

# Wind Generation Activities and Issues

Presentation to the

## Wind Power Standing Committee

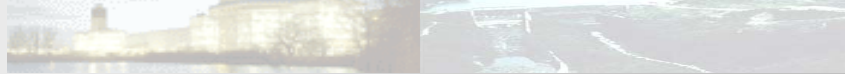
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Ontario Ministry of Energy

# Quick Facts

- ◆ 12.7 million people, 4.2 million electricity customers
- ◆ Total electricity market: \$14 billion/160 TWh
- ◆ Market about 1/2 the size of California
- ◆ 31,000 + MW installed capacity
- ◆ 27,005 MW all time peak usage (August 2006)
- ◆ 4,000 MW import capability
  - Manitoba, Quebec, Michigan, New York & Minnesota
- ◆ Additional 1,250 MW from Quebec being developed, discussions with Manitoba
- ◆ 29,000 km of transmission lines
- ◆ Over 140,000 km of distribution lines
- ◆ Over 300 market participants
- ◆ Local Distribution Utilities





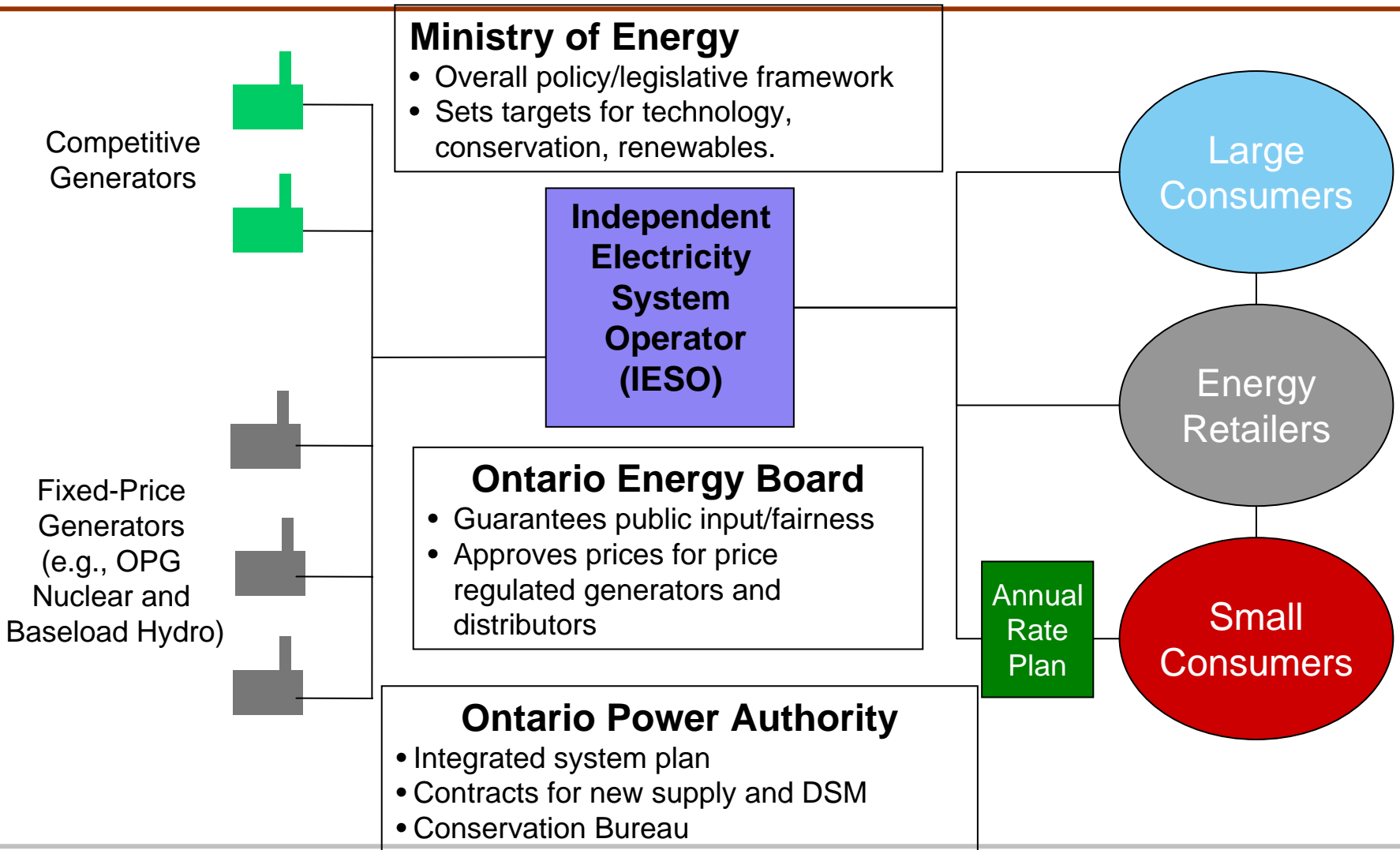
## Environmental and Health Drivers for New Renewable and Clean Supply

