

ONTARIO **POWER** GENERATION

Atikokan Biomass Repowering Project

OMAFRA Guelph

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Biomass Conversion



Ontario Power Generation Profile

- Owned by the Province of Ontario
- Ontario's lowest price electricity producer
- Costs subject to third party review
- Generated 92.5 TWh in 2009
- Produced about 65% of Ontario's electricity
- 12,000 employees





OPG Facilities



- **3 Nuclear stations
(10 units)**
- **5 Thermal stations
(19 units)**
- **65 Hydroelectric stations
(4 being redeveloped;
236 operating units)**
- **2 Co-Owned Natural
Gas stations**



Coal Phase Out

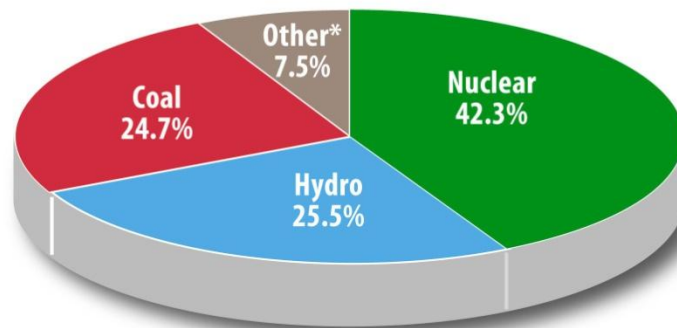
A managed phase out of coal that:

- **Completes regulated phase out of coal by end of 2014**
- **Ensures adequate electricity supply in Ontario. (While non-coal capacity may appear to exceed demand, non-coal generators are not all available at all times or able to produce at peak capacity at all times)**
- **Advances phase-out of coal generators where possible to save costs for consumers without risking reliability (Closure of four coal units in October 2010 will save \$50 million per year)**
- **Maintains lowest-emission coal units in-service – generally first on and last off**



Ontario: Electricity Supply 2002 & 2009

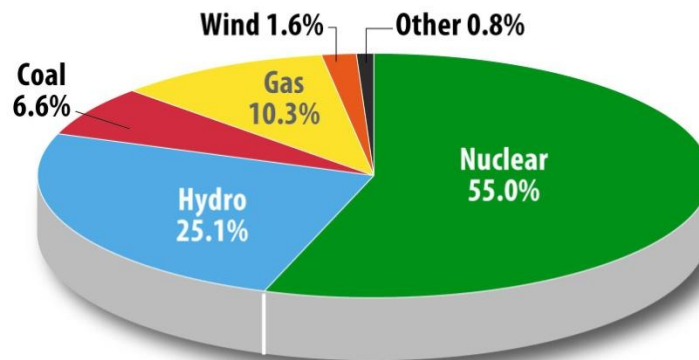
Ontario: Electricity Supply 2002



* Includes Gas, Oil, some Wood Waste

Source: IESO

Ontario: Electricity Supply 2009



Source: IESO Jan. 2010



Atikokan Biomass Conversion Project



Atikokan GS Today

Electricity Production:

- Capacity 211 MW (1 generating unit)
- Uses low sulphur lignite coal from Western Canada
- Average annual electricity production 2000-2009 was 750 million kWh, enough to power >60,000 homes

Environmental Stewardship:

- ISO 14001 registered (environmental management standard)
- Wildlife Habitat Council certified site

