



Canada Report on Bioenergy 2009

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Natural Resources
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Sponsors:

Canadian Bioenergy Association

Canadian Renewable Fuels Association

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* revising to biomass power page 4

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(This is an update to the Canada Bioenergy Report written in June 2008. Section 6- “Biomass Prices” has not been updated as there has been no new survey. Also Section 4.1-“Heat and Power” has not been updated to reflect pulp mill closures where cogen plants were also shut down, again due to lack of survey and accurate data.)

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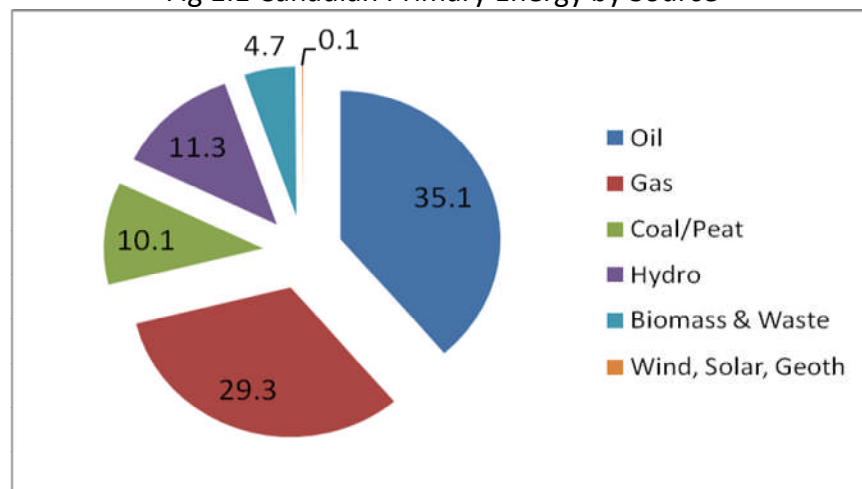
1. General Introduction

Canada is a country of over 33 million people, primarily English speaking, but with French minority large enough to warrant being an officially bilingual nation. At over 9 million sq. km., it is the second largest country in the world after Russia. It stretches from the US in the south to above the Arctic Circle, and from the Pacific Ocean to the Atlantic Ocean. Canada is blessed with considerable natural resources including oil and gas, coal, hydro, minerals, and forests.

Canada resembles the US in its market-oriented economic system, pattern of production, and affluent living standards. Growth of the manufacturing, mining, and service sectors has transformed the nation from a largely rural economy into an industrial, urban economy. Canada's GDP in 2008 was ~\$1.29 trillion (€0.8 trillion).

Fig 1.1 illustrates that Canada is a nation rich in fossil fuel resources. In 2006, 35% of Canada's primary energy was from oil, 29% from natural gas and 10% from coal. 11% was from renewable hydropower, and less than 5% was from renewable biomass and waste¹. Projections for the next couple of decades are for a biomass share of 6-9%².

Fig 1.1 Canadian Primary Energy by Source



Canada has a large, well-developed forest sector and has historically been one of the world's largest exporters of wood products. 402 million ha, or 41% of Canada's land area, is forested. 26.5 million ha, or 6.6% of forests, are National parks. 77% of forests are under provincial jurisdiction, 16% are federal, and 7% are privately owned. In 2005, 191 million m³ of industrial roundwood was harvested on 1,108,000 ha, or 0.3% of total forest land³. Due to falling demand for wood products in the US, only 182 million m³ wood was harvested in 2007 and an estimated 160 million m³ in 2008, resulting in a decline in available mill residues.