- **Climate Change**
  - **GHGs**
- **Air Emissions:**
  - **NO<sub>x</sub>, SO<sub>2</sub>, Mercury, Particulates**

# Ontario's Evolving Electricity Sector: Trends

- ◆ From monopoly to competitive market
- ◆ From vertical to horizontal structure
- ◆ From reliance on coal to reduction of CO<sub>2</sub> and shift to renewable and gas-fired generation
- ◆ Renewable energy a critical part of the new electricity picture in Ontario

# New Structure for Electricity Supply



# Government Commitments

- ◆ The following commitments are the primary drivers for new renewable energy:
  - Shut down coal-fired generation in the province for environmental and health protection
  - Five per cent (1,350 megawatts) of generating capacity from new renewable sources by 2007; ten per cent (2,700 megawatts) new renewable generation by 2010
  - Over 7800 new renewable megawatts by 2025
  - Other new generation to be from clean sources such as natural gas, surplus energy streams

# Chronology of Actions

- ◆ Wind Power Task Force
- ◆ Initiated inter-ministry and inter-agency issues groups
  - Streamlined EA and connection processes
  - Municipal education
  - Tax assessments and incentives
- ◆ New government targets and timelines
- ◆ Renewable RFPs I and II
  - Targeted to available transmission, approvals in hand/underway
- ◆ Creation of the OPA as procurement agency
  - IPSP
  - RESOP
  - RES III competitive procurements
- ◆ Managing issues created by existing procurements and planning to deliver IPSP

# Renewable Energy RFP I

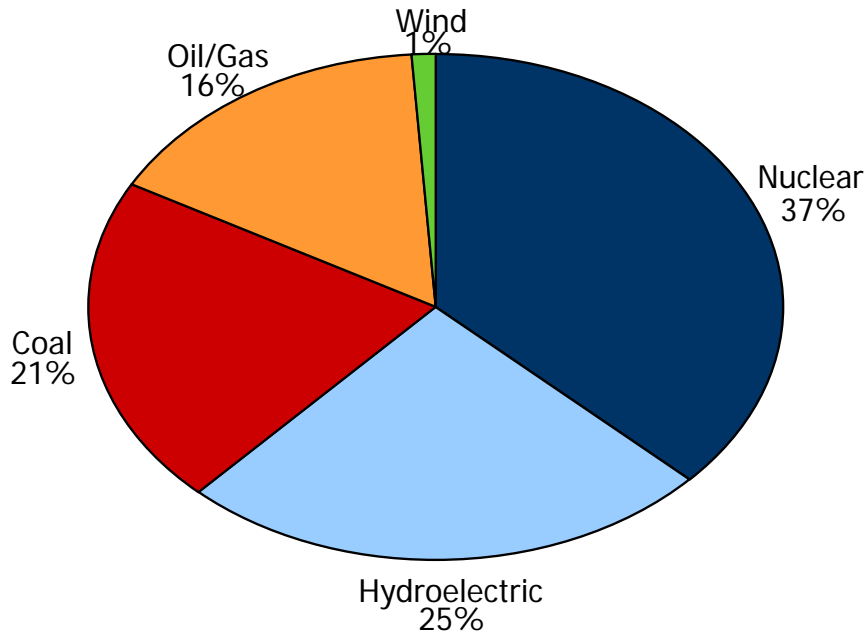
- ◆ Target total: 300 megawatts, **maximum project size 100 MW, no minimum**
- ◆ **Results: 10 contracted projects – 395 MW of renewable energy**
  - 355 MW wind (5 projects), 40 to 99 MW
  - 31 MW water (2 projects), 8 and 23 MW
  - 9 MW landfill gas/biogas (3 projects), 1.6 to 5 MW
- ◆ Status:
  - 8 of 9 remaining projects have reached commercial operation
  - 322 MW of total 345 MW on-line
  - 1 project (49.5 MW) was terminated due to municipal approvals difficulties

