

Transmission Constraints, Availability, and Impact on Wind Power Development in Ontario

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- About the IESO
- The IESO and wind power
- Ontario system overview
- Transmission congestion
- Examples of congested zones:
 - Southwest/Bruce
 - Northeast
 - Distribution
- Addressing the issues
- Looking ahead



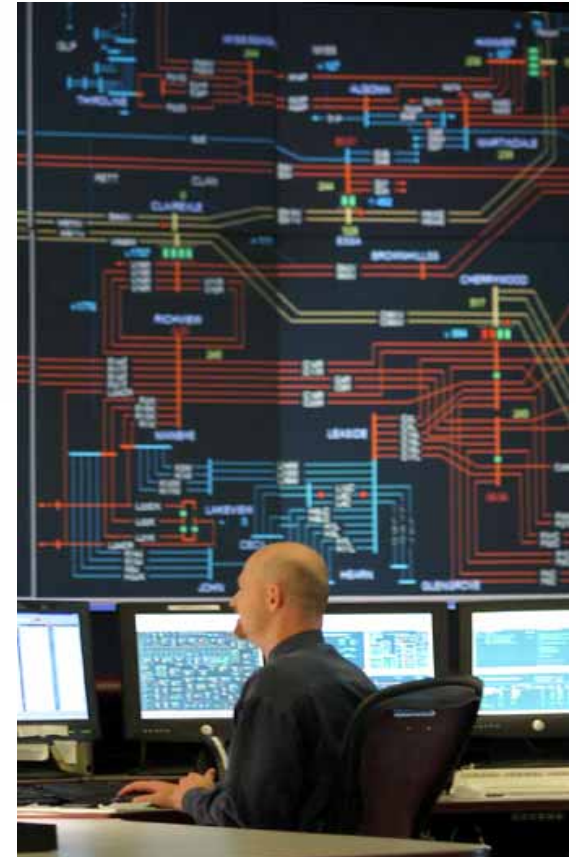
Ontario's IESO has two fundamental roles:

- Oversee the reliable operation of the provincial electricity grid and
- Manage the wholesale electricity market.

At a high level the first means;

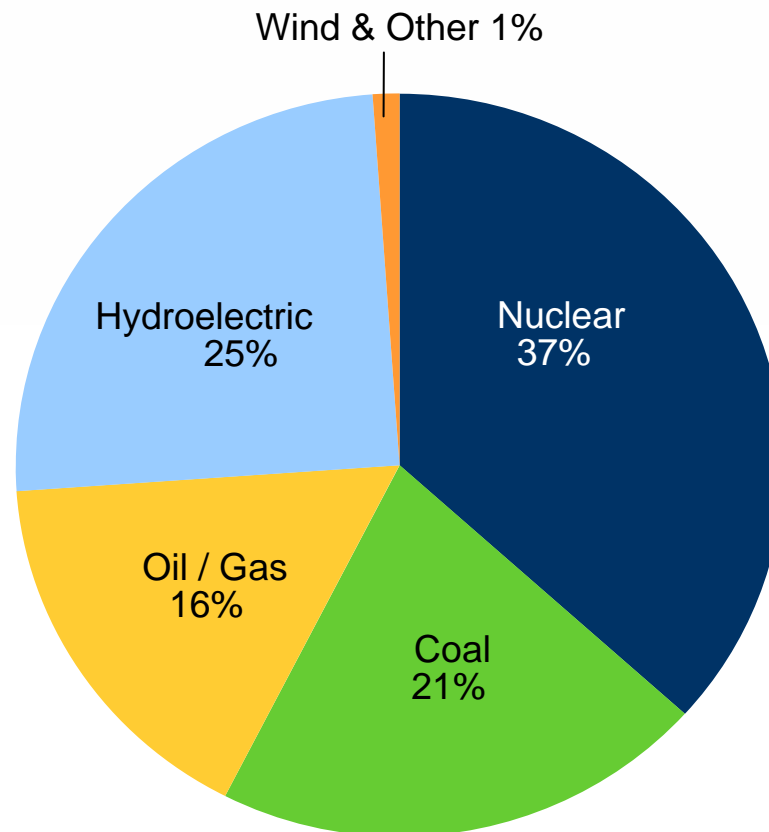
- Balance load and generation at all times and operate with system limits

And we do this efficiently through the wholesale electricity market.