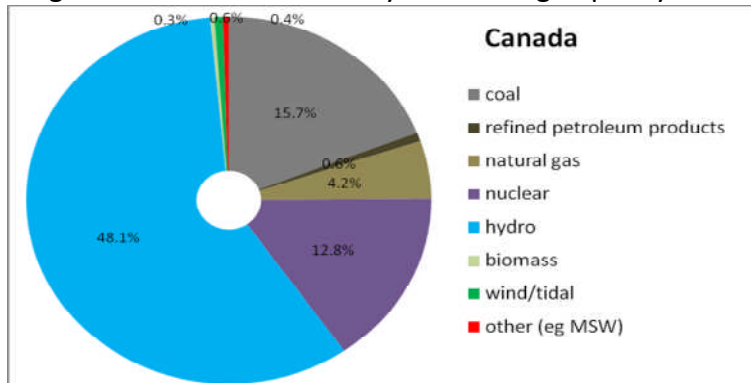
¹ OECD/IEA 2008

² Peter Hall, Natural Resources Canada, Canadian Forest Service

³ State of Canada's Forests 2008

Major initiatives are underway in Canada to produce power from renewable sources. Incentives designed for renewable power resulted in a major increase in wind power capacity in 2006-08, reaching 2,369 MW in 2008⁴. **Grid power capacity** from wind and tidal sources reached 3,850 GWh in 2007, 0.6% of Canada's power **capacity**, compared with 1,980 GWh for biomass. **If off-grid power is included, biomass power production is 7-8,000 GWh**. A major advantage of biomass over wind is that power supply is constant, while wind can only supply power at 33% efficiency. Another advantage singular to biomass is the production of renewable heat, largely ignored in incentive programs.

Fig 1.2 Renewable Electricity Generating Capacity 2007

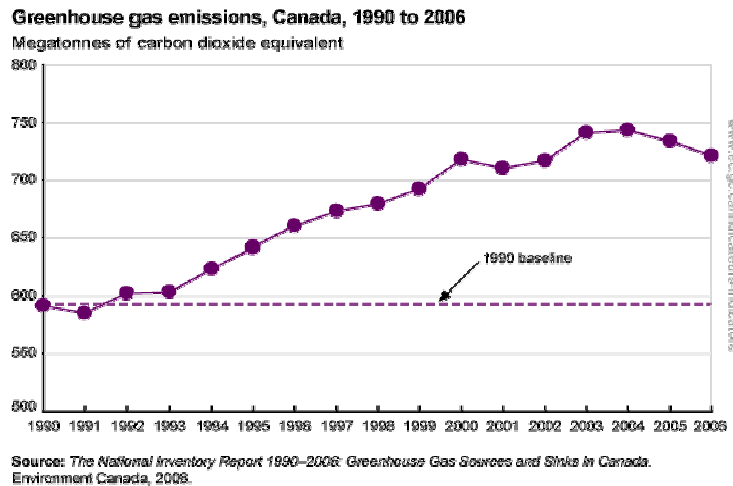


2. Policy

2.1. Climate Change Policy

In 2007 Canadians contributed about 747 million tonnes (MT) CO₂e of GHGs to the atmosphere, approximately the same level as in 2004 as shown in Fig 2.1⁵.

Figure 2.1- Canada GHG Emission Performance 1990-2007



⁴ CanWea

⁵ Environment Canada 2007- http://www.ec.gc.ca/pdb/ghg/inventory_report/2005_report/som-sum_eng.cfm#s1

The trend of GHG emissions is flat from 2003. Emissions in 2007 are 26% above 1990 levels and 33.8% above the Kyoto target of 558 MT. Increases are due to higher oil & gas extraction (largely for export to the US to improve their energy security), and higher heating requirements and transportation due to our increasing population. Canada ranked 57 of 58 industrialized countries and developing nations on climate change progress based on a performance index⁶. Sweden, Germany and France topped the ranking. However, Canada is a growing country. Fig 2.2 illustrates that GHG emissions per person in 2006 grew only 3% from 1990 levels, and it has declined 6% since 2003. Canada's population grew 21% since 1990, compared with Sweden-7% and France-9%.