# Renewable Energy RFP II

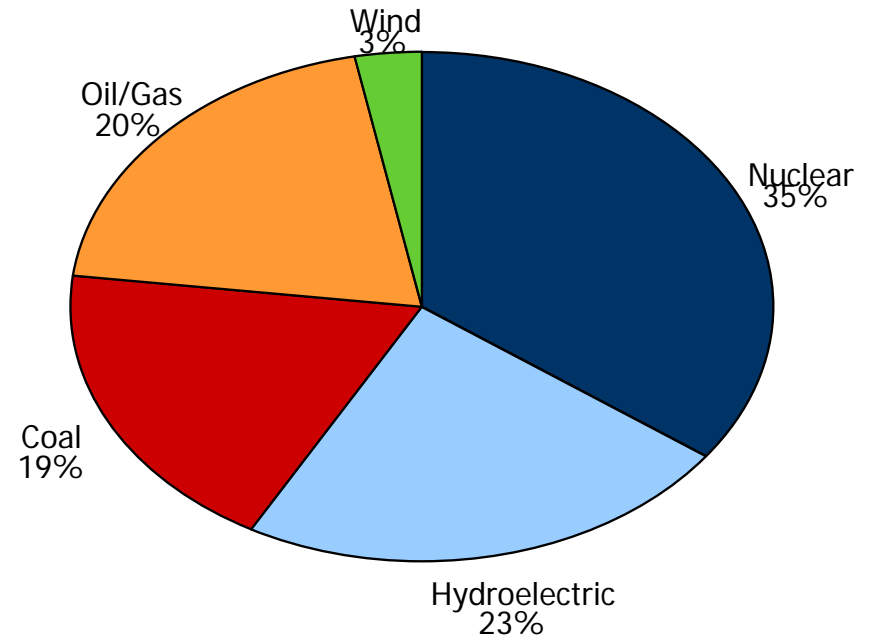
- ◆ Target: 1000 megawatts (for projects between 20 MW and 200 MW)
  
- ◆ Results: 9 successful projects – 957 MW of renewable energy
  - 937 MW wind (8 projects)
  - 20 MW water (1 projects)
  
- ◆ Status:
  - 2 projects online; 3 under construction
  - 4 projects working on environmental/municipal approvals
  - 166 MW of 957 MW on-line

