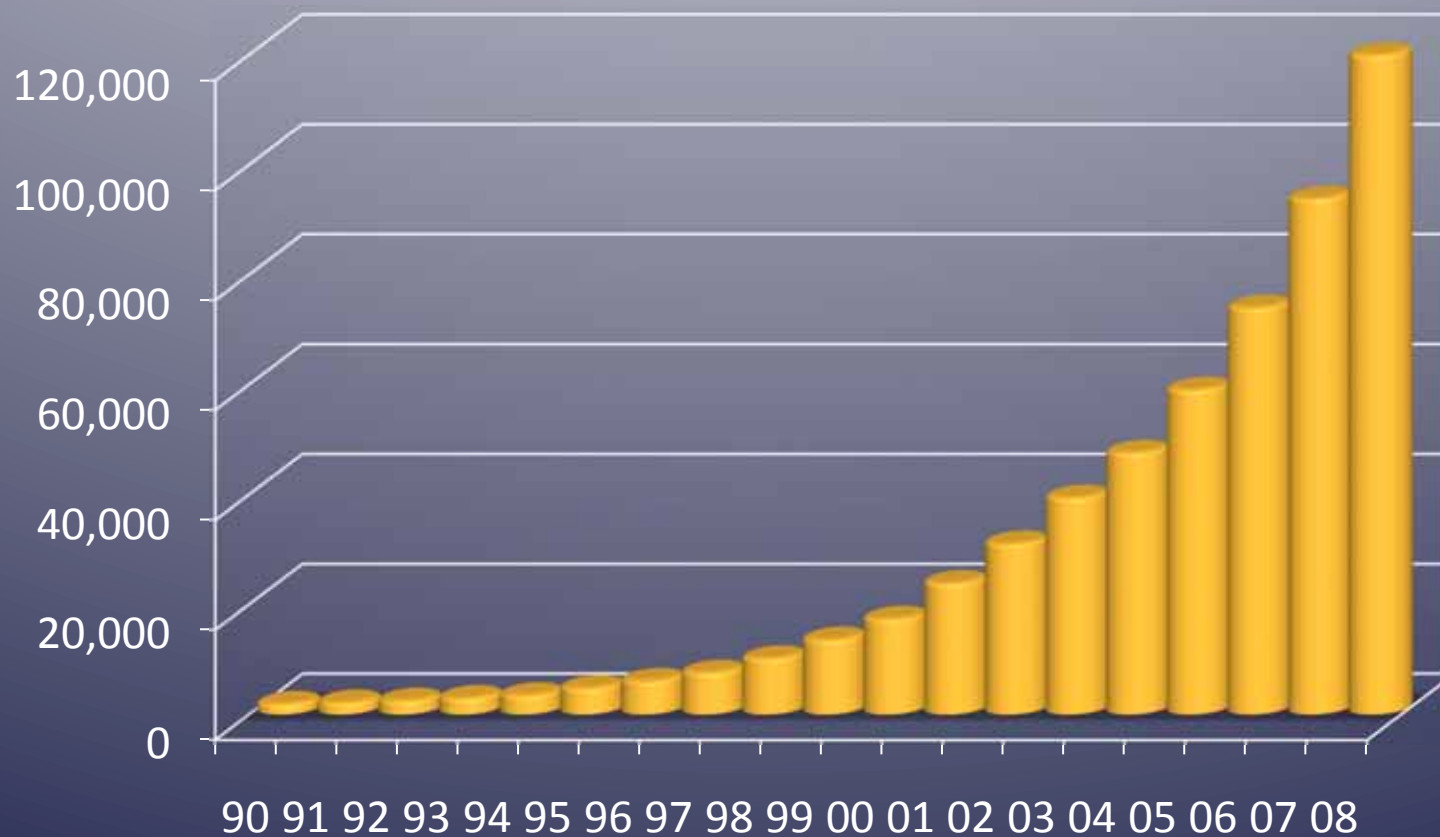
# Canadian Wind Capacity (Cumulative Megawatts Installed)



Wind power installations have grown by rates of 20-30%, both globally and in Canada.