Existing Supply Mix September 2006

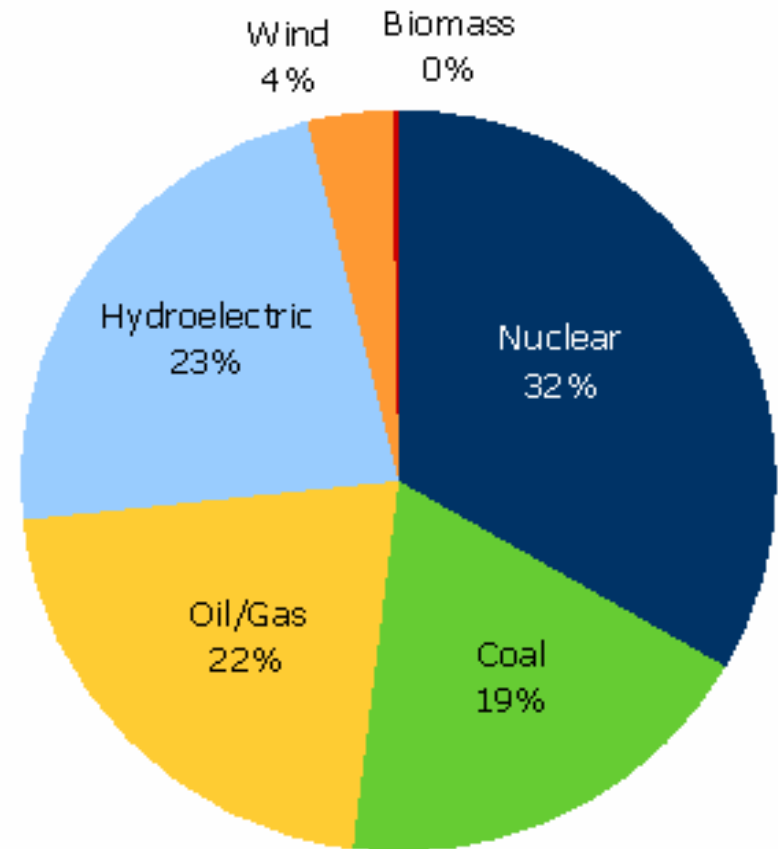
- Approximately 31,000 MW of installed capacity
- 300 MW of installed wind capacity