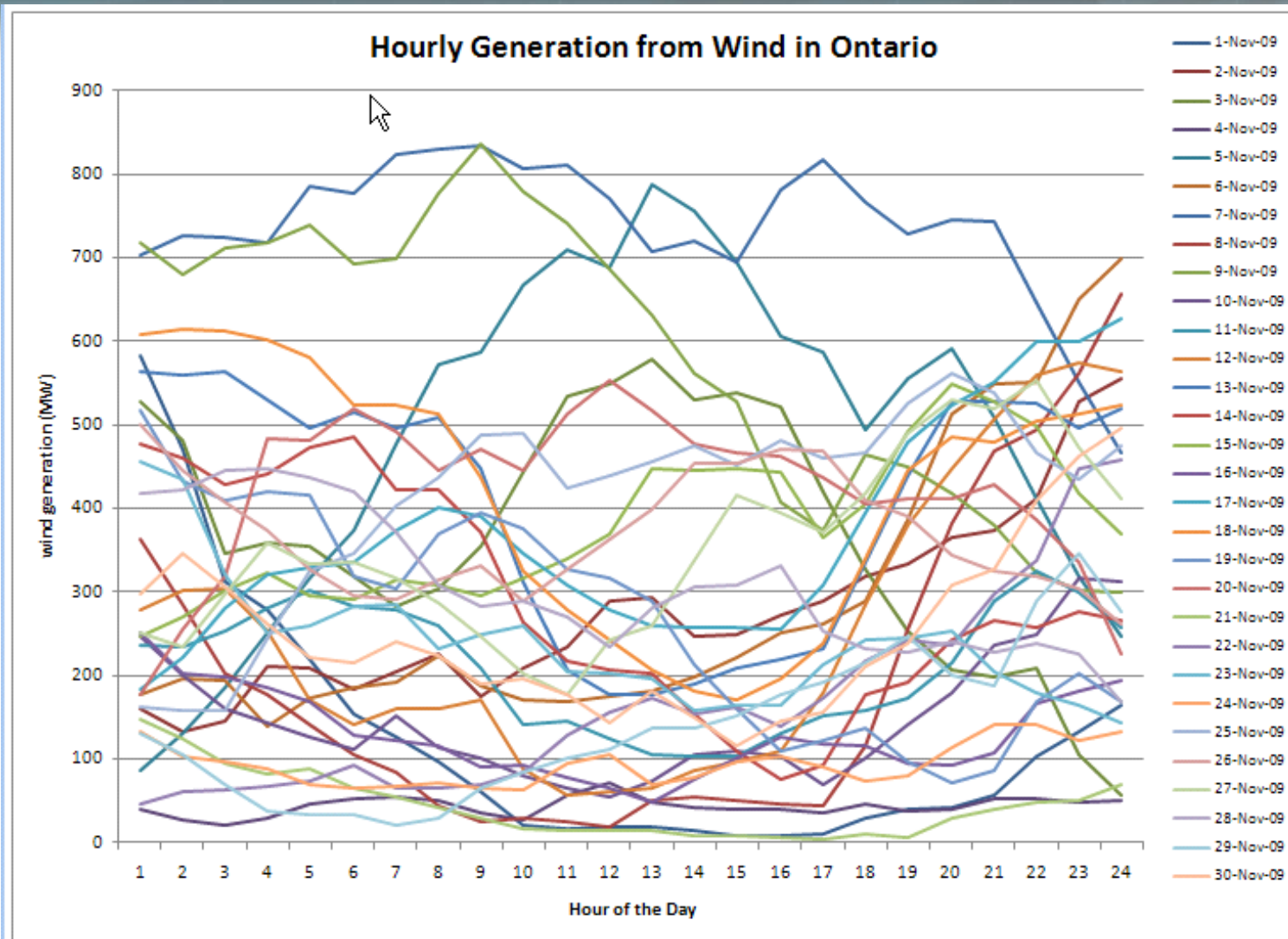
Community Contribution:

- Employs 90 people
- Contributed more than \$2.5 million (2009) to the community in taxes, spending and charitable support



