Wind Power Takes Flight

March, 2007

Manitoba Wind

- WindFarms - Why Wind?
- Global, North American and Manitoba Perspective
- The Benefits and Challenges
- What is happening in Manitoba
- Summary

Why Wind?

- Large scale wind power generation is one of the most competitive forms of renewable energy
- Trend for industrialized countries to reduce emissions
- Provides diversity for our hydro generated electricity
- Security of energy supply

What are the factors influencing a wind farm?

- **Quality of wind resource**
  - Average wind speeds
  - Capacity factor
- **Economies of scale**
  - Larger projects generally have more favourable economics
- **Technology**
  - Cost of wind has dropped 50% in 15 years

Factors…

- **Cost of competing generation**
  - Manitoba has the lowest hydro rates in N.A.
- **Transmission capabilities**
  - Need to transmit and distribute the energy
- **Environmental considerations**
  - Emission reductions
  - Clean Air
  - Lower CO_2

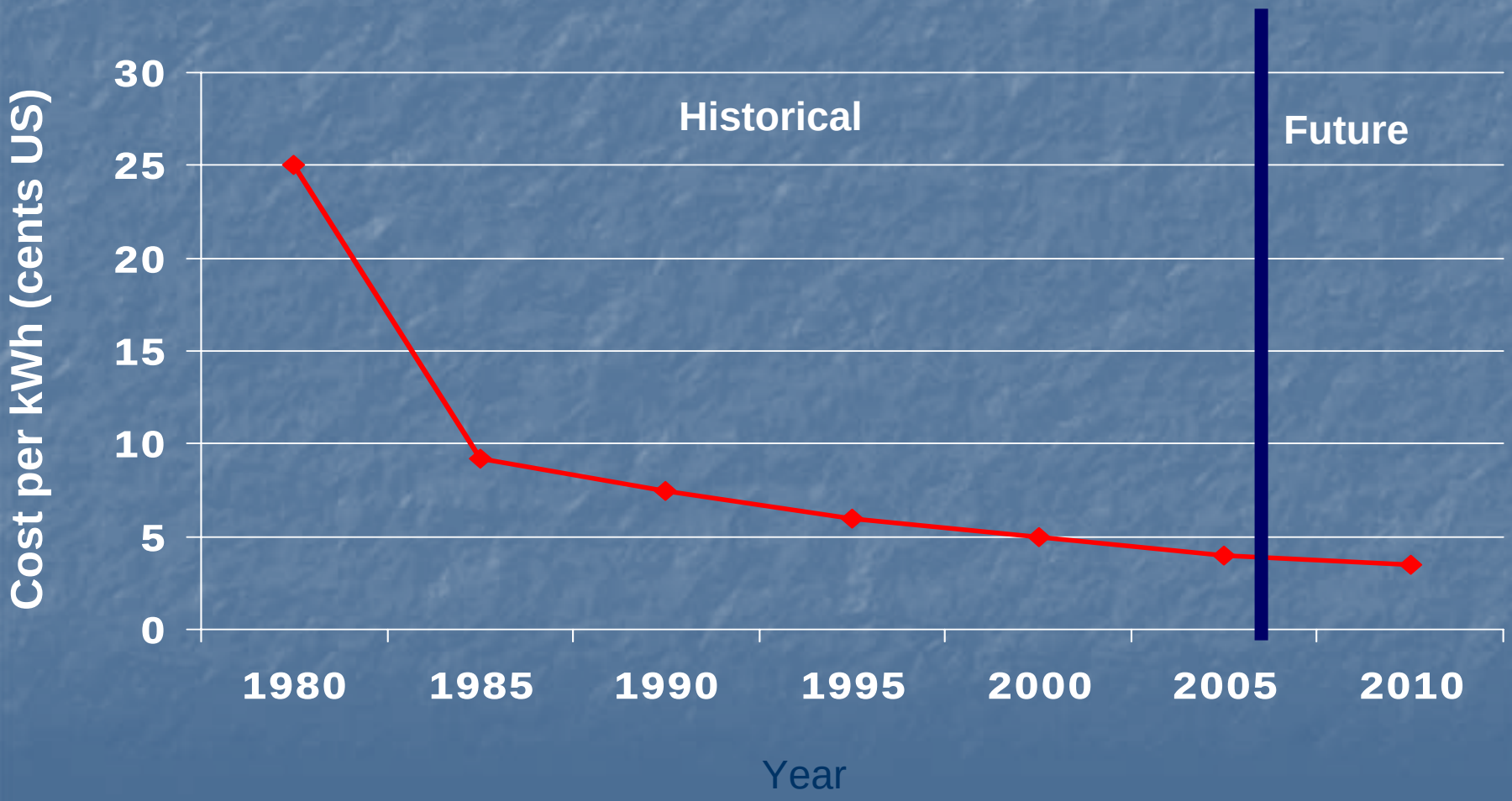
…and wind and hydro generation are very complementary

- Wind is intermittent
- Wind requires to be firmed and shaped
- Hydro reservoirs provide storage for generating power when the wind is blowing

From a global perspective...