Expected Supply Mix

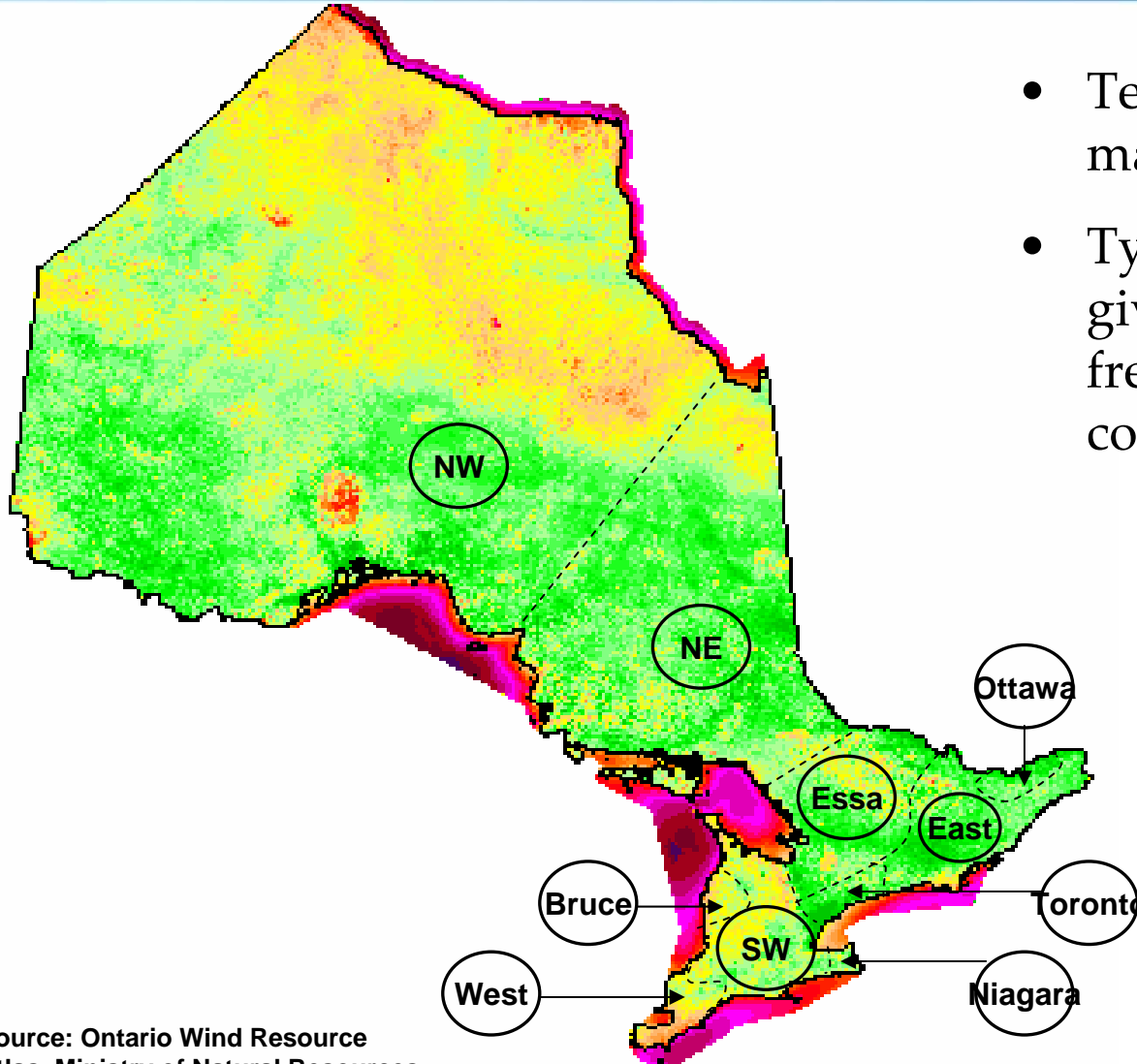
End of 2008

- Approximately 34,000 MW of installed capacity
- 1260 MW of installed wind capacity

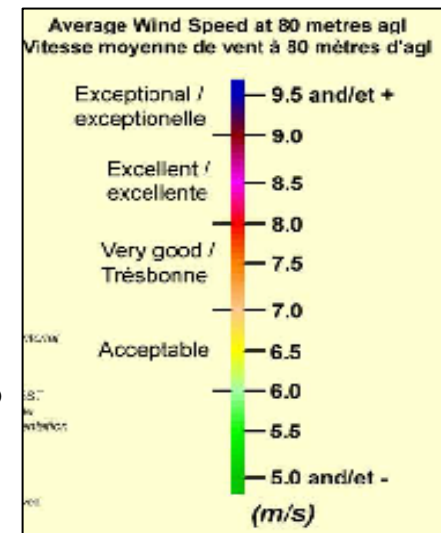




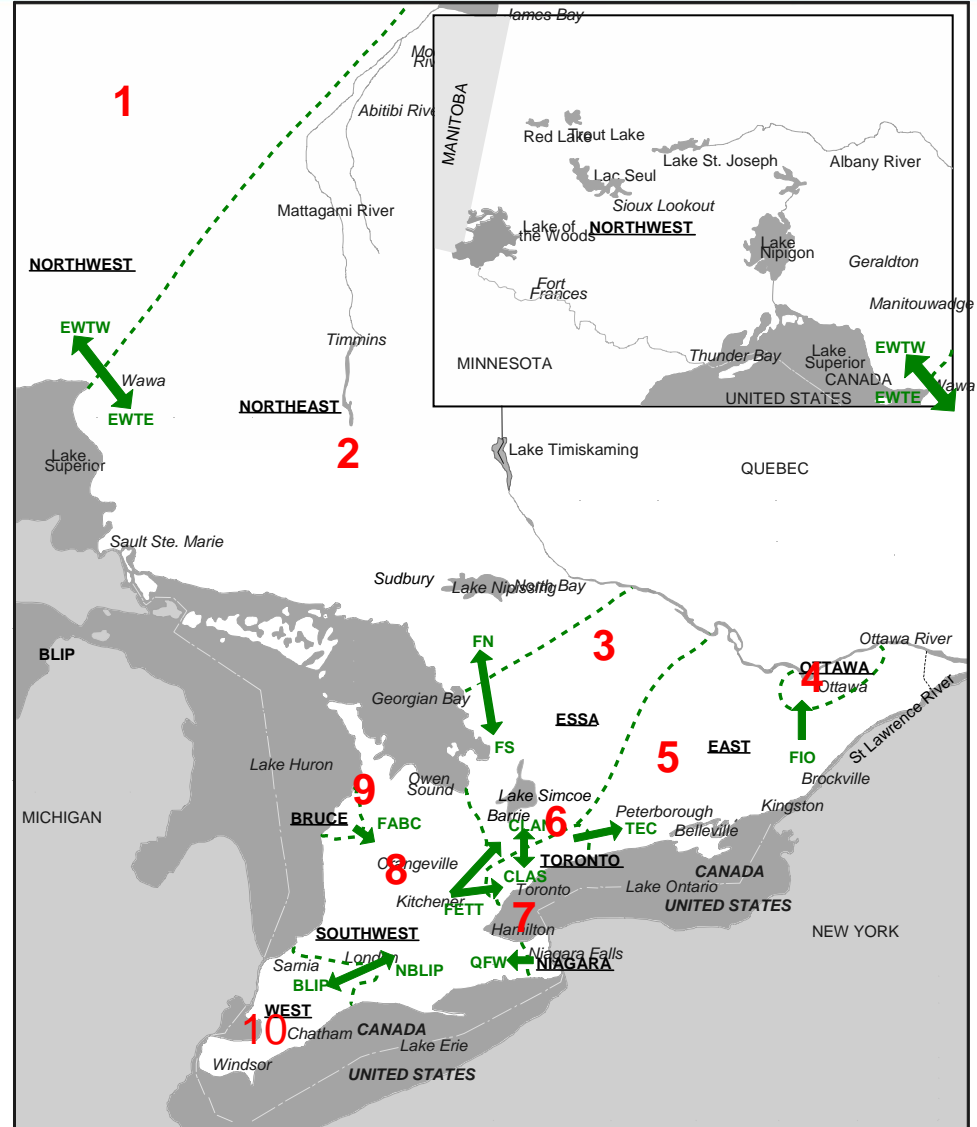
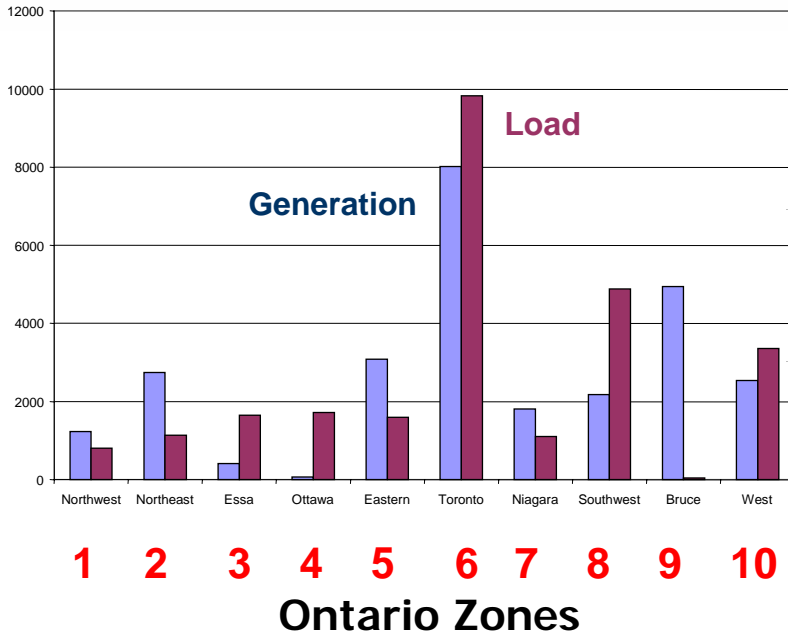
Wind and Ontario Transmission Zones