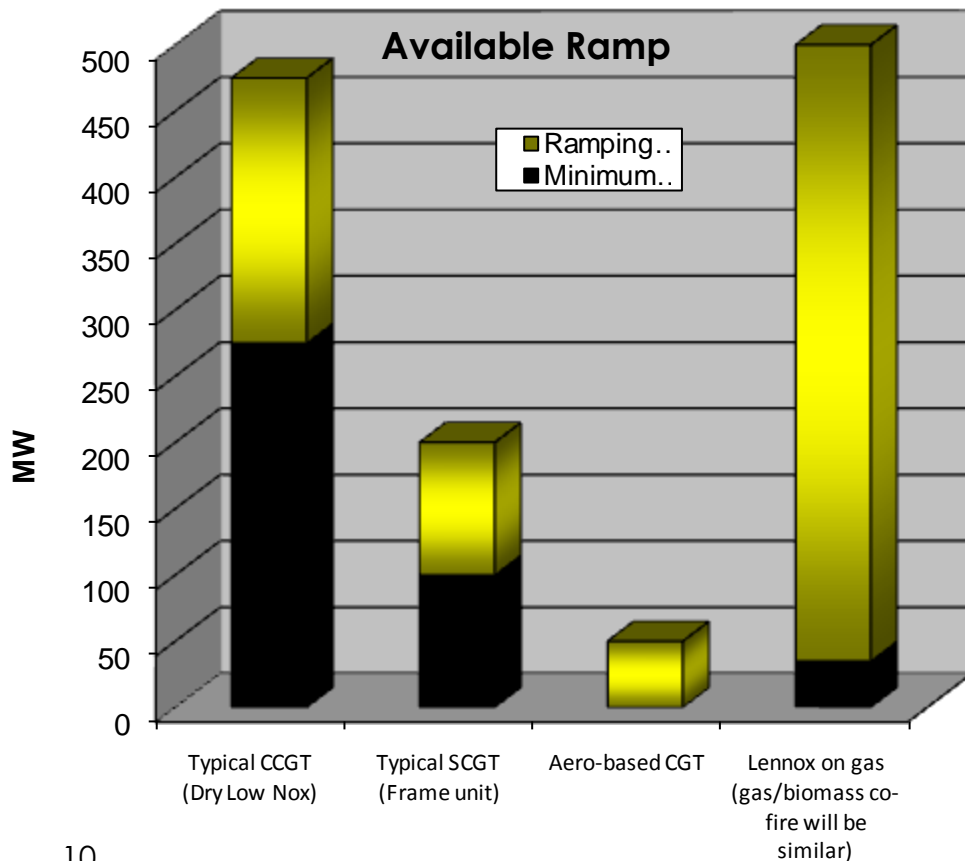
Why Biomass at Atikokan?

- **Renewable energy**
- **Produces electricity when you need it**
- **Greenhouse gas benefits compared to coal**
- **Backs up OPG Hydro in low water years and complements intermittent renewable (wind, solar)**
- **Synergy with Ontario's forestry sector**
- **Makes use of existing generating station owned by the people of Ontario. Tremendous local support**
- **Conversion costs less than building new gas plant**





Converted Coal Units Provide Greater Flexibility Than Other Forms of Thermal Generation



Available “ramp” is the difference between minimum production level and maximum production level of a generating unit

CCGT – combined cycle gas turbine (Portlands)
SCGT – simple cycle gas turbine (York Region)
Aero-based CGT – derived from an aircraft engine
Lennox – conventional boiler similar to coal units