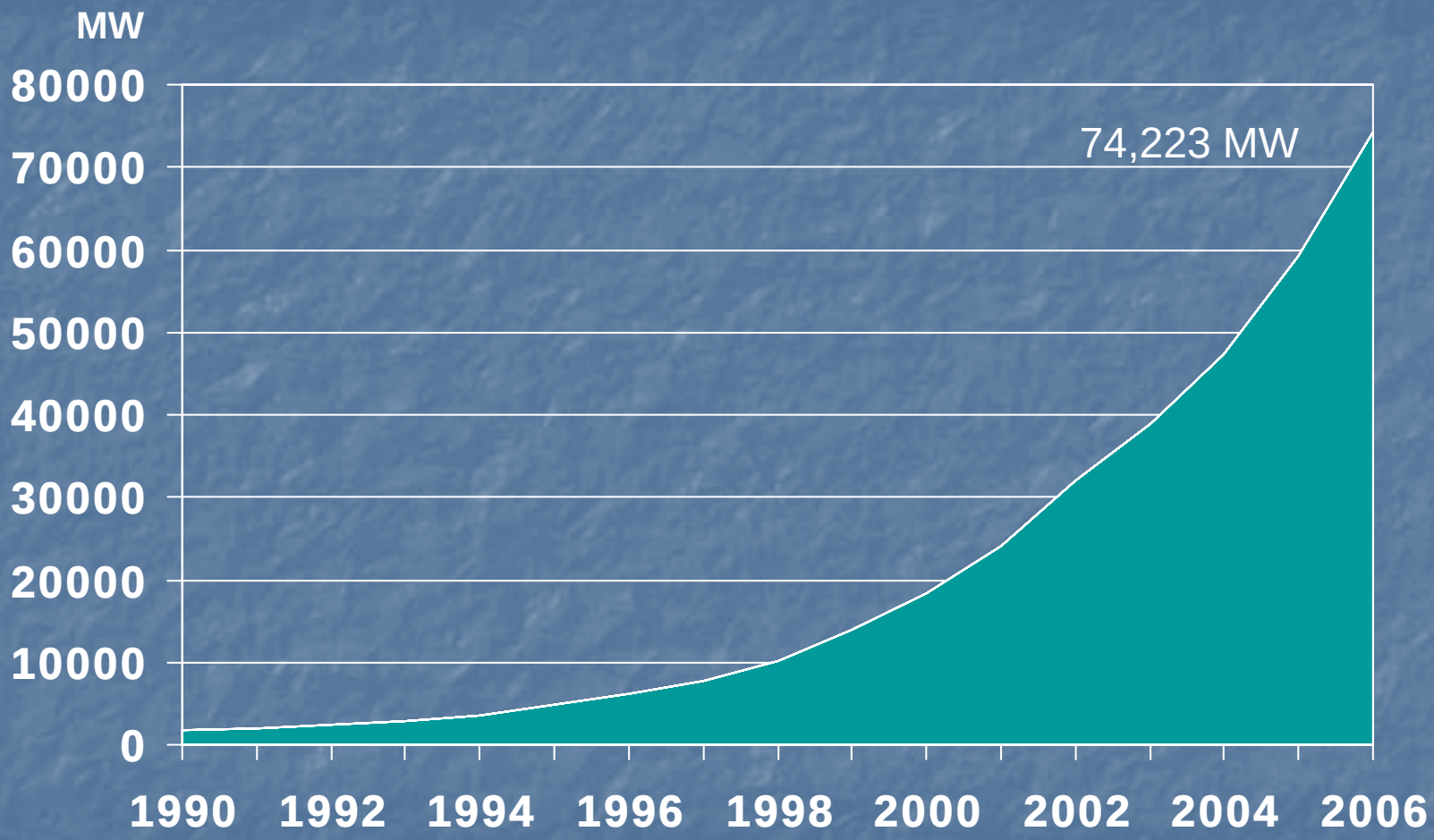
- Wind is the fastest growing energy source – 25-30% over last 10 years
- U.S. $23 billion annual sales
- Employs over 150,000
- 85,000 turbines installed in over 50 countries
- Over 74,000 MW of installed capacity meeting the needs of 31 million households

Improvements in technology and larger turbines are driving down costs (over 50% in the last 15 years!)



