

Biomass Innovation Centre  
March 29, 2015

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## 2015 Climate Change Discussions

Submitted to The Honourable Glen  
Murray, Minister of the Environment and  
Climate Change

## EXECUTIVE SUMMARY

The Biomass Innovation Centre at Nipissing University, and the Union of Ontario Indians (political advocate for 39 First Nations in Ontario), have partnered to develop a Northern Ontario Bioeconomy Strategy. This strategy will leverage our northern sustainable forestry resources to **trigger economic development and job growth**, push **innovation and entrepreneurship**, and develop domestic markets and international partnerships.

**The Strategy is also a critical platform for greenhouse gas reductions.** The EU has made great strides in reducing GHG emissions by converting electricity and heat production to renewable biomass: ironically, the largest source of that biomass is from Canadian forests.

Using our sustainably sourced forestry residues to create energy is already part of the province's energy plan; Atikokan OPG has been converted to wood pellets, replacing coal as the generating fuel. By converting the Ontario homes currently heated with oil and propane to clean forest-residue wood pellets, using Ontario-made pellet furnaces and boilers, **we can reduce emissions by approximately 1.6 Mt/year** and create up to **3900 local jobs** in the supply chain. If we also convert 50% of the residences that are currently heated with electricity to wood pellet heat, we can create another 15000 jobs with only a 0.2 Mt carbon debt (Appendix A)

The Ministry of the Environment and Climate Change is in a unique position to push the conversion of energy production from fossil fuels to renewable sustainable biomass. As well as having the mandate to address climate change, the MOE&CC also holds one of the critical barriers to moving to low-carbon/carbon-neutral bioenergy. Ontario's Environmental Compliance Approval process for bioenergy heat plants that serve more than three families, or for commercial space heat, is based on 35 year data and ignores decades of research in clean combustion technology. While this process is undergoing review, it still takes 5 years for an installation to get an ECA. This approval is often contingent on additional capital expense for 24/7 monitoring of equipment that meets more stringent EU emissions standards than Ontario's standards

MOE&CC - specific Recommendation 1: The MOE&CC support the Northern Ontario Bioeconomy Strategy through direct funding of feasibility analysis of carbon-reduction projects within each pillar.

MOE&CC – specific Recommendation 2: The MOE&CC commit to prioritize the modernization of the ECA and permitting process for renewable bioenergy projects in the province.

## CONTEXT

The Biomass Innovation Centre at Nipissing University, and the Union of Ontario Indians, political advocate for 39 First Nations in Ontario, have partnered to develop a Northern Ontario Bioeconomy Strategy. This strategy will focus on how best to leverage our northern sustainable forestry resources to trigger economic development and job growth, push innovation and entrepreneurship, and develop new domestic markets and international partnerships.



Figure 1 - Northern Ontario Bioeconomy Strategy Framework

**The Strategy is also a critical platform for greenhouse gas reductions.** The EU has made great strides in reducing GHG emissions by converting electricity and heat production to renewable biomass: ironically, the largest source of that biomass is from Canadian forests.

A bioeconomy is one where most of the energy, materials, and chemicals for industry and consumers come from renewable biological resources. Other jurisdictions, including British Columbia, Quebec, Finland, the UK, and Germany, are realizing the economic, social and environmental benefits to developing a regional bioeconomy strategy. Whether it is to build the energy infrastructure and social license necessary to develop the Ring of Fire, to revive our manufacturing sector, or to reduce energy poverty, Ontario is uniquely positioned to use the forestry residues and unmerchantable species from its sustainably-managed forests to fuel economic growth throughout the province.

## IMPACTS FOR THE ENVIRONMENT & CLIMATE CHANGE

The Premier has directed The Honourable Glen Murray and the Ministry of the Environment and Climate Change to “lead the development of a new long term climate change strategy for Ontario” and to “to help our government achieve its greenhouse gas reduction targets for 2020”. Bioenergy created from sustainable forest resources is carbon neutral, and can offer a quick win in reducing emissions, especially when compared with the current emissions profile from northern heavy fuel oil and propane heating systems (Figure 2).