- Ten zones defined by nine major internal interfaces
- Type of generation in a given zone can affect the frequency and duration of congestion

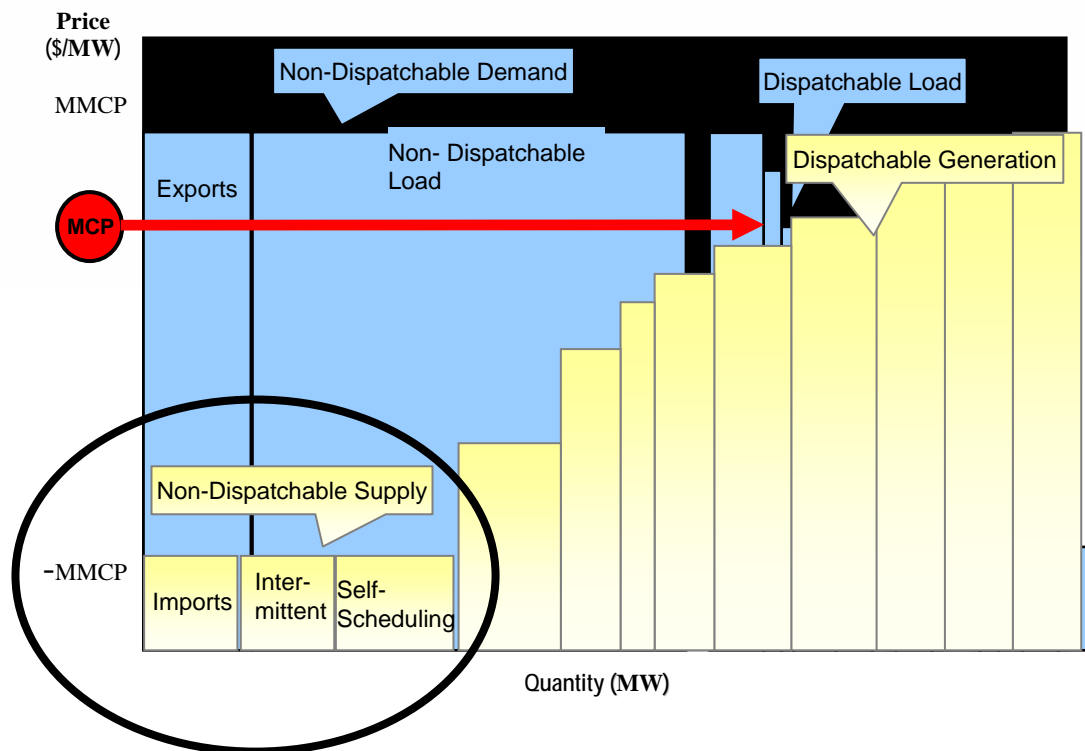


Zonal Generation/Load Balance As of 2003 (MW)