# Wind in Ontario's Supply Mix

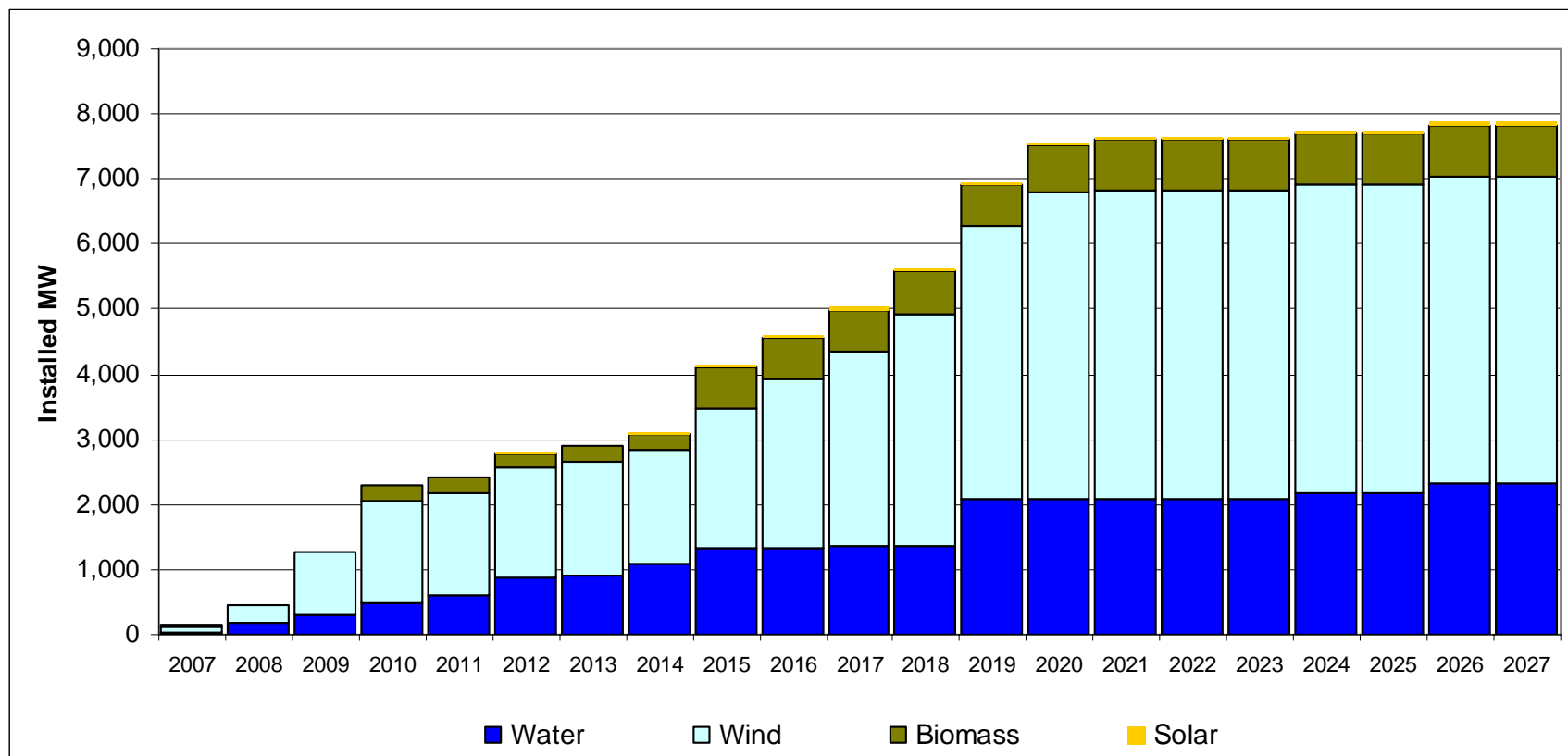
2007



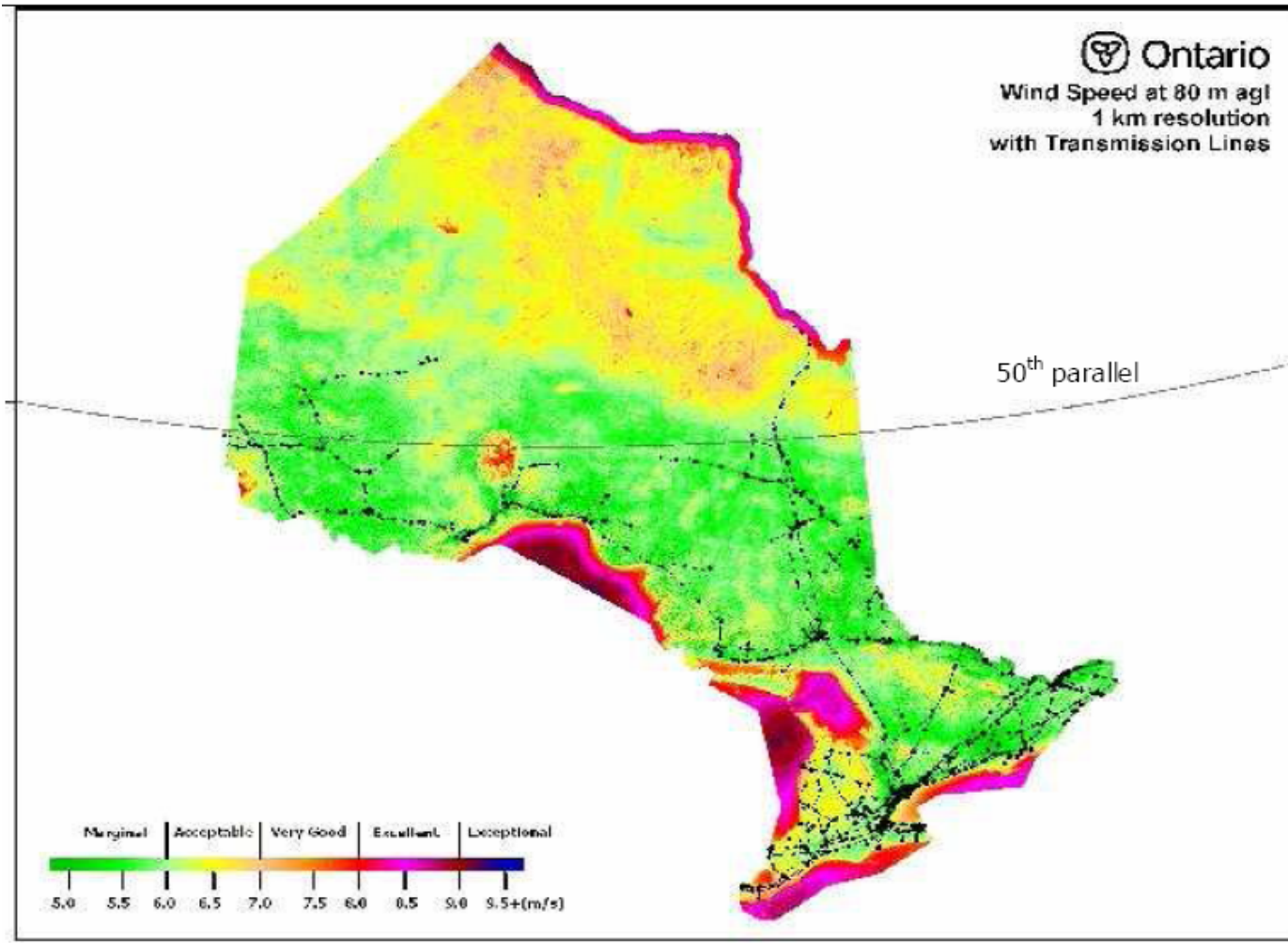
End of 2008



# Renewable Resources 2007-2027

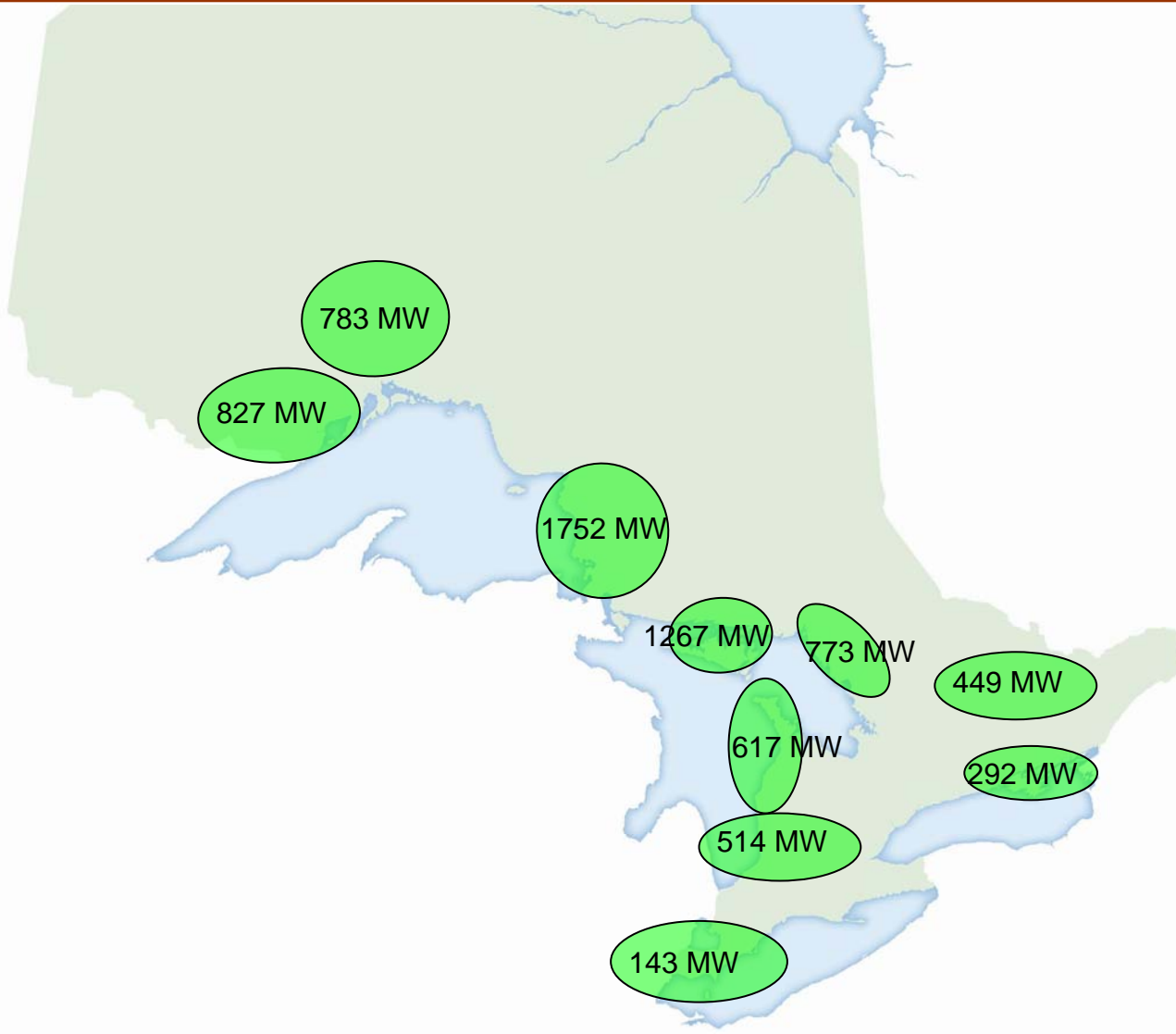