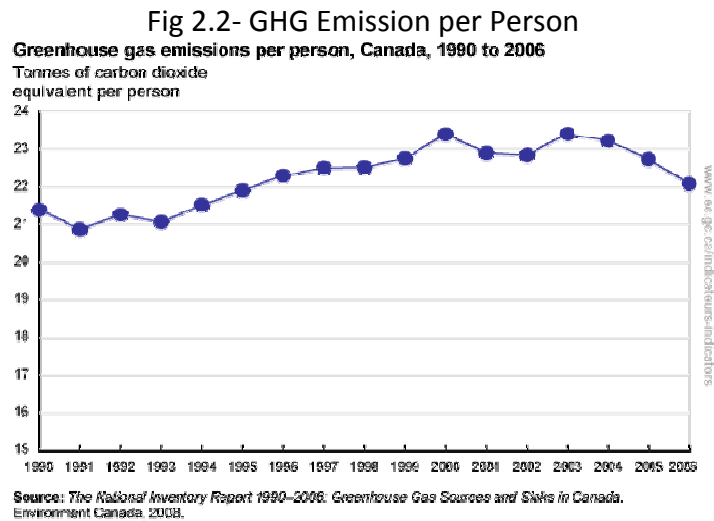
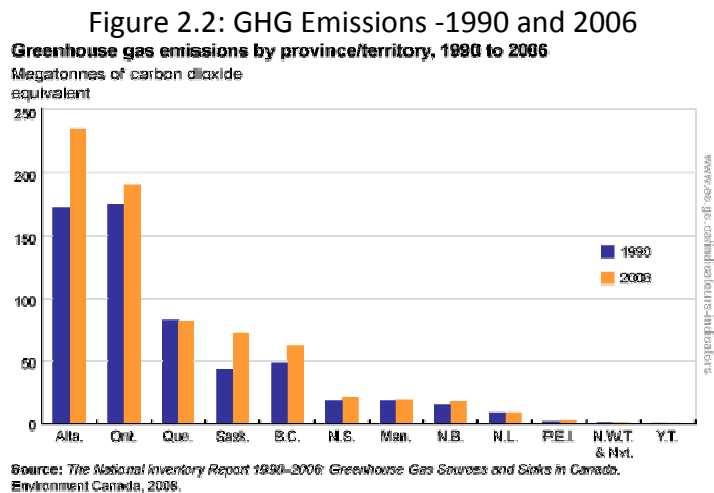


Fig 2.2 illustrates GHG emissions by province. While many provinces barely increased GHG emissions, including hydro-rich Quebec, Alberta and Saskatchewan have increased emissions considerably, almost entirely due to oil and natural gas development so that the US can import from Canada rather than from the Middle East.



⁶ Canwest News Service Dec 10 2008, based on a report released by Germanwatch

The Canadian Government is committed to reducing greenhouse gases. Although the previous government ratified the Kyoto Protocol, the circumstances of Canada's resources and economy made achievement of short-term Kyoto targets all but impossible. Therefore the government decided to develop and implement a made-in-Canada plan that will focus on achieving sustained reductions in emissions in Canada while ensuring a strong economy. In April 2007 the federal government unveiled an action plan that imposed mandatory targets on industry so that Canada can achieve a goal of an absolute reduction of 150 million tonnes by 2020, and put in place a GHG reporting system for large industrial emitters, which make up approximately 1/3 of total emissions. In May 2009 it announced the detailed program rules for a carbon credit offset system that will allow proponents to obtain carbon credits for GHG reducing projects outside the regulated industry program.

The provinces are also committed. In Feb, 2008, BC announced North America's first full carbon tax on all fossil fuels. In July, the tax rate started at \$10/tCO₂e (6.7€), to rise at \$5 per year (3.3€) per year for the next four years. The tax increased the price of gasoline in July 2008 by 2.41¢/l (1.6€). The province also set a target of 33% emission reductions from 2007 to 2020. In Oct, 2007, Quebec instituted a carbon tax on energy companies of 0.8¢/l gasoline and 0.9¢/l diesel, but there was no indication on whether the tax would be passed down to consumers. Alberta implemented a carbon emission trading system in June 2007, which required companies with greater than 100,000 tCO₂e emissions to reduce emissions by 12% from July 1 to Dec 31 2007. Regulated firms could achieve targets by trading verified emission reductions, buying offsets from unregulated activities, or investing in a technology fund. Few trades took place, and most targets were achieved by pumping money into the technology fund, which had no positive GHG impact. BC and Manitoba have joined several US states in the Western Climate Initiative, which aims to set caps and trading goals for carbon emissions. BC plans to have a carbon trading system in place by 2010.

2.2. Renewable Fuels Policy

Policy incentives to promote biofuel use have been in place for years, such as a \$.10 per litre (6.8€_c/l) federal excise tax exemption implemented in the 1990's, however these incentives had little impact in developing a biofuels industry. That changed in 2006 when a new federal government announced a biofuel strategy to increase ethanol production. A mandate in June 2008 legally requires annual renewable content of 5% ethanol by volume in all gasoline for ground transportation by 2010, and 2% in diesel for ground transportation and heating by 2012. Including diesel in the new renewable fuel standards (RFS) is in response to a lobby by oil seed producers. Canada is the world's largest producer of canola, 8,750 tonnes in 2007-08. Adding new demand for canola for bio-diesel will enhance farm incomes.