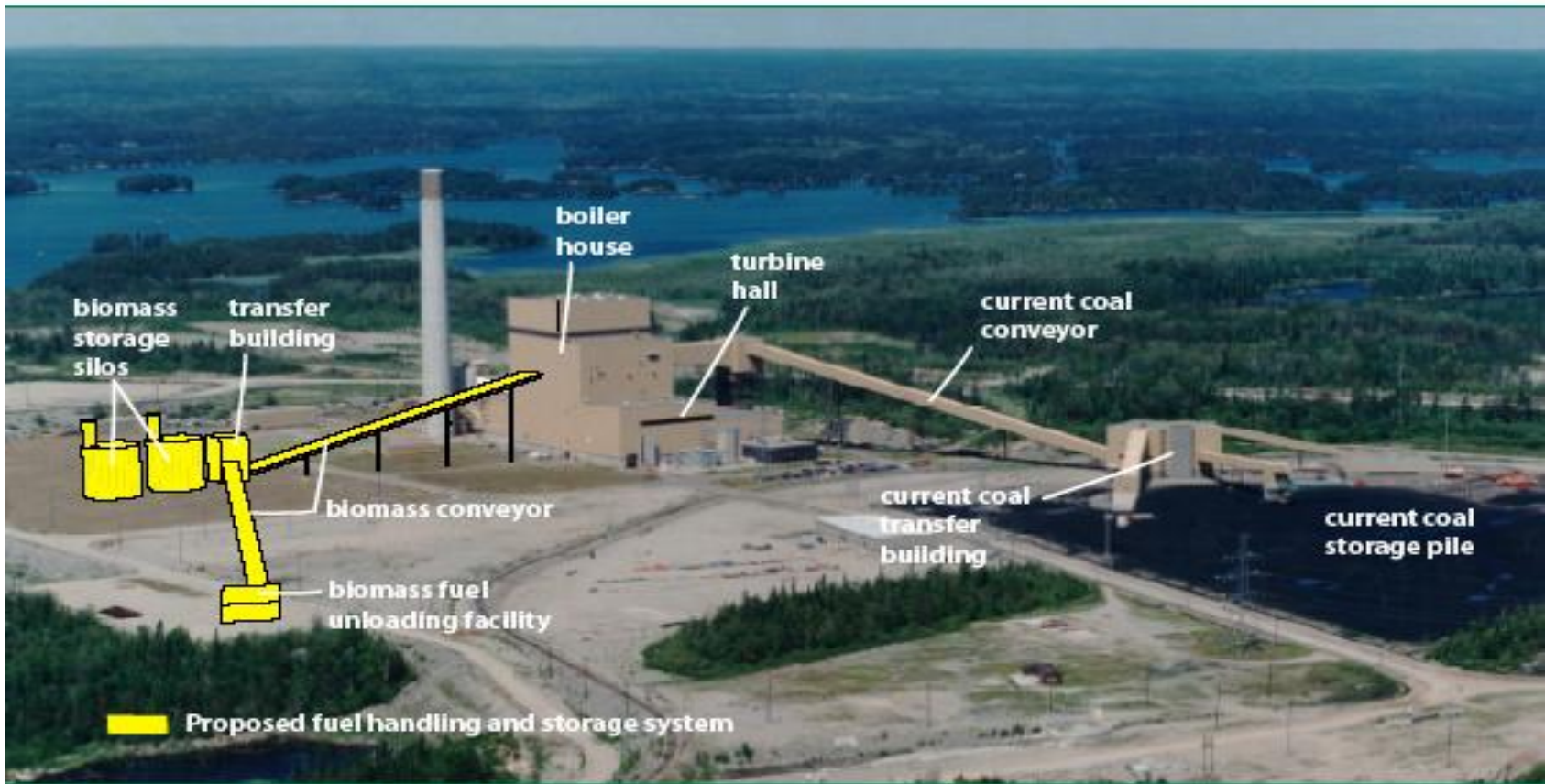


Safety

- Detailed investigation of 2008 explosion with employee involvement
- Cause was dust – ignition sources narrowed down
- Raw biomass creates more dust and has lower ignition threshold
- Redesign fuel handling system to reduce dust creation



Plant Modifications





Concept

- **140 Gwh/y 90, 000 t/y 8% Capacity factor 5d/wk 4hr/d**
- **Truck delivery of pellets (avg. 10 trucks/d 35 t/truck 5d/wk)**
- **Two unloaders onto belt feeding storage (10 min unload)**
- **10,000 tons of storage using two 5,000 ton silos**
- **Pellets First in First out... minimizes self heating**
- **Aeration to control temp, recirculation capabilities**
- **Monitor pellet temps, N2 or CO2 gas to suppress combustion**
- **Bottom feeder to single conveyor to powerhouse**
- **Surge hoppers made from existing silo cones to feeders, rotary valve provides separation**
- **Pulverizers modification... lower airflows, lower temps, less classification**



Concept

- **Burners to be replaced... velocities different**
- **Expect minor if any changes to boiler pressure parts**
- **Primary Air heater major change... we don't need the heat**
- **Precipitators minor changes,... avoid sparking and ash removal changes**
- **Furnace ash water expect changes in ash chemistry**
- **Ash has approval for local landfill**
- **Housekeeping important to prevent self combustion**
- **Dust control at transfer points**
- **Avoid water and pellets**
- **Occupational Hygiene issues with wood dust**