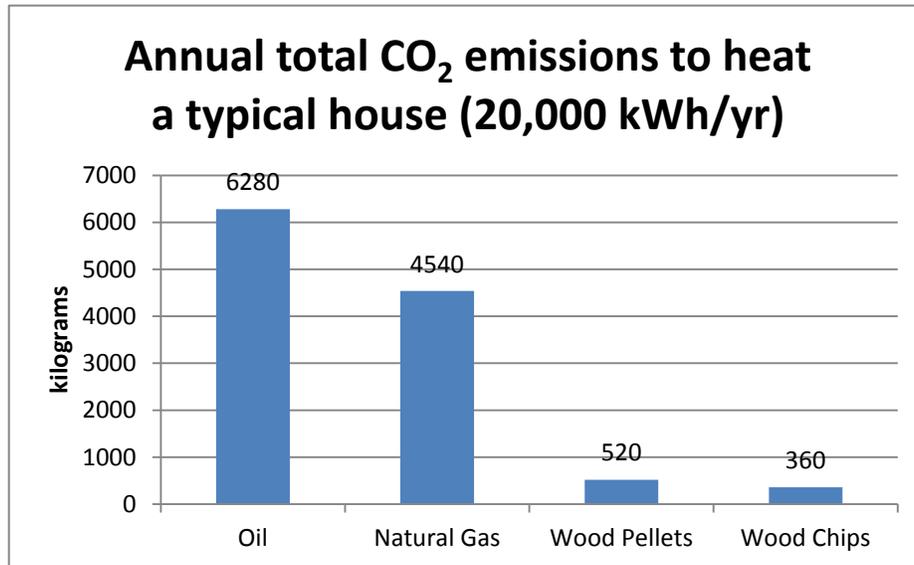


Figure 2 - GHG Emissions from different heating fuel types <sup>1</sup>

The Northern Ontario Bioeconomy Strategy is being developed with extensive input from northern Ontario municipalities, First Nations, industry leaders and associations, small-to-medium sized enterprises, entrepreneurs, academia, and community organizations. The strategy includes developing demonstration projects in four pillars, reducing policy and regulatory barriers to sustainable bioenergy projects, and defining a skills and training roadmap to qualify a domestic workforce in this growing sector.

The Northern Ontario Bioeconomy Strategy will address challenges to northern development and assist the government in delivery on its key priorities.

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<sup>1</sup>SOURCE: BIOMASS ENERGY CENTRE  
[HTTP://WWW.BIOMASSENERGYCENTRE.ORG.UK/PORTAL/PAGE?\\_PAGEID=75,163182&\\_DAD=PORTAL&\\_SCHEMA=PORTAL](http://www.biomassenergycentre.org.uk/portal/page?_PAGEID=75,163182&_DAD=PORTAL&_SCHEMA=PORTAL)

## IMPACTS FOR FORESTRY

The forestry sector in Ontario has experienced a structural change since 2004, and traditional markets for traditional wood products have not rebounded. This has had a devastating economic effect on northern communities (Figure 3).