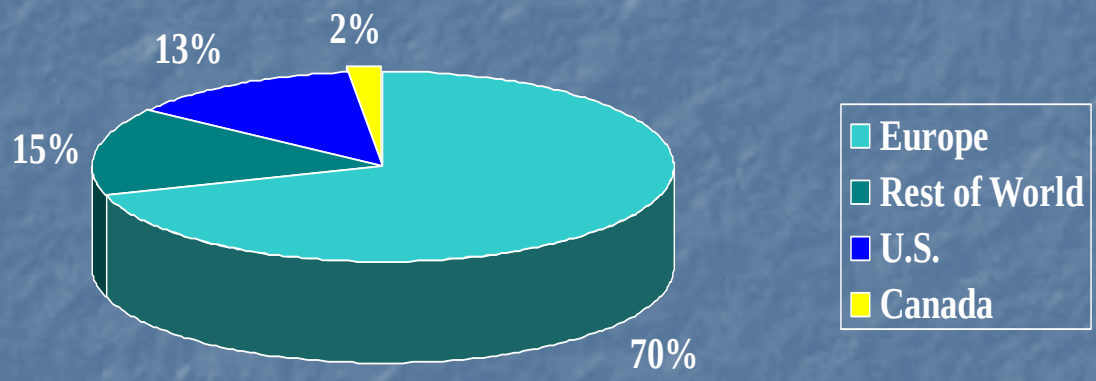
In fact, modern wind turbines have blades larger than the wings of a Boeing 747!

And as wind becomes more competitive, more is installed



Source: GWEC, CanWEA 2007

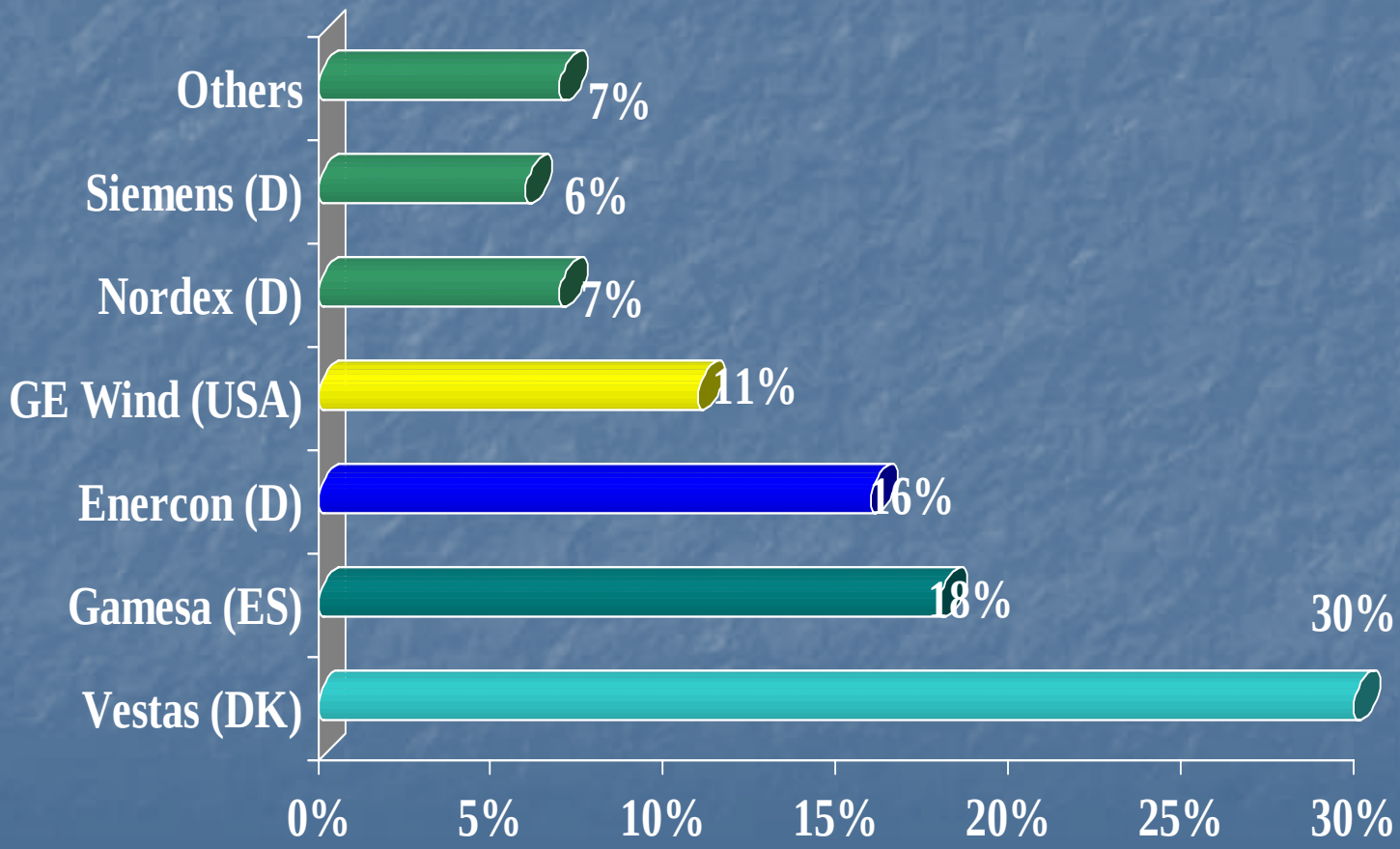
Europe has 65-% of the worlds installed wind capacity, but Canada has about 50,000 MW of developable wind power