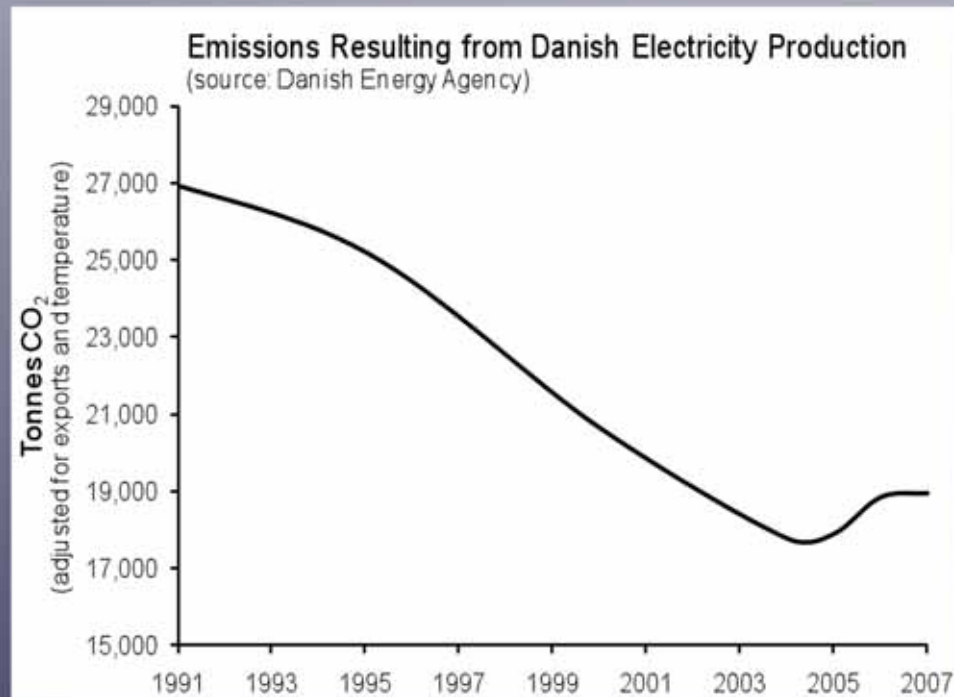


# Global Wind Capacity (Cumulative Megawatts Installed)



Source: Global Wind Energy Council

# Success Story: Denmark



Every year since 2000, Denmark has produced enough electricity from the wind to supply almost one-fifth, or 20% of its national demand.

- From 1991 to 2007, Denmark's reliance on wind power grew from 3% to 19.7% of its total electricity supply.
- In the same period, emissions from electricity production fell 30%, while the country's GDP grew by 45%.

# *Benefits of* WIND POWER



Photo: David Dodge, The Pembina Institute



# 1 ONE:

Creating jobs in project development, construction, maintenance and manufacturing.



Photo: Tim Weis, The Pembina Institute

# 2 TWO:

Stabilizing long-term electricity costs as the wind is not depleted and does not increase in price.



Photo: Chris Severson-Baker, The Pembina Institute

# 3 THREE:

Creating healthier living conditions by reducing air emissions including mercury, sulfur and nitrogen oxides.