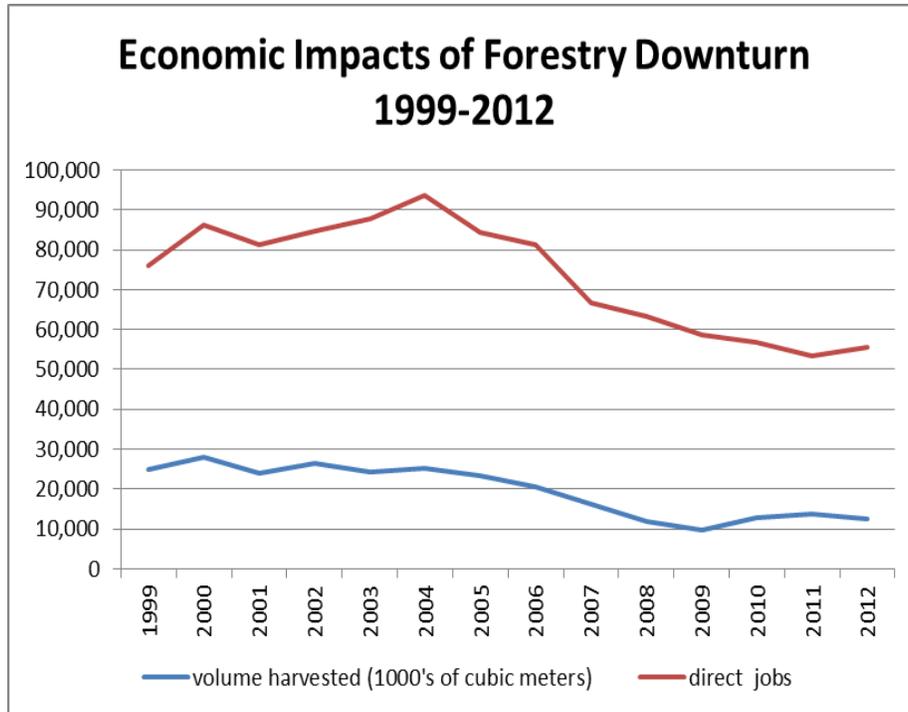


Figure 3 - Economic Impacts of Forestry Downturn 1999-2012 <sup>2</sup>

As Premier Wynne directed in her Mandate Letter to The Honourable Bill Mauro, Minister of Natural Resources and Forestry, supporting forestry by “continuing to work with forestry companies, environmental organizations, First Nations and community representatives to ensure that Crown forest resources are being put to their best use — and in an economically, socially and environmentally sustainable fashion” is a top priority for the MNR&F.

Developing new markets, domestic and foreign, and new bioproducts/applications from our sustainable wood fibre are critical requirements for future growth in this sector. The Northern Ontario Bioeconomy Strategy will identify and develop those markets and products.

Increasing Ontario's use of bioenergy from renewable forest resources would not just decrease our GHG emissions, but would create jobs and economic growth in a critical sector of the provincial economy.

<sup>2</sup> Source: Natural Resources Canada Statistical Data - <https://cfs.nrcan.gc.ca/statsprofile/employment/on>

## IMPACTS FOR FIRST NATIONS

First Nations in Ontario are exercising jurisdiction over their traditional lands and resources, in order to drive economic development and local benefits.<sup>3</sup> As Premier Wynn directed in her Mandate Letter to The Honourable David Zimmer, Minister of Aboriginal Affairs, “Improving opportunities for meaningful employment and business development” and “continuing to work across government to ensure that Aboriginal peoples share in the benefits of natural resources and are engaged in resource-related economic development.....by advancing the province’s local/sectoral approach to resource benefits sharing” are top priorities for MAA.

The Northern Ontario Bioeconomy Strategy, co-led by the Union of Ontario Indians with full engagement and input from the 39 First Nations they represent, will focus on ensuring resource-sharing and benefit realization for First Nations communities throughout Ontario.

Increasing Ontario’s use of bioenergy from renewable forest resources would not just decrease our GHG emissions, but would create First Nations’ jobs and economic growth, and deliver on the province’s benefit-sharing commitment.

## IMPACTS FOR ENERGY

In northern Ontario, our residential heat energy needs are greater than our electricity energy needs. In many northern communities, energy poverty IS heat poverty (Figure 4).

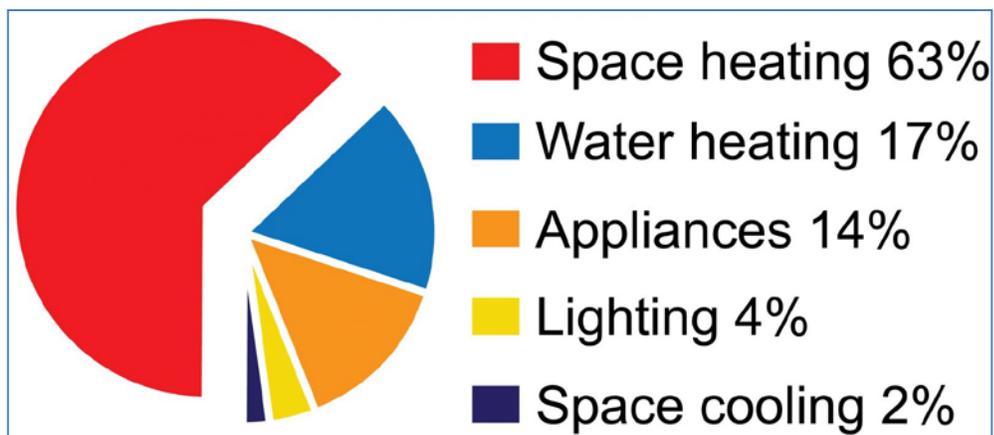


Figure 4 - Residential Energy Use in Canada by activity, 2010<sup>4</sup>

Approximately 1.2 million homes in Ontario are heated by electricity, oil, and propane. An average Ontario home uses 10,000 kWh of electricity to power its electronics and appliances; however that same home uses more than 20,000 kWh of energy for heat. Developing combined heat and power as well as heat-only bioenergy solutions would cut heating costs by more than 40%<sup>5</sup>. In several of the communities along the north shore of the Great Lakes, the commercial sector has contracted due to unsustainable space heating costs. Some municipalities in the north can spend up to \$25,000/month to