In March 2007 the federal excise tax incentive was dropped and replaced with producer incentives, shown in Table 2.2, which pay a maximum 10¢/litre (6.8€_c/l) initially for ethanol in gasoline and 20¢/litre (13.5€_c/l) for biodiesel. These incentives were

established to encourage biofuel production in Canada, rather than importing from the US or Brazil. \$1.5Cdn billion (1€billion) in funding was budgeted to establish a volume limit of 2 billion litres of renewables (ethanol) in gasoline and 500 million litres of biodiesel. The incentive is calculated to ensure a 20% pre-tax return to manufacturers, even before considering any provincial incentives.

Table 2.2-
Maximum Incentive Rates Renewable Fuels- Currency per Litre- April 1-March 31

	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>
In gasoline (\$Cdn)	0.10	0.10	0.10	0.08	0.07	0.06	0.05	0.04	0.04
In gasoline (€)	0.067	0.067	0.067	0.054	0.047	0.040	0.034	0.027	0.027
In Diesel (\$Cdn)	0.20	0.20	0.20	0.16	0.14	0.12	0.10	0.08	0.06
In Diesel (€)	0.13	0.13	0.13	0.11	0.09	0.08	0.07	0.05	0.04

Federal policies are being put in place to go beyond increasing biofuel production to establishing a sustainable bio-based economy. Other support programs include: a \$145 million (98€million) Agricultural Bio-products Innovation Program (ABIP) to mobilize research networks to develop effective, efficient technologies for agricultural biomass conversion; and a \$134 million (90€million) Agri-Opportunities Program over 5 years to accelerate commercialization of agricultural products. In 2007 Sustainable Development Technology Canada (SDTC) announced a \$500 million (336€million) NextGen Biofuels Fund to pay up to 40% of project costs to establish first-of-a-kind large demonstration-scale facilities producing next-generation biofuels. This fund promotes biofuels from many feedstocks such as wheat straw, corn stover, wood residue and switch grass. By March 2009, 13 funding rounds had committed \$376 million (€232million) to 154 clean technology projects. Federal programs are summarized in Appendix 1.

Many provinces have mandated renewable fuel content in fuels, shown in Table 2.3, and some have announced infrastructure grants. While some provinces now have renewable targets, each is implementing its own complex, unharmonized tax exemptions. Inconsistencies in threshold levels, timeframes and feedstocks have hindered intra-provincial biofuel trade. For example, ethanol produced in Alberta is exempted from Alberta's gas tax, but not ethanol produced in neighbouring BC or Saskatchewan.

Table 2.3- Provincial Renewable Fuel Incentives (1¢=.68€c)

	<u>Mandate</u>	<u>Incentive</u>
BC	5% ethanol, 5% biodiesel-Jan 2010	14.5¢/l tax exemption, BC fuel only
Alberta	5%ethanol. 2%biodiesel-July 1, 2010	9¢/l tax exemption, Alta fuel only
Saskatchewan	7% ethanol in Gas	15¢/l tax exemption. Sask fuel only
Manitoba	8.5% ethanol in Gas*	20¢/l producer incentive 2008-09, Man only 15¢/l producer credit 2010-12, Man only 10¢/l 2013-15, Man only
Ontario	5% ethanol in gas 2007 10% ethanol in gas 2010	20¢/l producer incentive

Although Quebec announced its intention to mandate a 5% biofuel content, leading to the construction of a 200 million litre corn ethanol plant at Verennes, in November 2007 Quebec announced that no other corn ethanol plants would be built in Quebec, owing to findings about environmental impacts of intensive corn cultivation and market price impacts of corn to ethanol seen in the US. However, Quebec announced \$25 million (17€million) in June 2007 to establish a Chair at Sherbrooke University to develop two cellulosic ethanol demonstration plants.