# Wind Resources



Source: MNR

# Wind Power Potential (Onshore)

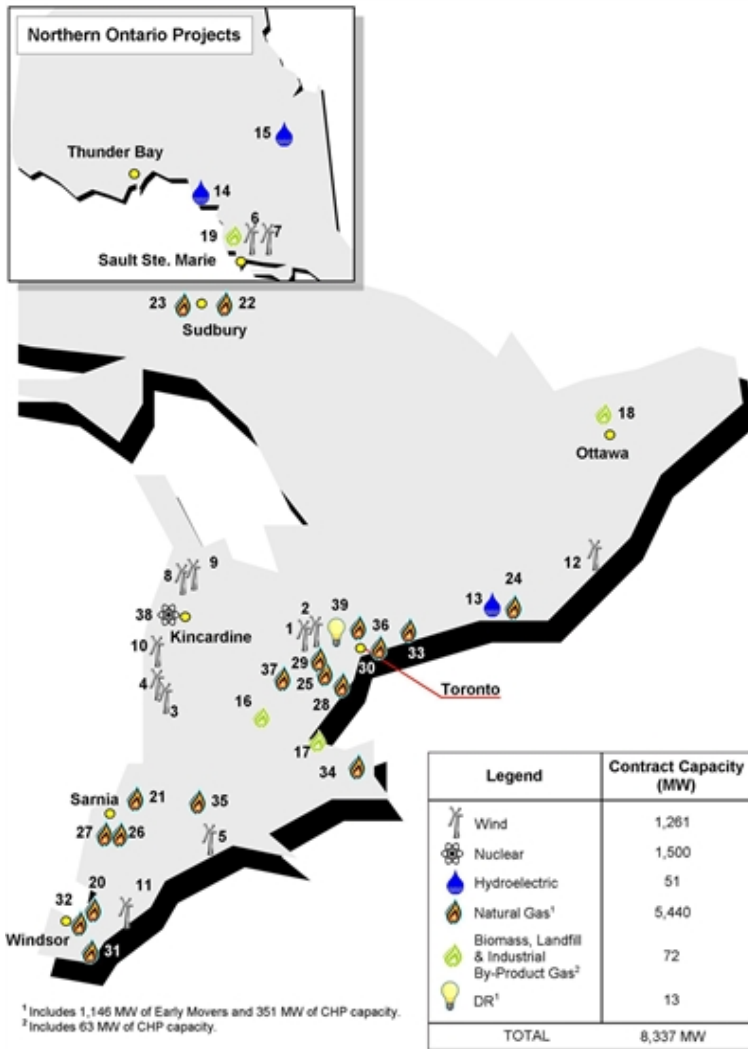


## Renewable Energy Standard Offer Program (RESOP)



- ◆ Program Launch: November 2006
- ◆ 313 executed contracts to date, totaling 1,300 MW of renewable energy
- ◆ Breakdown by technology:
  - Wind – 748 MW
  - Solar – 420 MW
  - Bio Energy – 67 MW
  - Water – 66 MW