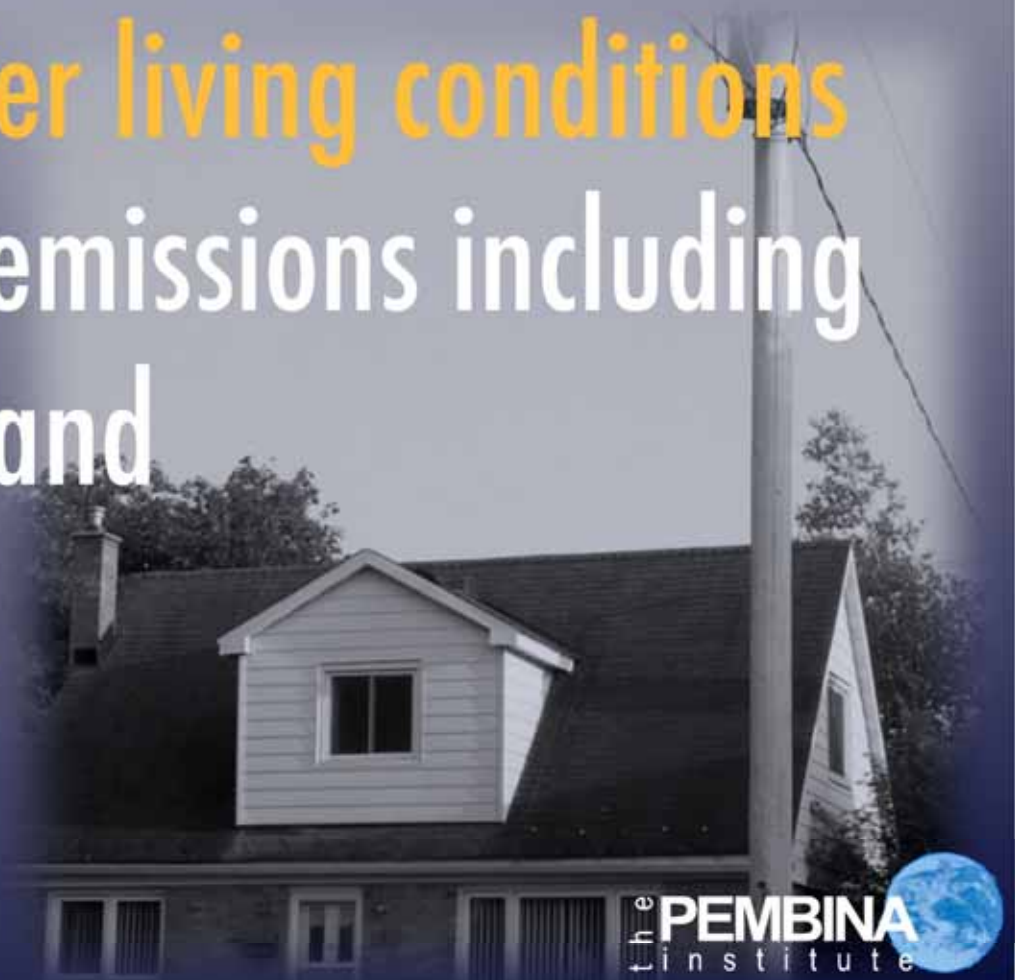


Photo: Tim Weis, The Pembina Institute

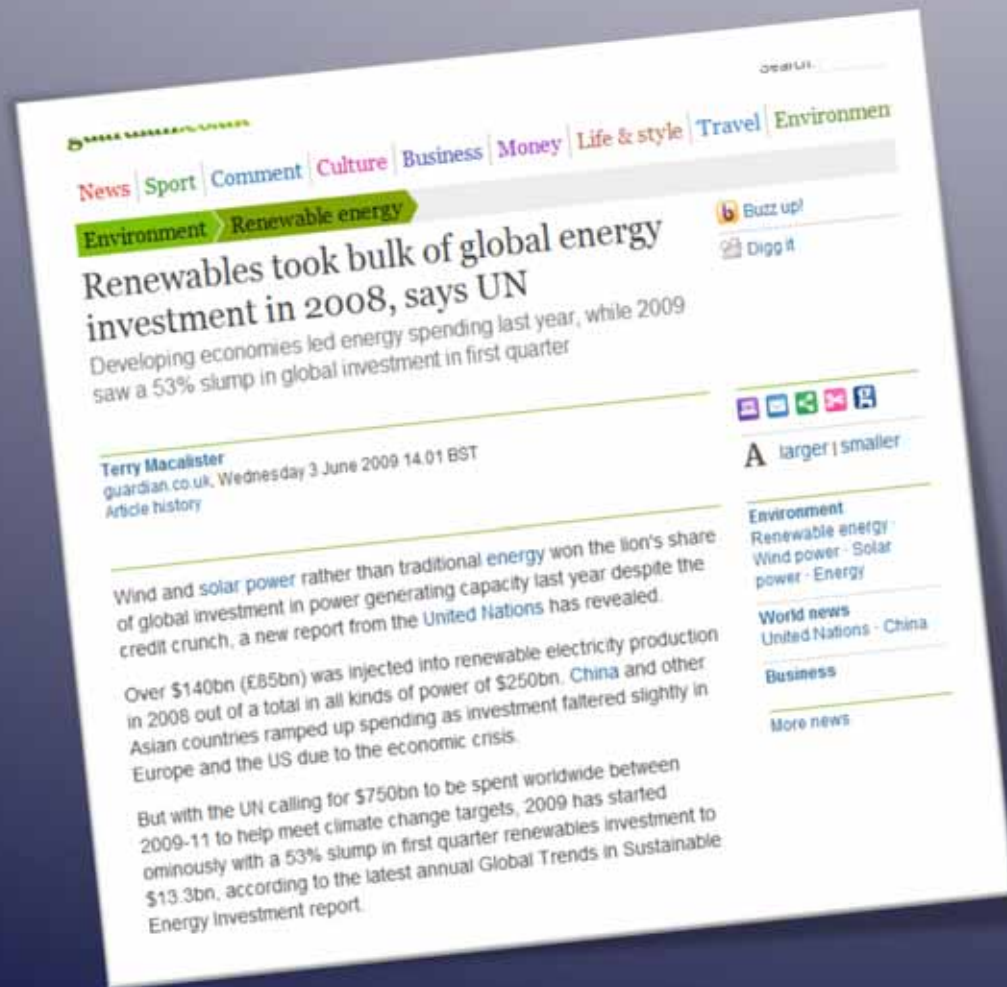


# 4 FOUR:

Not leaving **future generations** with the risk and responsibility of managing wastes from other forms of energy generation.