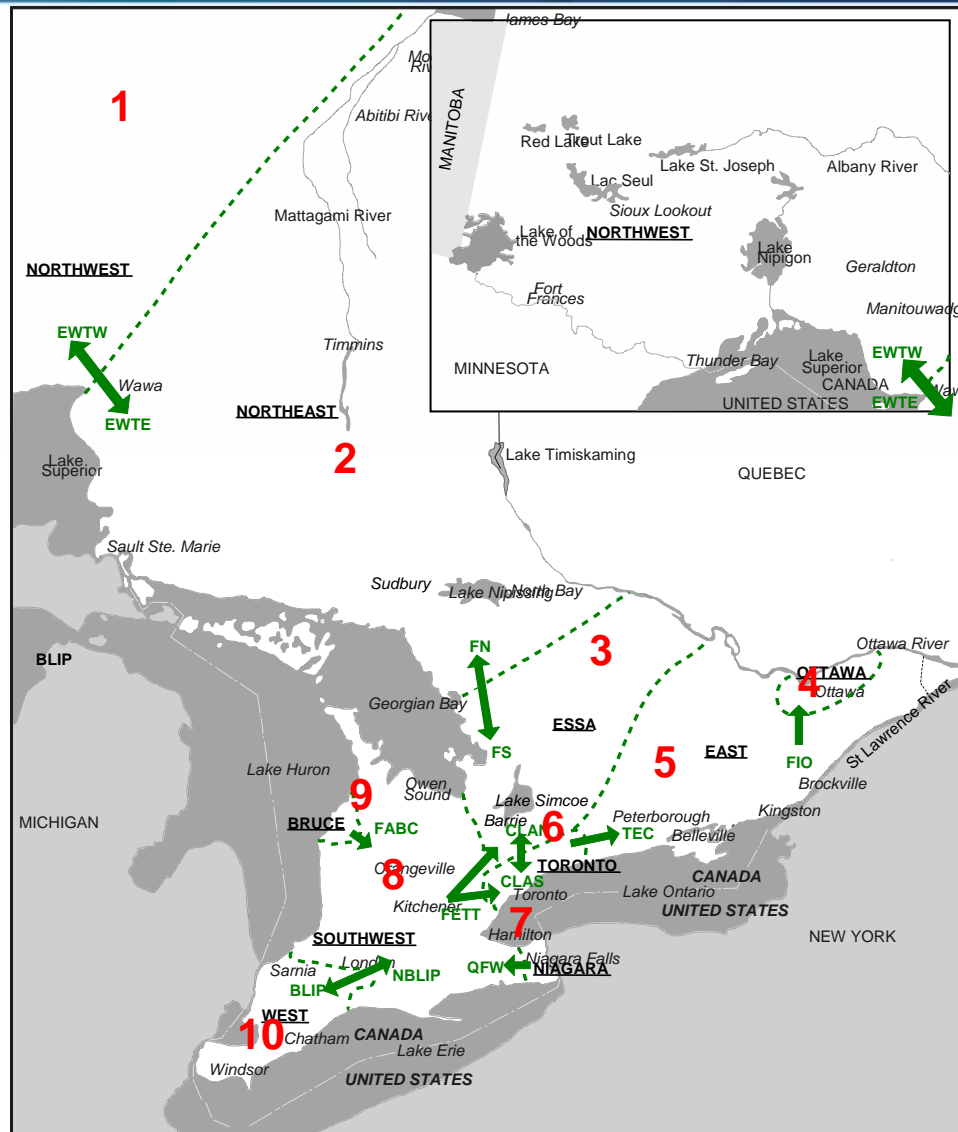
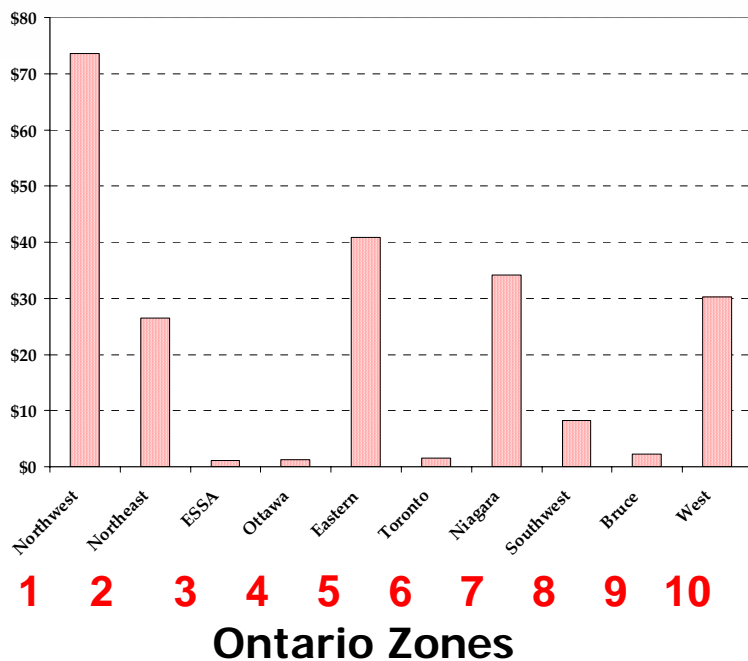