2.3. Renewable Biomass Heat and Power Policy

While government policies and incentives have been very supportive of biofuels, supported by a strong industry lobby, support for biomass heat and power has been lean and ineffective by comparison. Federally programs typically focus on basic research, applied R&D, demonstration and pre-commercialization. For example the \$550 million (370€million) SD Tech Fund™ (SDTC above) is aimed at supporting the late-stage development and pre-commercial demonstration of clean technology solutions: products and processes that contribute to clean air, clean water and clean land, that address climate change and improve the productivity and the global competitiveness of the Canadian industry. However, there is little federal support for anything after the pre-commercialization stage. In 2009, the federal government announced a \$1 billion aid package to the pulp industry to counter a similar program in the US that will provide 16¢/litre of black liquor produced in 2009, a renewable fuel which pulp mills use to power their boilers. The subsidy must be used to increase energy efficiency.

With pulp & paper and sawmill industries in distress, and mill closures rampant, the provinces are beginning to see bioenergy as a viable socio-economic alternative to traditional forest products. BC has the largest forest industry in Canada. In 2008 BC became the first jurisdiction in Canada to release a Bioenergy Strategy which includes: \$25 million (17€million) to establish a bioenergy network, a target of at least 10 community energy projects by 2020, a commitment to establish a comprehensive biomass inventory, and a 2-part call for power. The strategy is short on incentives. The first call for power was targeted at projects that were already well along in planning and proponents had to “bid” a power price. In June 2008, 20 proposals were received from 13 proponents to provide 6,000 GWh with bid prices of 10.7-30.0¢/KWh (6.6-18.5€). Four projects were chosen that will provide 579 GWh (60MW) at 9.7-10.7¢/KWh (6-6.6€). The second call for power was released March 5, 2009 targeted to acquire 1000 GWh. BC has committed to;

- Develop legislation to phase in requirements for methane gas capture
- Streamline the regulatory and environmental permitting process
- Develop regulations to eliminate wasteful beehive burners
- Promote wood pellet production and facilitate pellet market development
- Improve access to wood fibre feedstocks for generation of heat and power
- Review onerous boiler and pressure vessel regulations to speed bioenergy development
- Develop new fine particulate standards

In Quebec, the second largest forest industry in Canada is reeling due to cut backs in annual allowable cut of wood, the rising Canadian dollar, and the falling demand for lumber by the US. Quebec issued a “Green Paper” to begin restructuring the forest regime to ensure equitable management and allocation of timber resources. A May 2007 call for 100MW of biomass power by Hydro Quebec was unsuccessful, partly due to the inadequate time allowed to prepare proposals. Only two cogen projects at pulp & paper mills were submitted. There are no incentives for small power. However, Quebec remains committed and in 2008 launched a program for wood bioenergy followed by a call for 125 MW power. \$150 million (€93 million) was allocated over three years to convert heavy oil heating systems to woody biomass. Activity is being driven at the regional level by CREs (Conseil régionale de l’environnement), privileged partners of the government for regional development. Several regions are moving quickly to garner forest biomass for small community heating systems.

Ontario set two renewable targets in 2004: 5% of generating capacity from renewable sources by 2007 (1350 MW), 10% by 2010 (2700 MW). The provincial utility made calls for renewable power, which drew primarily wind power projects. Only two biomass proposals, both landfill gas totaling 7.5 MW, were submitted, partly due the inadequate time provided. Biomass proposals need time to line up long term biomass supply contracts. In an effort to move forward meaningfully with renewable power, the Ontario Power Authority announced the Standard Offer Program in 2007, paying 11¢/KWh (7.4€/KWh) for renewable power (14.5¢ at peak) over 20 years for projects under 10 MW. By Jan 2008, 262 contracts for power were executed; 69 for wind power, 158 for solar power, 15 for water power, and only 20 for biomass. Of the biomass projects 13 were landfill gas, 3 were biofuels, and only 4 out of 262 were biomass heat and power, again partly due to economics, but partly due to lack of time to prepare biomass supply.

In an effort to enable wood supply for energy Ontario began to streamline the process to gain access to an estimated 22 million m³ of biofibre⁷, including harvest tops and branches, unused allowable harvest, and unmerchantable timber. A 2009 call for expressions of interest drew 130 applications for 143 facilities to use Biofibre, of which 84 were for the manufacture of pellets. The province will follow up with a request for proposals later in 2009.