<sup>3</sup> [http://www.chiefs-of-ontario.org/sites/default/files/news\\_files/NOTICE-1.pdf](http://www.chiefs-of-ontario.org/sites/default/files/news_files/NOTICE-1.pdf)

<sup>4</sup> Source: Energy Efficiency Trends in Canada 1990-2010, Natural Resources Canada.

<sup>5</sup> Source: US Government Energy Information Administration [www.eia.gov/tools/faqs/heatcalc.xls](http://www.eia.gov/tools/faqs/heatcalc.xls)

heat arenas and swimming pools. Using low cost local biofuels and bioenergy would reduce the high heating costs that trouble northern residents and businesses, as well as lead to significant GHG reductions.

#### IMPACTS FOR ECONOMIC DEVELOPMENT

Bioenergy projects do more than yield substantial savings for residents and commercial enterprises: they stimulate local economic development through heat entrepreneurship, a business model widely used in Finland and Sweden. When one adds the economic benefit of energy dollars cycling through a local economy several times before leaking out to other jurisdictions, in contrast to heavy fuel oil and propane, developing local bioenergy projects offer a win-win for economic development. Harvesting and marketing forestry residues as fuel for clean energy yields more jobs than burning those slash piles in the winter to reduce forest fire hazards.

**Table 1 - Wood Pellet Conversion Analysis - Appendix A**

Conversion Factor	Number of homes	Mt CO2e BAU	Mt CO2e for wood pellets	Net CO2e Savings (Mt)/year	Potential Supply Chain Jobs Created
<b>50% of oil homes</b>	172,350	0.70	0.196	<b>0.504</b>	<b>1355</b>
<b>100% of oil homes</b>	344,700	1.40	0.392	<b>1.008</b>	<b>2709</b>
<b>50% of coal/propane homes</b>	28,750	0.35	0.033	<b>0.317</b>	<b>636</b>
<b>100% of coal/propane homes</b>	57,500	0.70	0.065	<b>0.635</b>	<b>1272</b>
<b>Convert 50% of electricity homes</b>	444,750	0.28	0.506	<b>-0.230</b>	<b>1830</b>
<b>100% of electricity homes</b>	889,500	0.55	1.012	<b>-0.460</b>	<b>3660</b>
<b>50% of natural gas homes</b>	1,837,300	7.45	2.090	<b>5.360</b>	<b>15774</b>

By converting homes to high-tech pellet furnaces and boilers, the Government of Ontario can spur significant local job growth in the north and fuel manufacturing in the south. The province can reduce emissions by 1.6 Mt/year CO2e by supporting the conversion of the province's oil and propane burning residences AND create 3900+ jobs in the north and open the opportunity to manufacture 400,000+ pellet furnaces and boilers in the south.

## IMPACTS FOR INNOVATION

Innovative bioproducts such as biocomposites and biochemicals are seeing exponentially growing global demand. From [Magna Interiors and Exteriors](#) R&D work on developing biocomposites panels, to the work the [Functional Fibre and Biochemical Network](#) is doing to develop industrial biochemicals, Ontario is striving to lead the global sector in developing new products and new markets.

CHEMICAL SECTOR	2010	2025
Commodity Chemicals	1-2 percent	6-10 percent
Specialty Chemicals	20-25 percent	45-50 percent
Fine Chemicals	20-25 percent	45-50 percent
Polymers	5-10 percent	10-20 percent

Figure 2 - World Biobased Market Penetration 2010-2025 <sup>6</sup>

The Biomass Innovation Centre has developed strategic partnerships with Ontario innovation clusters, universities and colleges, economic development corporations, and European research and trade organizations, to ease technology and knowledge transfer and identify opportunities for innovation and technology development. A BIC-led Northern Ontario Opportunity Discovery Tour brought 25 industry and sector leaders from Finland and Sweden through northern Ontario communities, to identify opportunities for manufacturing and development of bioenergy solutions. This has led to the Finnish government expressing a desire to develop joint research opportunities with key Ontario ministries and joint ventures with industry leaders.