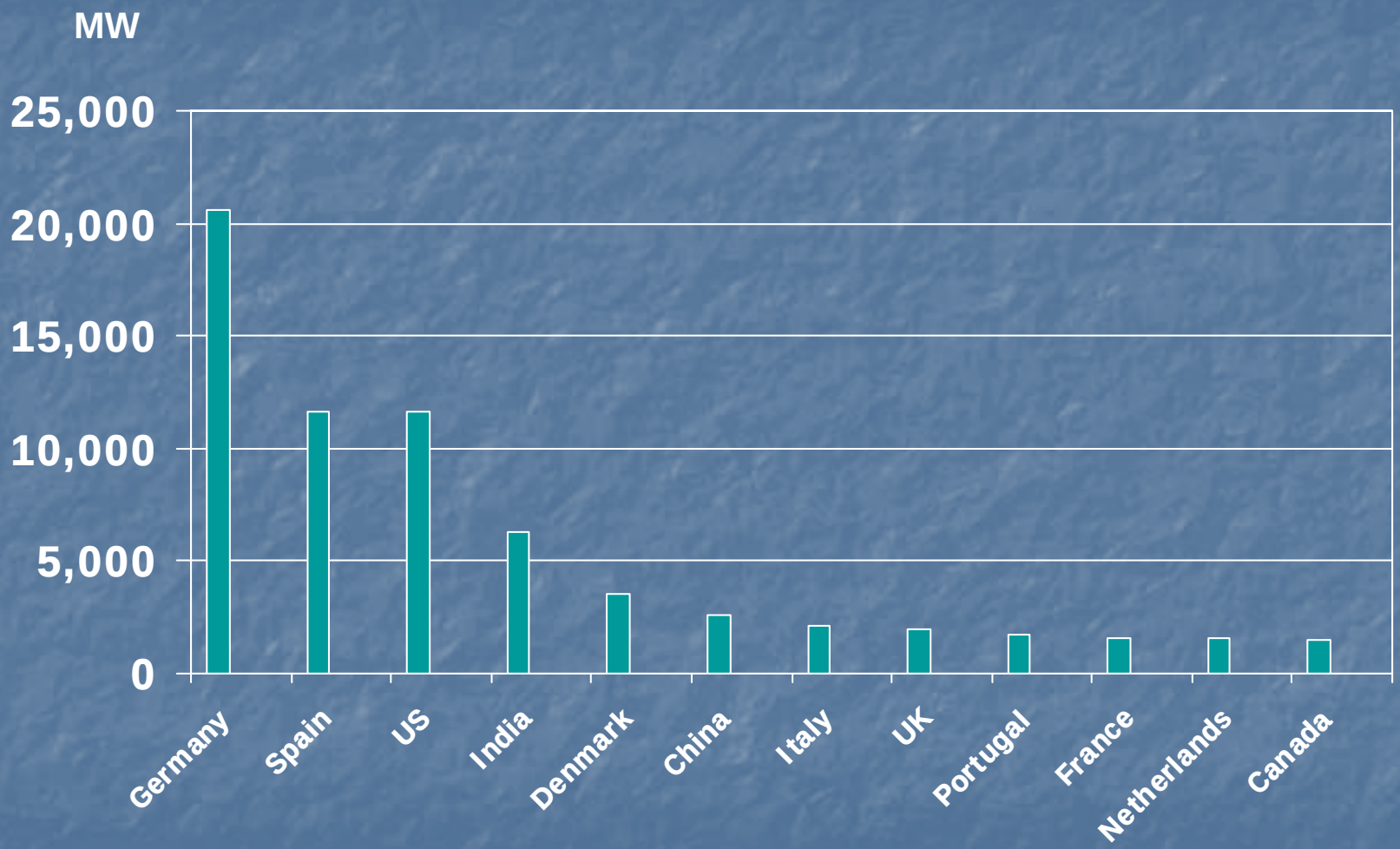
- Manitoba Hydro has 5,000 MW of capacity
- Canada has over 1,460 MW of installed Wind Capacity