# Location of Contracted Projects



Delivery by Date and Technology Type for OPA Managed Contracts								
Technology		2005 Total	2006 Total	2007 YTD	2007 Planned	2008 Planned	2009 Planned	2010 Planned
	Wind		395.1		76.0	789.4		
	Hydroelectric	8.0				23.0	20.0	
	Biomass, Landfill and Industrial By-Product Gas	2.5	1.6		5.0		63.0	
	Natural Gas		1,236.0		485.0	1,940.8	942.0	836.4
	Bruce A Units 1 & 2 Refurbishment						750.0	750.0
	Demand Response		13.0					
<b>Total (MW)</b>		<b>11</b>	<b>1,646</b>		<b>566</b>	<b>2,753</b>	<b>1,775</b>	<b>1,586</b>
<b>Cumulative Total (MW)</b>		<b>11</b>	<b>1,656</b>	<b>1,656</b>	<b>2,222</b>	<b>4,975</b>	<b>6,750</b>	<b>8,337</b>

## Other Government Policies to Help Renewable and Clean Power

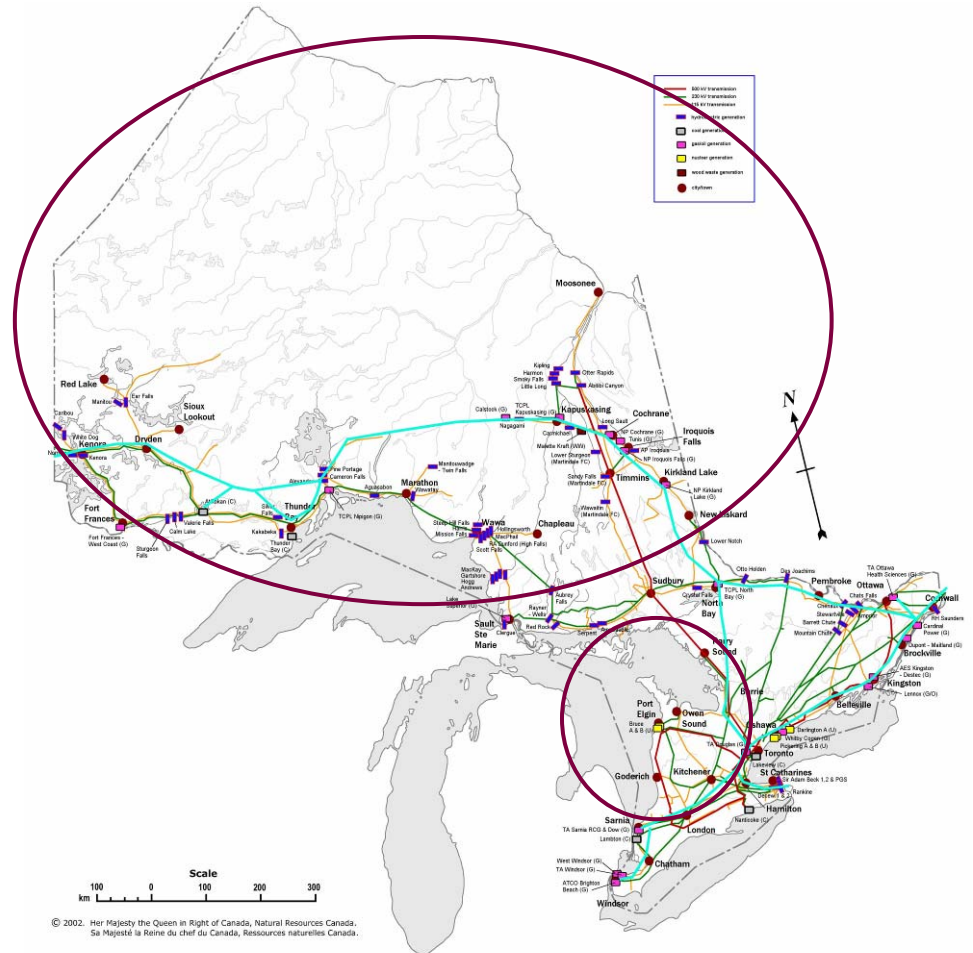
- ◆ Tax incentives – accelerated write-off, revenue holidays - MOF
- ◆ Streamlined environmental review – MOE
- ◆ Grid and distribution connection standards and streamlined connection assessment processes – IESO, OEB, Hydro One
- ◆ Crown land availability and disposition processes – MNR for wind and water
- ◆ Resource mapping – MNR for wind and water
- ◆ Construction standards for energy projects – MAH (wind towers)
- ◆ Zoning guidance for municipalities – MAH
- ◆ Guide for small wind project development – OMAF
- ◆ Emissions trading for NO<sub>x</sub> and SO<sub>x</sub> reduction credits