It is clear that the Northern Ontario Bioeconomy Strategy can be a critical success factor in The Honourable Brad Duguid's mandate for the Ministry of Economic Development, Employment and Infrastructure, particularly "developing strategies for key-growth sectors... advanced manufacturing and automotive, agri-food, cleantech, ... natural resources" and "support ... communities that are still recovering from the global recession, with particular focus on Southwestern and Northern Ontario....to develop strategies to attract new investment and jobs".

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<sup>6</sup> Source: USDA, U.S. Biobased Product Market Potential and Projections  
[https://www.bio.org/sites/default/files/20100310\\_biobased\\_chemicals.pdf](https://www.bio.org/sites/default/files/20100310_biobased_chemicals.pdf)

## GENERAL RECOMMENDATIONS

The Biomass Innovation Centre (BIC), hosted by Nipissing University in North Bay, was initiated by representatives from industry, NGOs, academia, municipalities, and First Nations to develop a robust bioeconomy in northern Ontario. By leveraging underutilized forest resources, waste, and other sustainable biomass sources, northern Ontario can provide local energy and fuels, develop new and innovative biocomposites and biochemicals, and ensure food security in northern communities.

The BIC has conducted extensive domestic and international research and held community workshops and seminars throughout northern Ontario to identify best practices, opportunities, and barriers to developing the northern bioeconomy.

Investing in a northern forest-based bioeconomy will benefit more than just northern Ontario. By helping Ontario reach its greenhouse emissions reduction goals, developing modern energy infrastructure to support remote mining operations, and identify new opportunities for our manufacturing sector, the northern bioeconomy seeds benefits in all regions of the province. Northern communities can reap large energy cost savings, reducing the need for provincial monies.

The province has already made considerable investment to develop key components of a thriving northern bioeconomy, such as establishing the Centre for Research and Innovation in the Bio-Economy (CRIBE), supporting demonstration projects such as the Bioenergy Learning and Research Centre at Confederation College, and investing in Whitesand First Nation's biomass-fueled combined heat and power plant.

However, the lack of an over-arching strategy has resulted in policy and regulatory barriers preventing the development of key projects in Ontario communities and First Nations jurisdictions, the responsibility and permitting of these projects to be fragmented across several ministries, and a dearth of skilled workers to support their



operation if implemented. A telling example of this fragmentation was revealed during the Ontario Green Schools Pilot Initiative, a joint effort of the Ministries of Research & Innovation and Education. Four projects under this initiative saw elementary schools without access to the natural gas grid converted to cleantech wood pellet boilers with fuel sourced from local providers. While the physical conversions took less than 6 months, it was another 5 years before the Ministry of the Environment provided Environmental Compliance Approvals to the schools to allow them to run their new systems.

To address these gaps and realize the potential economic and environmental benefits of a bioeconomy, The Union of Ontario Indians and Nipissing University have partnered to develop a Northern Ontario Bioeconomy Strategy.

The Biomass Innovation Centre recommends that the Government of Ontario:

**Recommendation 1:**

Support the development of the Northern Ontario Bioeconomy Strategy through both direct funding and a coordinated effort to reduce policy and regulatory barriers for businesses looking to develop bioenergy projects and new bioproducts.

**Recommendation 2:**

Prioritize the allocation of forest resources to support the development of community bioenergy and biofuel projects in First Nations communities and northern municipalities.

**Recommendation 3:**

Fast-track the review and modernization of regulatory and policy barriers to align with global best practice.

**Recommendation 4:**

Support the growing partnerships with Finland and Sweden, world leaders in bioeconomy development, to develop a joint plan for knowledge and technology transfer and to explore trade and investment opportunities.

**Recommendation 5:**

Support the development and implementation of 10 demonstration projects throughout the north to spur knowledge and technology transfer to other communities, as well as derive the economic benefits of the projects themselves.

**Recommendation 6:**

Develop a skills and training plan to identify and address gaps in the necessary skill-sets required by the emerging bioeconomy, with a particular focus on First Nations youth and young entrepreneurs.