Dispatch of Generation in the Market

- Energy from Intermittent and Self-scheduled generators is taken when it is produced
- Output of Dispatchable generators is set based on offers to supply and bids to consume
- All are subject to IESO direction to maintain flows within system reliability limits



**Congestion Costs (CMSC) by Zone
May 2005 to April 2006
(Millions of \$)**



ENERGY

- Dispatch of more expensive resources
- Constraint costs
- Spot market dispatch can manage effectively

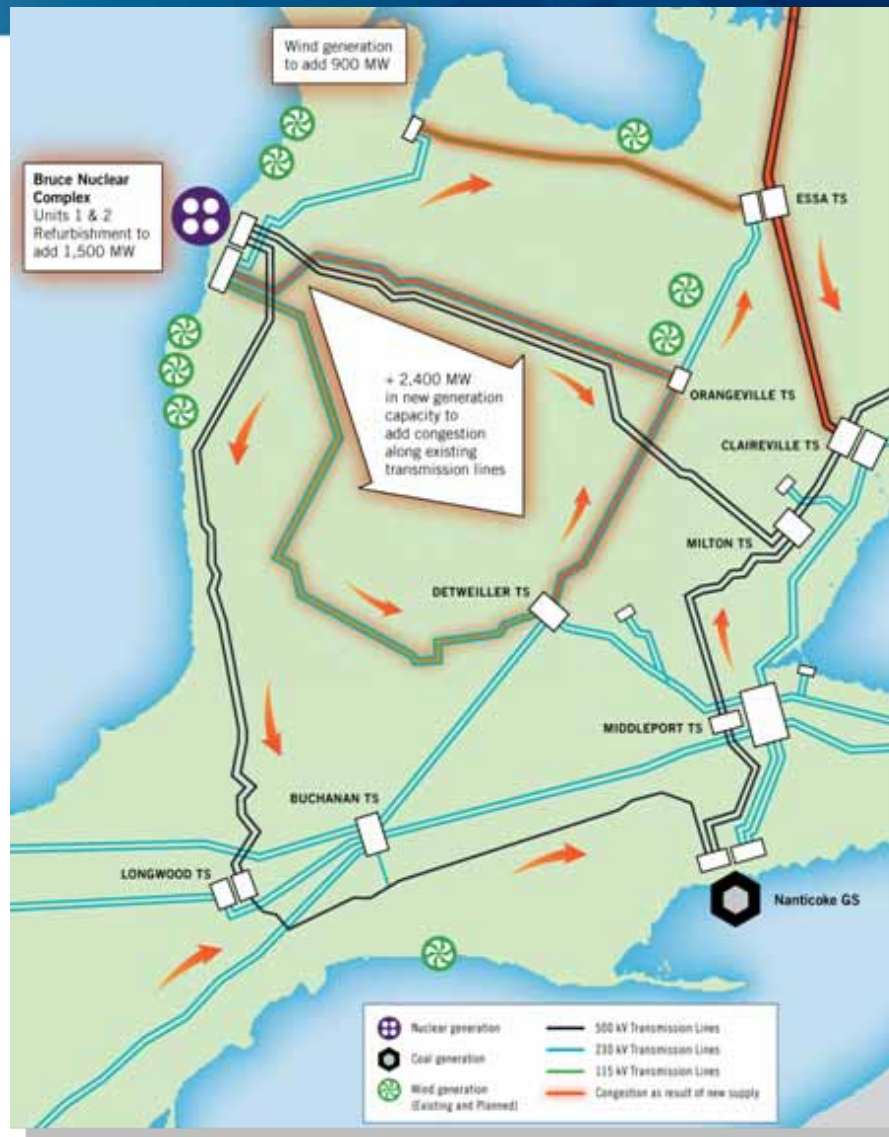
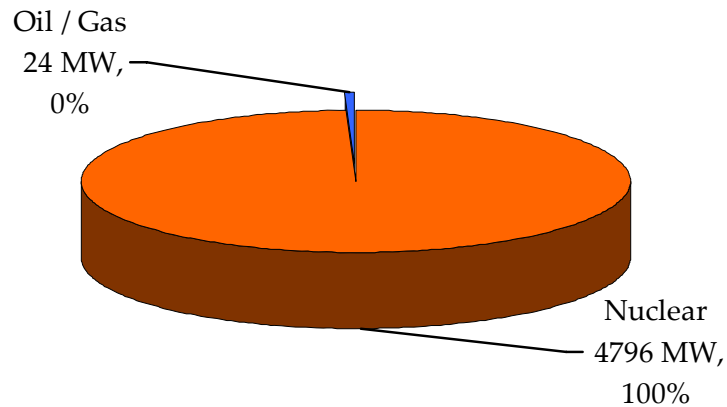
CAPACITY

- Reduced capacity available over peak
- Cost of additional capacity

Transmission Expansion?