Photo: David Dodge, The Pembina Institute

# Economy & Environment



## Global Investments in Renewable Electricity

- Approx. 150 billion \$US in 2008
- Wind alone expected to be 1 trillion \$US by 2020

## Wind Energy Jobs (2008)

- United States – 85,000
- Germany – 70,000
- Spain – 60,000
- Canada – 4,500

# Energy Recovery

- It takes about **3,600 MWh** of energy to build a typical wind turbine that will generate roughly 6,000 MWh per year.
- That means the electricity required for manufacturing is **recovered within 7 to 8 months.**

Photo: David Dodge, The Pembina Institute



The New York Times

# Energy Regulatory Chief Says New Coal, Nuclear Plants May Be Unnecessary

By NOELLE STRAUB AND PETER BEHR,  
Published: April 22, 2009



Jon Wellinghoff, the chairman of the Federal Energy Regulatory Commission, said renewables like wind and solar will provide enough energy.

No new nuclear or coal plants may ever be needed in the United States, the chairman of the Federal Energy Regulatory Commission said today.

"We may not need any, ever," Jon Wellinghoff told reporters at a U.S. Energy Association forum.

The FERC chairman's comments go beyond those of other Obama administration officials, who have strongly endorsed greater efficiency and renewables deployment but also say nuclear and fossil energies will continue playing a major role.

Wellinghoff's view also goes beyond the consensus outlook in the electric power industry about future sources of electricity. The industry has assumed that more baseload generation would provide part of an increasing demand for power, along with a rapid deployment of renewable generation, smart grid technologies and demand reduction strategies.

Jay Apt, a professor at Carnegie Mellon University's Electricity Industry Center, expressed skepticism about the feasibility of relying so heavily on renewable energy. "I don't think we're where Chairman Wellinghoff would like us to be," Apt said. "You need firm power to fill in when the wind doesn't blow. There is just no getting around that."

Some combination of more gas- or coal-fired generation, or nuclear power, will be needed, he said. "Demand response can provide a significant buffering of the power fluctuations coming from wind. Interacting widely scattered wind farms cannot provide smooth power."

Wellinghoff said renewables like wind, solar and biomass will provide enough energy to meet baseload capacity and future energy demands. Nuclear and coal plants are too expensive, he added.

"I think baseload capacity is going to become an anachronism," he said. "Baseload capacity really used to only mean in an economic dispatch, which you dispatch first, what would be the cheapest thing to do. Well, ultimately wind's going to be the cheapest thing to do, so you'll dispatch that first."

# ADDRESSING CONCERNS

## *About Wind Development*



Photo: David Dodge, The Pembina Institute

# Noise Impacts of Wind Turbines

Modern, utility-scale turbines are relatively quiet, compared to other sounds people encounter every day.





# Health Concerns

Numerous peer-reviewed scientific studies have concluded that wind farms do not pose a significant risk to human health.

- "Context and Opinion Related to the Health Effects of Noise Generated by Wind Turbines." Agence Française de Sécurité Sanitaire de l'Environnement et du Travail (Affset), 2006.
- "Energy, sustainable development and health." World Health Organisation, 2004.
- Hayes, M. "Low Frequency and Infrasound Immission from Wind Farms and the Potential for Vibro Acoustic Disease" Presentation: 2006.
- Kent, D. "Health impact of wind turbines." Municipality of Chatham-Kent Health & Family Services Public Health Unit. 2008.
- Leventhall, G. "Infrasound from Wind Turbines – Fact, Fiction or Deception?" *Canadian Acoustics*. Vol. 34 No.2, 2006.
- Markandya, A.; Wilkinson, P. "Electricity generation and health." Vol. 370. *The Lancet*. 2007.
- Rodgers, A. "Wind Turbine Acoustic Noise". White Paper, University of Massachusetts at Amherst, 2006.


# “No Direct Adverse Effects”

In December 2009, after conducting the most extensive scientific review to date, an international panel of scientists, doctors and environmental experts concluded that:

- There is nothing unique about the sounds and vibrations emitted by wind turbines.
- The body of accumulated knowledge about sound and health is substantial.
- The body of accumulated knowledge provides **no evidence** that the audible or subaudible sounds emitted by wind turbines have **any direct adverse physiological effects.**

Source: Colby, David W. et al. “Wind Turbine Sound and Health Effects.” Dec. 2009.