A major barrier to bioenergy has been antiquated legacy legislation by the Ministry of the Environment (MOE) including; conflicting air quality permits, an onerous permitting process, and inappropriate definitions that lump woody biomass together with municipal waste. Policy often puts project development into gridlock. To cut a swath through red tape three provincial Ministries and labour unions combined efforts to approve an \$84 million biomass boiler project at the Abitibi-Bowater paper mill at Ft Frances. It will use sawdust, harvest slash and mill sludge to make steam and power and

⁷ Jo Maure, Ontario Ministry of Natural Resources, Sherbrooke presentation, June 2009

eliminate natural gas a fuel. Ontario Power Generation is legislated to shut down all coal-fueled power generation by 2014, and has plans to convert the Atikokan power station and part of the Nanticoke power station to biomass. It held an “expression of interest” to supply biomass in early 2009.

One of the major shortfalls of Canadian policy is the fixation with power rather than heat. This focus has led to a significant increase in power “capacity” building, largely by way of wind turbines, but the result has been a realization that wind power capacity translates to production only 32% of the time, and now additional gas cogeneration is being contemplated to meet peak power needs. Production of renewable energy that includes power AND heat is one of bioenergy’s great advantages. The Canadian Bioenergy Association (CanBio) is promoting equal incentives for both power AND heat, both to improve the economics of biomass energy projects and to enable the constant power required by grids.

Provincial policies are summarized in Appendix 1.

3. Biomass Resources

3.1. Woody Biomass

Forest biomass can be broadly separated into three categories; mill residue (bark, sawdust and shavings primarily from pulp mill and sawmill operations), forest residue (tops, branches and leaves from harvest and thinning operations that are left in the forest or at roadside after delimiting), and standing timber (Mountain Pine Beetle Wood and unmerchantable wood for example).

3.1.1. Annual Residue Production:

In 2004 Canadian sawmills produced 83.5 million m³ of lumber. However, the sub-prime financial crisis in the US which led to a worldwide recession in 2008-09 has changed the situation entirely. Millions of unsold homes in the US have drastically reduced home building and subsequently the demand for Canadian lumber. Production has fallen from 83.5 million m³ in 2004 to 57.2 million m³ in 2008, as shown in Fig. 3.1.

Fig 3.1



Table 3.1 shows that the decline has hit all provinces, with Ontario, Quebec and New Brunswick being particularly hard hit.

Table 3.1- Sawmill Production in Canada by Province⁸ (000m³)

	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	ch 04-08
BC	39,205	41,014	41,050	36,677	28,192	-28.1%
Alberta	8,053	7,362	6,782	7,853	7,358	-8.6%
Sask	1,184	749	479	200	0	-100.0%
Manitoba	637	700	459	200	0	-100.0%
Ontario	8,728	9,104	8,493	7,753	5,509	-36.9%
Quebec	19,883	18,607	16,126	14,588	12,401	-37.6%
New Brunswick	4,039	3,797	3,525	3,349	2,408	-40.4%
Nova Scotia	1,785	<u>1,557</u>	<u>1,308</u>	<u>1,224</u>	<u>817</u>	<u>-54.2%</u>
Canada	83,514	82,890	78,222	71,844	58,693	-29.7%

⁸ Statistics Canada Publication 35-003-X

The severe drop in lumber production has essentially wiped out surpluses of mill residue in 2009. A 2005 mill residue survey⁹ of Canadian pulp mills and sawmills indicated that 2004 production of bark, sawdust and shavings was 21.2 million Odt¹⁰ (365 PJ) as shown in Table 3.2. Of this 17.7 million Odt was committed to produce onsite energy, or sold to independent power producers, board and pellet manufacturers, farmers for animal bedding, and landscapers for garden beds. Some was exported, but there was still an annual mill residue surplus of 2.7 million Odt (46 PJ). In 2009, with the drop in lumber production, the estimated production of mill residues is only 14.0 million Odt.

In 2005-08 several large new biomass projects were built that anticipated using 1.1 million Odt of mill residue including 815,000 Odt¹¹ in BC alone. These projects included a new pellet plant in Houston BC, a pellet plant expansion in Price George, a pellet capacity increase at Canfor, and a bark boiler project at the AbitibiBowater pulp & paper mill in Ft. Frances in Ontario. As shown in Table 3.2, mill residue demand by existing projects in 2004 combined with demand from new projects exceeds 2008 mill residue production by 4.9 million Odt, leaving many projects scrambling for biomass. Many biomass energy plants have had to reduce capacity or shut down. There may be small surpluses in some locations.