Contracting Strategy

- **Major Contract** will be the material handling and storage
 - Work will be outside of powerhouse, and not effect operations
 - Concrete or steel silos 50' diameter, 150 ' tall
 - Work will be 2012, and allow storage of pellets over the winter
 - Tie in work to existing silos/feeders will be 2013 during outage
- **Secondary Contract** will be **Combustion and Boiler Modifications**
 - Pulverizers, Burners, Air heaters, Precipitator and Ash Removal
 - 6 month outage March-Aug.. 4 to make changes, 1 for commissioning, 1 for insurance



Details

- **Project team and trades max during 2013**
- **Interface with a 25 year old plant, expect the unexpected..**
- **High degree of visibility on the project given politics, Financial constraints, OPA involvement in PPA and financing, industry first, focus on management of risk, etc. thus the reporting on progress will be a key deliverable**
- **All the contracts need to come together before the OPG can approve the project. Likely we can negotiate contracts and they be contingent on the Board Of Director approval. OPA and OPG need to develop the right agreement**
- **Discussions with Aboriginal groups required as part of Directive to OPA/OPG**



Air Emissions

Emissions comparison based on 100% wood-pellet trials at Atikokan GS in July 2008:

	Lignite Coal	Wood-Pellet
SO ₂ emissions	4.2 kg/MWh	Below Monitor Detection Limits
NO _x emissions	1.50 kg/MWh	0.6 kg/MWh



Climate Change Benefits

- Biomass is generally accepted as carbon neutral
- There is a growing body of science looking into the climate change benefits of biomass
- Studies generally agree there is a climate change benefit at some point in time – often depends on type of coal being replaced and scale of geographic regions being considered
- OPG is supporting new research including an Ontario model of carbon neutrality



Biomass: Supply Chain Business Model

OPG will:

- buy pelletized biomass fuel from technically and financially capable counterparties who aggregate raw biomass materials and produce processed fuel
- arrange transportation of processed fuel
- purchase fuel through competitive Requests for Indicative Prices (RFIPs) on the basis of well defined technical specifications for pelletized wood biomass and pelletized agricultural biomass
- enter into long term fuel contracts



Atikokan GS Sustainable Fuel Supply

- **90,000 tonnes per year of dried wood-pellets**
< 1% of annual harvest in Ontario
- **Meets United Nations Framework Convention on Climate Change definition of renewable**
- **OPG will require suppliers to have 3rd party certification that the wood-fibre is sourced from sustainably managed forests**
- **OPG Request for Indicative Prices issued in March and closed in May 2010**
- **Concurrent with Ontario Government wood-fibre allocation process**



Benefits of Atikokan Repowering Project

Economy:

- Investment in Northwestern Ontario
- 200 construction jobs, OPG Atikokan jobs, forestry and fuel processing jobs

Cost:

- Re-use of generating station owned by the people of Ontario
- Conversion cost less than building new

Environmental:

- Conversion to biomass fuel is an opportunity to manage CO₂

Flexible:

- provides needed flexibility for electricity system



Atikokan GS Repowering Project To Do List

January 2010	Engineering Concept
March 2010	Request for Indicative Prices for Wood-Pellet Fuel
August 2010	Minister of Energy directive for Power Purchase Agreement
May 2011	ABESA with OPG/OPA, Major equipment contracts negotiated, Fuel contracts in place for Board Approval
Spring 2012	Mobilization for Material Handling/Storage
Spring 2013	Powerhouse modifications begin
July 2013	First Fuel Delivery for commissioning
Fall 2013	In-Service and commercial operation



Challenges

- **The effect of biomass on the boiler is an imprecise science, this may effect efficiency, reliability, capacity. We will learn much in the first year of operation**
- **The Fuel supply chain and the on site storage requirements are based on assumptions on dispatch. Experience will guide future designs as to how to match supply and demand**
- **Biomass, in the near term, will be more expensive than fossil fuels. To what extent will the public financially support lower CO2 emissions**

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Questions?