A young girl with brown hair, wearing a blue tank top and grey sweatpants, is jumping joyfully with her arms raised in the air. She is standing on a gravel path in a field of golden-brown grass. In the background, several white wind turbines are visible against a blue sky with scattered white clouds. The scene is bright and sunny.

“Opposition to wind farms on the basis of potential adverse health consequences is not justified by the evidence.”

- Dr. David Colby, acting medical officer of health for Chatham-Kent

# Property Values



- A 2003 study of 25,000 property sales within five miles of wind farms found *“no evidence supporting the claim that views of wind farms decrease property values”*\*
- In fact, property values increased 18% faster within the view shed of wind turbines than outside of it.

*\*Note: A 2009 study by Lawrence Berkeley National Laboratory reached similar conclusions.*

(Source: Sterzinger, Beck, Kostiuik: May 2003 Analytic Report.)



# Ecological Concerns

Wind power has the **least impact** on wildlife, compared to coal, oil, natural gas, nuclear and hydro power generation.

(Source: New York State Energy Research and Development)

# Bats and Birds

- On average, just **two birds** are killed by turbines in North America each year, compared to 10,000 killed by collisions with office towers in Toronto each year.
- Bats typically are not harmed by wind turbines, but they have been adversely affected at a few sites.
- Early tests have found that shutting down wind turbines for a few hours a week at certain wind speeds and times of night has **reduced fatalities by more than 50%**.

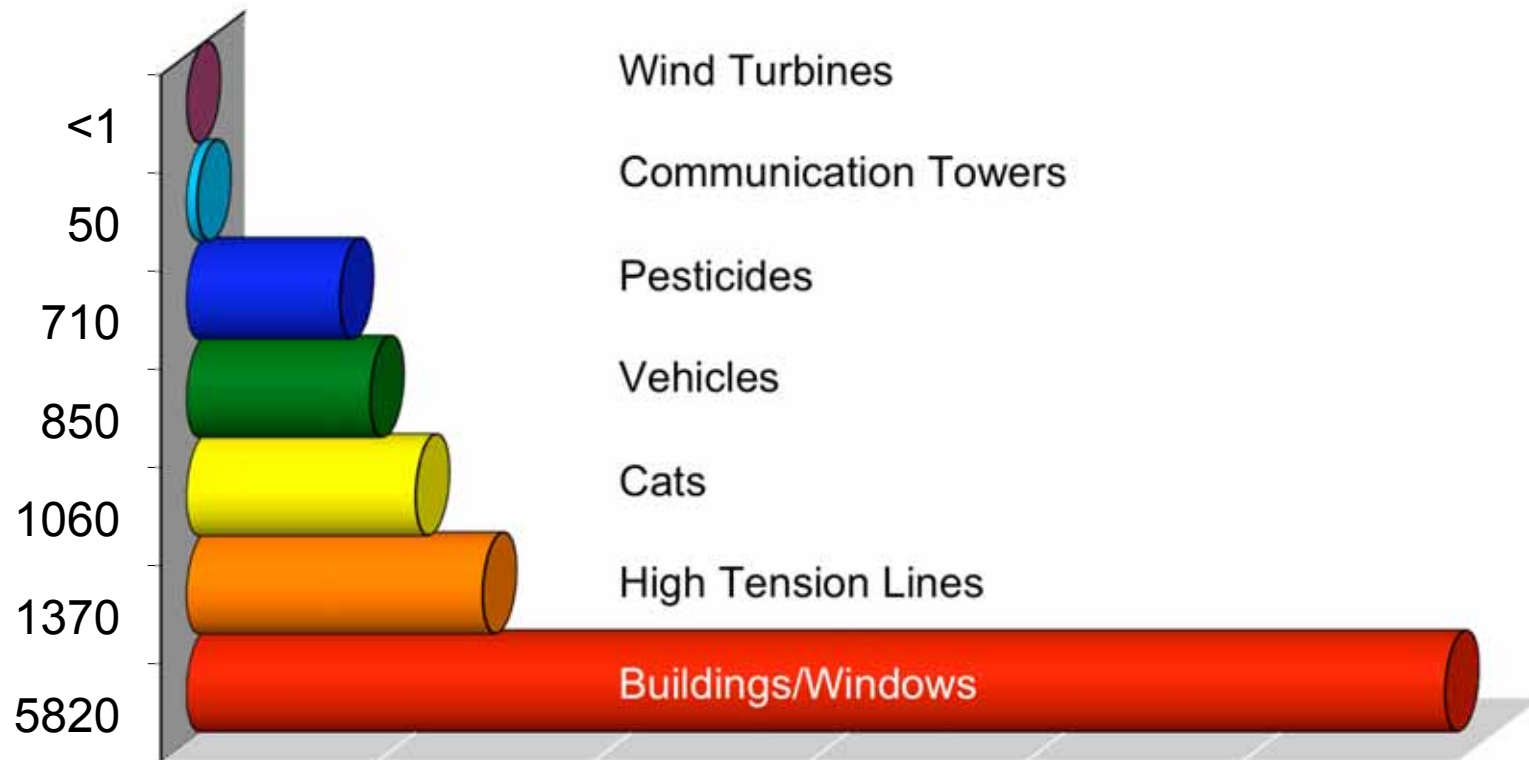


Source: Erickson, et al.