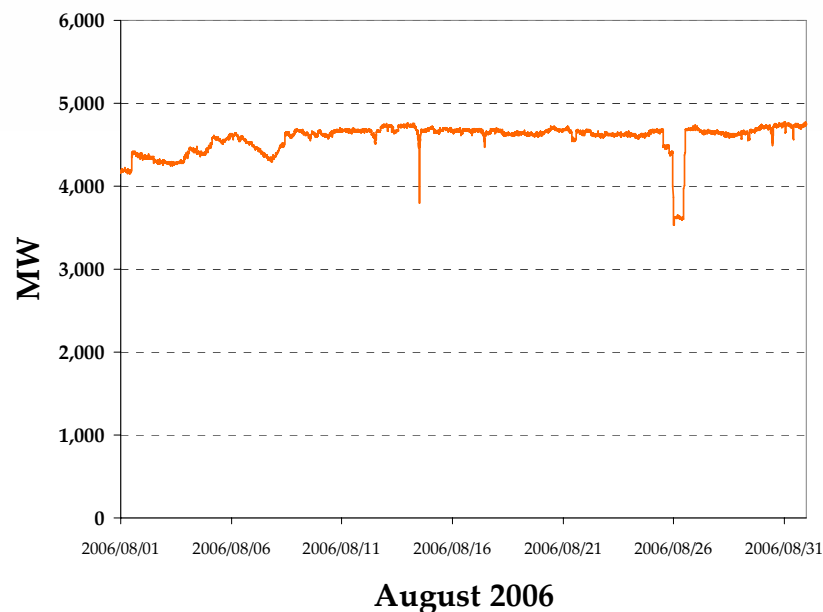
- Minimal dispatch flexibility available from existing and planned resources

Bruce Zone - Installed Capacity
Generation Mix, October 2006
(Total Installed Capacity: 4820 MW)



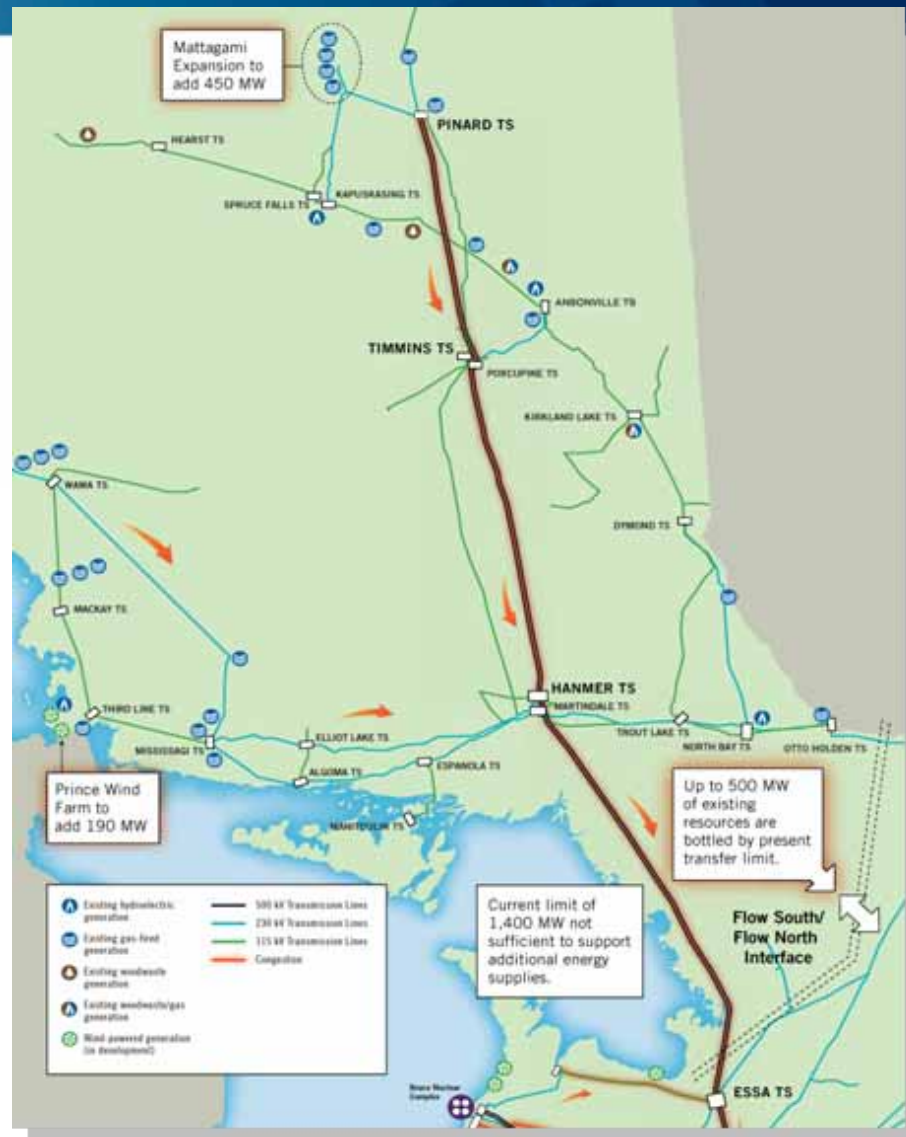
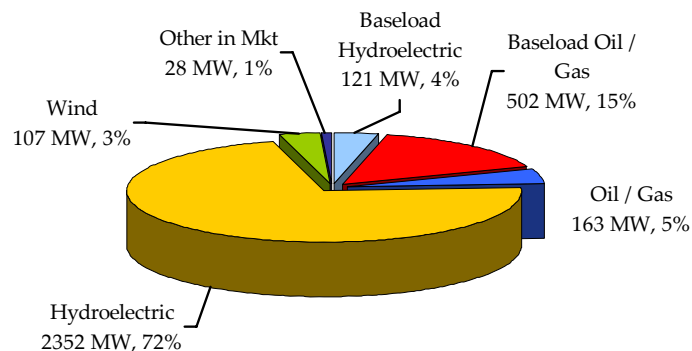
- Bruce Power units offered in a way to ensure that they run
- Capacity and energy of wind integration a concern