## NEXT STEPS

The Biomass Innovation Centre and the Union of Ontario Indians have been conducting community engagement sessions throughout northern Ontario in the months of February and March, 2015. These sessions have identified demonstration project types and locations with the greatest economic impact, highlighted the existing regulatory and policy barriers to the bioeconomy and global best practices for modernizing them, built public/private funding partnerships to develop those projects, and mapped out a high level skills/training plan to meet the expected demand for bioeconomy skills and knowledge.

The strategy will be shared with the larger public at an international event hosted in northern Ontario.

Both organizations will be submitting funding proposals through various ministries and agencies to fund the implementation of the strategy. We anticipate the opportunity to work closely with the various ministries affected by the strategy to ensure projected benefits are realized.

Contact Information:

Dawn Lambe  
Biomass Innovation Centre  
100 College Drive Box 5002  
North Bay Ontario, P1B 8L7  
(705)474-3450 x 4079  
[dawnl@nipissingu.ca](mailto:dawnl@nipissingu.ca)

[www.biomassinnovation.ca](http://www.biomassinnovation.ca)

**Appendix A**

**Business as Usual**

	Space Heating Energy use by fuel type - Ontario (GJ)	Water Heating Energy use by fuel type - Ontario (GJ)	# Homes with Energy Source	Average Household space heating energy use	Average Household heat energy use (GJ)	Mt CO2e - space heat	Mt CO2e - water heat	Total Mt CO2e - space and water heat	Net Mt CO2e - space and water heating - after renewal	Mt CO2e/GJ	Mt CO2e/household	t CO2e /household
Oil	17,100,000	9,100,000.00	344,700	50	76.01	1.20	0.20	1.40	1.40	0.00000005344	0.000004061503	4.06
Natural Gas	210,500,000	94,600,000.00	3,674,600	57	83.03	10.30	4.60	14.90	14.90	0.00000004884	0.000004054863	4.05
Electricity	32,800,000	2,600,000.00	889,500	37	39.80			0.55	0.55	0.00000001560	0.000000620734	0.62
Coal and Propane	11,000,000	1,300,000.00	57,500	191	213.91	0.70		0.70	0.70	0.00000005691	0.000012173913	12.17
Wood	43,900,000	3,000,000.00	118,700	370	395.11	0.90		0.90	0.135	0.00000000288	0.000001137321	1.14
	315,300,000	110,600,000	5,085,000	141	162	13.1	4.8	18.45				

	Number of homes	Mt Co2e for energy source	Mt CO2 for wood pellets (Net of carbon recovery through renewal)	Net CO2e Savings (Mt)/year	Heat Energy Produced (GJ)	Metric tons of pellets required	Average Metric tons of pellets per home	Supply Chain Jobs Created
Convert 50% of oil burning homes to renewable wood pellets	172,350	0.70	0.196	0.504	13100000	829499.3304	4.81	1355
Convert 100% of oil burning homes to renewable wood pellets	344,700	1.40	0.392	1.008	26200000	1658998.661	4.81	2709
								3981
Convert 50% of coal/propane (other) burning homes to renewable wood pellets	28,750	0.35	0.033	0.317	6150000	389421.4414	13.55	636
Convert 100% of coal/propane (other) burning homes to renewable wood pellets	57,500	0.70	0.065	0.635	12300000	778842.8828	13.55	1272
Convert 50% of electricity heating homes to renewable wood pellets	444,750	0.28	0.506	-0.230	17700000	1120773.904	2.52	1830
Convert 100% of electricity heating homes to renewable wood pellets	889,500	0.55	1.012	-0.460	35400000	2241547.809	2.52	3660
Convert 50% of natural gas burning homes to renewable wood pellets	1,837,300.00	7.45	2.090	5.360	152,550,000	9659551.363	5.26	15774

2012 Data Analysis - Ontario Household Space/Water Heating Energy Use

Number of residences in Ontario (2013)	5,084,900	<a href="http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&amp;sector=res&amp;iuris=on&amp;m=2&amp;page=f">http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&amp;sector=res&amp;iuris=on&amp;m=2&amp;page=f</a>
Energy Use - Space heating (GJ)	315,400,000	<a href="http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&amp;sector=res&amp;iuris=on&amp;m=2&amp;page=f">http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&amp;sector=res&amp;iuris=on&amp;m=2&amp;page=f</a>
Energy Use - Water heating (GJ)	110,500,000	<a href="http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&amp;sector=res&amp;iuris=on&amp;m=2&amp;page=f">http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&amp;sector=res&amp;iuris=on&amp;m=2&amp;page=f</a>
Total Generation 2012 (calculation year) (GJ)	5464800000	