Photo: Courtesy Lucas Gomes, 2007.

# Causes of Human Related Bird Fatalities

Number per 10,000 Fatalities



[1] Environmental Bioindicators Foundation Inc. and Pandion Systems Inc., *Comparison of Reported Effects and Risks to Vertebrate Wildlife from Six Electricity Generation Types in the New York/New England Region*, Prepared for New York State Energy Research and Development Authority, March 2009.



# Reliability of Wind Power

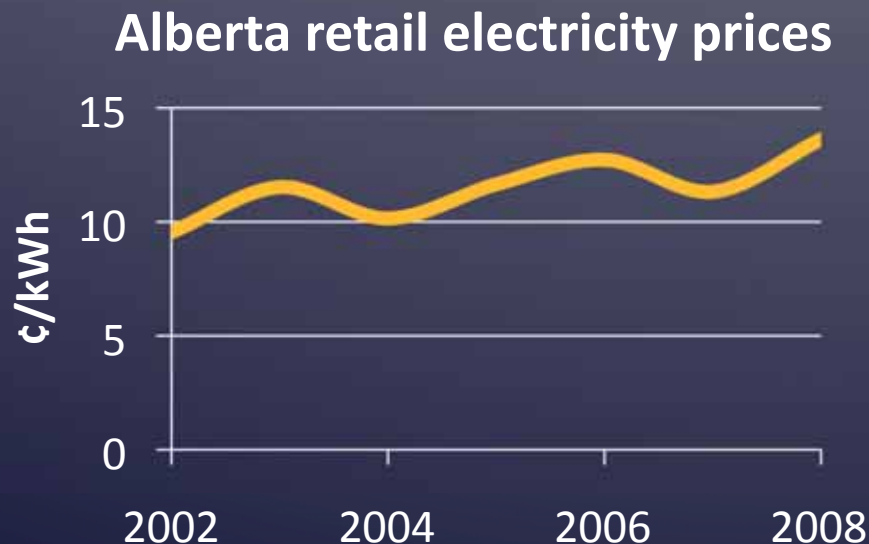
- Natural variations in wind supply are dwarfed by the normal fluctuations in the electrical system that are caused, for instance, when consumers turn appliances on or off.
- Variations in the output from wind turbines can be predicted and balanced by grid operators using complementary energy sources.