# Challenges to Further Wind Development

- ◆ Transmission/Distribution system adequacy
  - Most lines near capacity
  - Queues
- ◆ Integrating wind into the system
- ◆ Approvals
- ◆ Human resources
- ◆ Ontario climate and geography
- ◆ Cost/performance relative to other generation sources

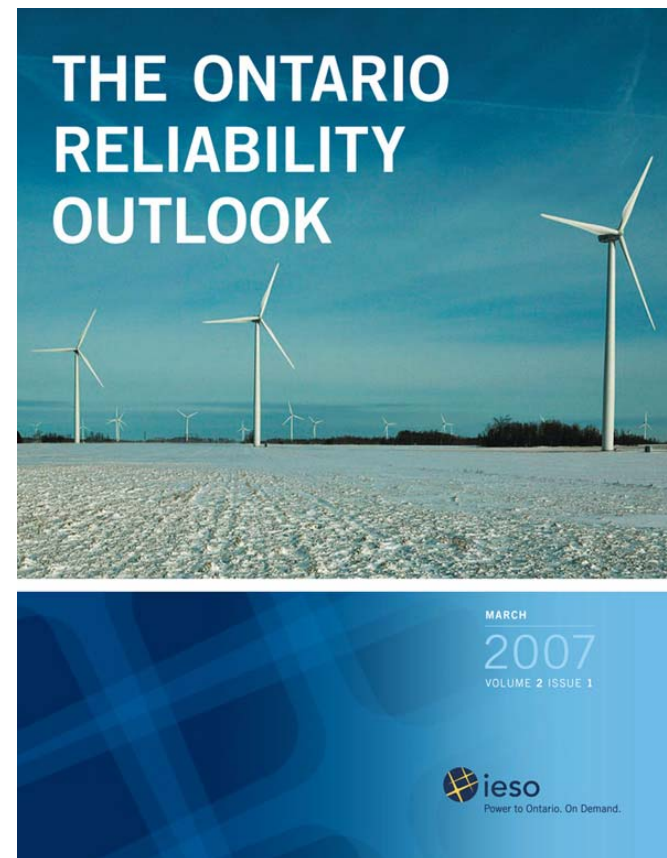
# Issue: Transmission System Adequacy

- ◆ Much of Ontario's transmission system is currently at capacity
- ◆ Constraints most problematic in areas most suited for wind
- ◆ System was built for few, large-scale projects; capturing Ontario's renewable resources will require significant upgrades
- ◆ Priority and cost allocation for system upgrades undetermined
- ◆ Approvals for new transmission can be controversial and will be subject to timing uncertainties



## Issue: Integrating Wind into the System

- ◆ The intermittent nature of wind power is presenting system management challenges
- ◆ Emerging understanding of impacts and practical technological and economic responses
- ◆ Back-up generation required, unless feasible storage solutions can be found



## Issue: Approvals

- ◆ Community concerns leading to approvals delay and denials.
- ◆ Increasing opposition and claims especially against wind generation and transmission from organized groups, cottagers, First Nations.
- ◆ Ontario has democratic EA and municipal approvals processes that allow multiple levels of appeal.
- ◆ Uncertainty and lack of standardization around limits for approval
  - Noise
  - Setbacks

## Issue: Human resources and expertise

- ◆ Design, construction, connection and operation of wind systems using existing technology
- ◆ Improve Technology
  - Turbine and blade technology
    - Safety, reliability, cold weather performance
    - Controllability/dispatchability
    - Output at lower wind speeds
    - Manufacturing, delivery and maintenance costs
  - Towers
    - Lower cost materials and easier to ship and construct assemblies
  - Grid integration
    - Power conditioning
    - Modeling and forecasting
- ◆ Develop Practical and Economic Energy Storage
  - Solid state batteries, flow batteries, capacitors, thermal, hydrogen, flywheels, pumped water, compressed air....

# Thank You

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