Fuel source data	Space Heating Energy use by fuel type - Ontario (GJ)		Water Heating Energy use by fuel type - Ontario (GJ)		# Homes with Energy Source	g's per mmbtu		Total Mt CO2e - space and water heating	Carbon capture through fuel source renewal (30 years)	Net Mt CO2e - space and water heating - after renewal
	Mt CO2e - space heat	Mt CO2e - water heat	Mt CO2e - space heat	Mt CO2e - water heat						
Oil	17,100,000	9,100,000	344,700	1.2	0.2	1.4	NA	1.4		
Natural Gas	210,500,000	94,600,000	3,674,600	10.3	4.6	14.9	NA	14.9		
Electricity	32,800,000	2,600,000	889,500	0.7	0.55	0.55	NA	0.55	NOTE: See electricity calculations tab for calculations based on Ontario Energy Report - Q3 2014 - used this data	
Coal and Propane	11,000,000	1,300,000	57,500	0.7	0.7	0.7	NA	0.7	0.7 from 2014 to capture "no coal" generation footprint	
Wood	43,900,000	3,000,000	118,700	0.9	0.9	0.9	85%	0.135	Assumption: 85% of Carbon is recaptured by new forest growth <a href="http://www.northernforest.org/berlin_dashboard.html">http://www.northernforest.org/berlin_dashboard.html</a>	
TOTAL - note rounding error diff	315,300,000	110,600,000	5,085,000	13.1	4.8	18.45				

kg CO2e per kWh of wood pellet combustion 0.03895 [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/69554/pb13773-ghg-conversion-factors-2012.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69554/pb13773-ghg-conversion-factors-2012.pdf)  
 kg CO2e per GJ of wood pellet combustion 0.00014022 <http://www.convertunits.com/from/kWh/to/gigajoule>

Jobs created per metric ton of pellets (direct, indirect, induced) 0.001633 <http://www.tsi-inc.net/news/williamStrauss.pdf>  
 Heat created per metric ton of pellets (BTU) 14968552.5 [https://www.google.com/url?sa=t&ct=i&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB0QFjAA&url=http%3A%2F%2Fwww.eia.gov%2Ftools%2Ffans%2Fheatcalc.xls&ei=jkHVbCLFLnsATvp4J4&usq=AfQjCNHIZ1sIQV864Q64iQ8tgp74n439A&sig2=pKfYb77BvU1R4btIo59HA&bvm=88198703\\_d\\_bGQ](https://www.google.com/url?sa=t&ct=i&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB0QFjAA&url=http%3A%2F%2Fwww.eia.gov%2Ftools%2Ffans%2Fheatcalc.xls&ei=jkHVbCLFLnsATvp4J4&usq=AfQjCNHIZ1sIQV864Q64iQ8tgp74n439A&sig2=pKfYb77BvU1R4btIo59HA&bvm=88198703_d_bGQ)  
 Heat created per metric ton of pellets (GJ) 15.79265892  
 Tons per GJ 0.06332056

**TWh Production**

	Nuclear	Hydro	Coal	Gas/Oil	Wind	Biofuel	Solar
2014	94.9	37.1	0.1	14.8	6.8	0.3	0.0185

154.0185 TWH  
554400000 GJ

**Emissions Footprint Calculation (2014) - Used 2014 to reflect closure of coal plants since 2012**

	MT	GWP CO2 Equivalence Factor (MT)		
CO2	6	1	6	
NOx	0.011902	280	3.33256	
TOTAL CO2e			9.33256	

SOURCE <http://www.ontarioenergyreport.ca/pdfs/OEQ%20Electricity%20Q3%202014.pdf?id=0>

CO2 production 8 Metric Tons  
(extrapolated from  
<http://www.ontarioenergyreport.ca/pdfs/OEQ%20Electricity%20Q3%202014.pdf?id=0>)

<http://www.ieso.ca/Pages/Power-Data/Supply.aspx>

	MT CO2	output GJ
Share for heat	0.5521428	32,800,000
Total Generation	9.33256	554,400,000