Photo: Tim Weis, The Pembina Institute



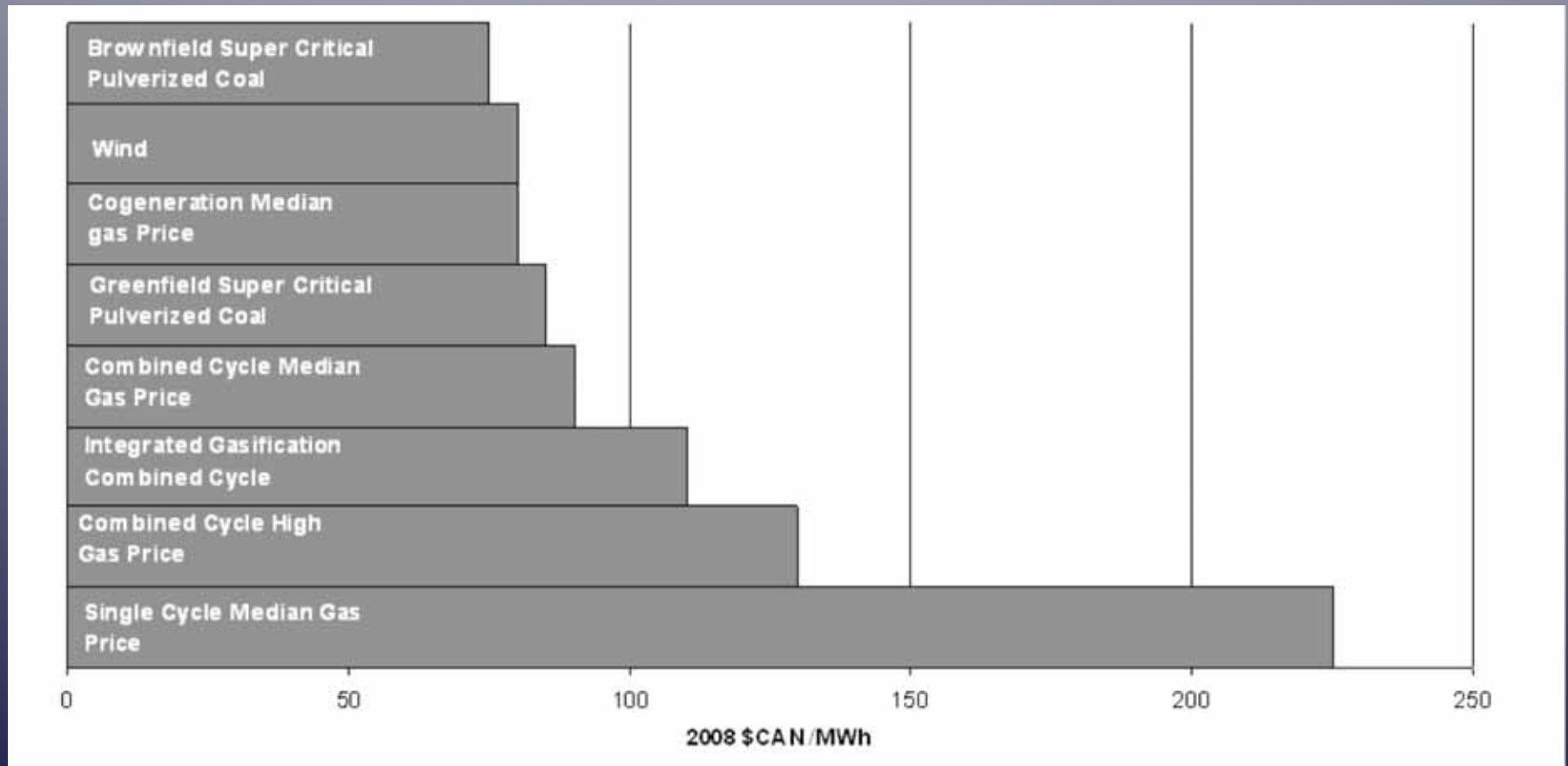
# Counting the Cost

- Onshore wind power currently costs 8-12 ¢/kWh (depending on how windy the site is and how far it is from existing transmission lines).
- Once installed, the cost of generating wind power remains steady for decades into the future.



- Polluters will soon have to pay for their pollution, meaning that the cost of power from fossil fuels will continue to rise, on top of normal market fluctuations.

# Cost Estimates of Select Technologies in Alberta



Source: Alberta Electric System Operator (based on 2008 market prices)



LOOKING  
*to the*  
FUTURE

Photo: David Dodge, The Pembina Institute

the **PEMBINA**  
Institute   
Sustainable Energy Solutions

# Capacity for Growth

- A 2006 General Electric study for the Ontario Power Authority found that the province could increase its wind capacity over 10 times its 2009 levels without major infrastructure upgrades.
- Germany has achieved more than 15% renewable power at an extra cost of about \$2.50 per month, per home.



# Integrating Wind: Denmark

*“We said that the electricity system could not function if wind power increased above 500 MW. Now [2003] we are handling almost 5 times as much. And I would like to tell the government that **we are ready to handle even more...**”*

*- Western Danish system operator ELTRA*

*In an average year...* a single wind turbine (1.8 MW) will produce 6,000 MWh of electricity, or **enough power for more than 750 Canadian homes**. Using this wind turbine rather than burning coal to produce electricity will **leave 2,700 tonnes of coal in the ground** and reduce greenhouse gas emissions by 6,000 tonnes annually. That's equivalent to **taking 1,260 cars off the road or planting 30,000 trees**.