**Flow Away Bruce Complex
(FABC) Interface - MW**



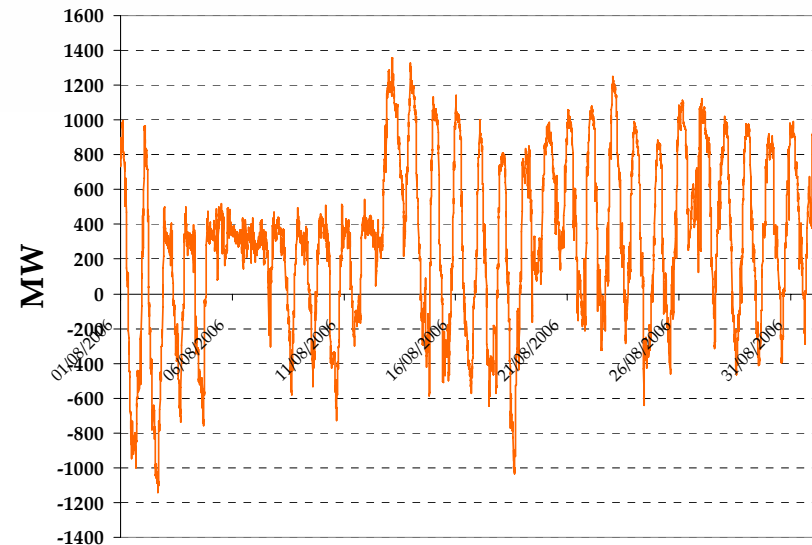
- Large amount of dispatch flexibility from existing resources

Northeast Zone - Installed Capacity
Generation Mix, October 2006
(Total Installed Capacity: 3273 Mw)



- Market dispatch finds optimal result on a 5 minute basis
- Energy integration managed through market dispatch
- Capacity integration still a concern as full capability of transmission is already utilized

**Flow South/Flow North (FS/FN)
Interface - MW**



August 2006

Wind on the Distribution System

- Adding wind on the distribution system in an area where load significantly exceeds supply is a good fit. Generally no limitations (e.g. Toronto)
- Adding wind on the distribution system in an area where supply significantly exceeds load is not as good a fit (e.g. Bruce)
- Good wind regimes appear to be in areas where supply exceeds load.



- Load and generation will always be operated in balance
- System flows will always be maintained within transmission system capability
- Areas where load exceeds supply are a good fit for any new supply. Both energy and capacity benefits can be realized
- Areas where supply exceeds load can generally accommodate additional energy resources. However, capacity addition may not be achieved without increasing transmission capability.
- Dispatch flexibility is the key to maximizing benefits

- Working together with OPA and Ontario government
 - Integrated Power System Plan and government directives
 - Build new/more transmission capacity
- Wind integration working group



Contact the IESO for more information on:

- Connection requirements
- System impact assessments
- Facility/meter registration
- Market and system training
- Market operation
- Energy settlement



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