Source: GWEC, 2007

As a result, about 75- 80% of the manufacturing is in Europe



But Canada is becoming a world leader in total installed wind capacity



Source: CanWEA 2007

To help grow the industry in Canada, the Federal Government Supports Wind through the ecoENERGY for Renewable Power program (Wind Power Production Incentive (WPPI))

- Announced in the January 2007 budget
- Available to electricity producers for the first ten years of a project
- Designed to support roughly 3000 MW of Wind Power
- Eligible recipients will receive 1 cent / kWh of production over ten years

A wind turbine includes

- **Rotor**
  - a hub with 3 blades that converts wind energy into shaft energy
- **Nacelle**
  - contains drive train, gearbox & generator
- **Tower**
  - supports nacelle and is 80 meters high
- **Electronic Controls**

A 100 MW windfarm is made of a series of turbines

- Turbines are typically 1.5 – 2.5 MW
- 100 MW windfarm would have about 40-75 turbines & would occupy about 25 sections of land (25 square miles)
- Wind turbines typically require a minimum wind speed of 12 - 14 km / hour to generate electricity

Windfarm Development has 2 Phases

- Pre Development phase includes:
  - community consultation
  - selecting the site
  - assessing the wind
  - securing the land (land lease agreements with options)
  - environmental licensing process
  - regulatory approvals and permits
  - Initial economic analysis

Windfarm Development has 2 Phases

- Development phase includes:
  - transmission studies
  - interconnection designs and agreements
  - Power Purchase Agreements
  - systems engineering
  - geotechnical studies
  - turbine selection and procurement
  - finalizing project economics
  - construction contracting
  - financial close

Some of the benefits include

- Minimal impact on the land
- Minimal impact on local plants and animals
- Well received by rural communities and is compatible with farming sector

Additional benefits include

- Offers significant annual revenues to land owners
- Contributes to a municipality's tax base
- Environmental Benefits

Additional benefits include jobs

- **A 100 MW wind farm with a capital investment of over $200 million will create**
  - 280 person years of employment during the construction phase
  - 30 additional ongoing positions to support and maintain the equipment

Source: Manitoba Bureau of Statistics

So what are the challenges?

- **Wind must be cost effective**
  - Manitoba Hydro currently offers one of the lowest electricity rates in North America
- **Wind is intermittent**
  - And in most case be firmed and shaped by the main source of generation

Challenges…

- **Imported Technology**
  - Local content is limited because turbine manufacturing is concentrated in Europe
- **Transmission**
  - Limits the amount of generation that can be integrated into the system

What is happening in Manitoba?

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- The St Leon Project
- 99 MW project is built with 63 Vestas 1.65 MW turbines
- Over $200 million in capital investment
- Produce 370.4 gigawatt hours of electricity
  - enough to supply energy to 35,000 homes
- Project could displace 370,000 tonnes of CO2 from thermal coal plants

What is happening in Manitoba?

- About $30 million in federal support through WPPI
- $15 million in property taxes
- $14 million in provincial income tax
- $5 million in capital tax
- $12 million in provincial sales tax

What is happening in Manitoba?

- And local landowners with turbines and right of ways on their properties will receive annual payments of $10 million over 25 years
- The project is owned by Algonquin Power Income Fund

What is happening in Manitoba?

- Over 50 met towers up or being erected monitoring wind throughout SW Manitoba and the Interlake
- There are over 40 proponents actively developing projects
- These represent about 10,000 MW of potential projects

Source: EOI Responses,
March 10, 2006

What is happening in Manitoba?

- The Province and Manitoba Hydro have announced that a RFP for 300 MW will be going out this winter
- Three further allocations of 200 MW each are targeted for 2013 – 2018

What is happening in Manitoba continued…

- Future phases of Manitoba's wind strategy will include community based wind projects
- Energy Development Initiative is currently working on a policy for community projects which may include a couple of small community pilot projects

To Sum it up!

- Wind is one of the most competitive forms of renewable energy
- The sector is a growth industry
- Manitoba has a world class resource
- Manitoba Hydro has very good firming and shaping capabilities and very good transmission capabilities
- Manitoba is well positioned to be a global leader in wind generation