Photo: David Dodge, The Pembina Institute



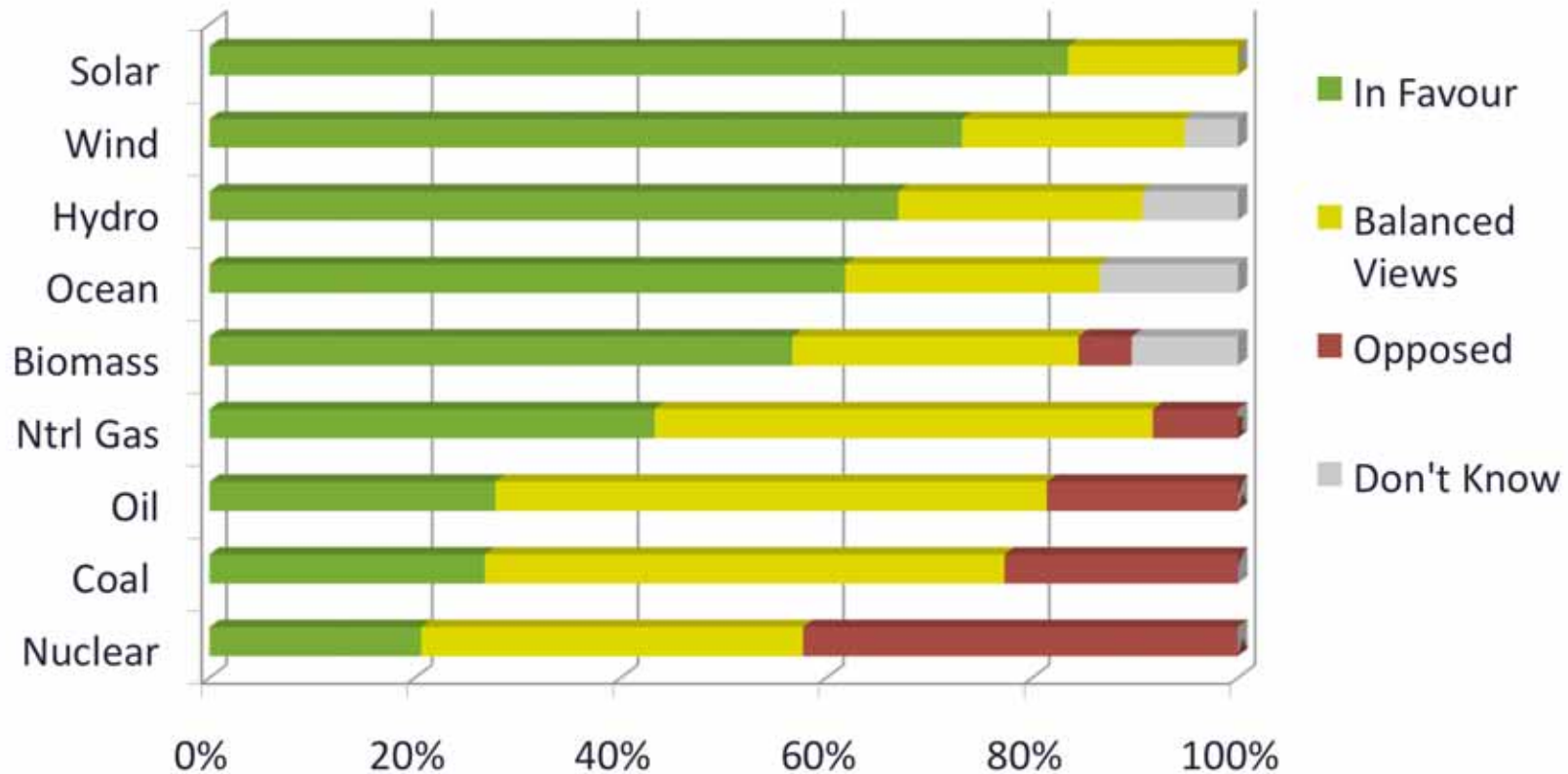
# Eye of the Beholder

- Not everyone sees wind turbines as attractive features on the landscape, but surveys have found that **support for wind farms increases the closer a community is to a project.**
- Widespread consultation and engagement with communities, experts and other stakeholders remains the key to choosing appropriate locations for future wind projects.



Photo: Tim Weis, The Pembina Institute

## Attitudes Toward Energy Sources in the EU



Nowhere is wind power more prominent on the landscape or in closer proximity to people than in Europe, where polls show very strong public support. (Source: European Commission, 2007)



# Inform yourself!

## FIND:

Videos, fact sheets, reports and summaries of the latest research on wind and other renewable energy sources at [re.pembina.org](http://re.pembina.org).

## CONTACT:

Tim Weis, Director of Renewable Energy for the Pembina Institute – [timw@pembina.org](mailto:timw@pembina.org)

## VISIT:

- Canadian Wind Energy Association (CANWEA) - [www.canwea.ca](http://www.canwea.ca)
- Ontario Green Energy Act - [www.ontariogreenenergyact.ca](http://www.ontariogreenenergyact.ca)
- Ontario Power Authority – [www.powerauthority.on.ca/FIT](http://www.powerauthority.on.ca/FIT)
- Risø laboratories, Denmark - [www.risoe.dk](http://www.risoe.dk)