Table 3.2- Canada Surplus Mill Residues 2009 (ODt)

Province	2004				2005-2008		
	Prod'n	Consump.	Export	Surplus	Est. Prod'n	New Proj.	Surplus
BC	6,554	4,338	350	1,815	4,713	815	-440
Alberta	2,406	1,924	0	481	2,198	30	244
Saskatchewan	580	416	0	164	0		-416
Manitoba	225	212	0	13	0		-212
Ontario	2,602	2,480	1	121	1,642	250	-1,088
Quebec	6,669	6,400	169	100	4,159		-2,241
New Brunswick	1,373	1,223	150	0	819		-404
Nova Scotia	601	588	0	13	275		-313
PEI	24	23			17		-6
Nfld & Lab.	195	166	0	30	137		-30
Total	21,229	17,770	670	2,737	13,960	1,095	-4,905

3.1.2. Hog Fuel Piles:

In BC, Alberta and Manitoba, sawmills were required to incinerate bark and sawdust that was not used internally or sold in the year it was produced, while in Saskatchewan and the Eastern provinces incineration was disallowed and mills piled excess residue at

⁹ Estimated Production, Consumption and Surplus Mill Wood Residues in Canada-2004, A National Report- NRCan & FPAC; Prepared by BW McCloy and Associates and Climate Change Solutions

¹⁰ Odt- Oven Dry tonnes= Bone Dry tonnes

¹¹ Latest estimate by Brian McCloy, BW McCloy and Associates

the mill site. With the rising cost of mill residue, mills began looking to this bark as a fuel source. In some cases the bark is contaminated with rocks or soil, or is too wet to be economically usable, however many of these piles are excellent sources of biomass for energy. Table 3.2 shows estimates made by sawmills of bark volume in 2005; usable bark (fairly dry, little contamination), and bark available (not committed). In Canada on Jan 1 2005 there were 34.8 million Odt of bark. An estimated 22.5 million Odt was usable and 20.9 million Odt was available (359 PJ). Some piles have begun to be mined in Ontario and Quebec so that the volume in 2009 may be closer to 20.4 million Odt, equivalent to 2.0 million Odt annually if mined over 10 years. (New analyses of the bark piles have shown that some bark piles were underestimated in terms of the amount that was usable, so these volumes, particularly in Quebec, could be 2 million Odt higher.)

Table 3.3- Surplus Historic Bark Piles- 000 Odt

	2005 Re-estimated			2005-2008		
	<u>Estimated</u>	<u>Usable</u>	<u>Available</u>	<u>Utilized</u>	<u>Remaining</u>	<u>Annual*</u>
Saskatchewan	2,900	2,900	2,900		2,900	290
Ontario	19,371	13,270	11,684	80	11,604	1,160
Quebec	11,710	5,651	5,651	400	5,251	525
New Brunswick	300	257	257		257	26
Nova Scotia	213	206	148		148	15
Prince Edward Is.	30	30	30		30	3
Newfoundland	<u>235</u>	<u>188</u>	<u>188</u>	-	<u>188</u>	<u>19</u>
Canada	34,759	22,502	20,858	480	20,378	2,038

* if mined over 10 years

3.1.3. Forest Harvest Waste and Urban Wood Residue:

With mill residue surpluses essentially gone until the sawmill industry recovers, forestry and energy companies and provincial governments are looking to harvest residues as the next fuel source, vast, and much of it burned at roadside. The Canadian Biomass Innovation Network, the Canadian Forest Service, Agriculture and Agri-Food Canada and the National Land and Water Information Service have collaborated to develop the Biomass Inventory and Assessment Tool (BIMAT) to identify and characterize biomass sources potentially available for bioenergy conversion in Canada. BIMAT is based on internet map server technology and when complete will allow users to both view and query the spatially explicit inventory of biomass sources across the country. The model reflects harvest operations in all provinces and territories. Ontario for example uses full tree harvesting methods and 90% of harvest residue is left at roadside. Quebec, in contrast, uses cut-to-length methods in 40% of its operations, thus only 60% of harvest residues are left at roadside. Since roadside residues are more cost effective than in situ residues, these only are considered available for bioenergy in this report. They include low-value materials resulting from harvesting and commercial thinning operations, primarily tops and branches, and in the case of full tree chipping, bark and log exterior

residue. The BIMAT woody biomass inventory does not include deforestation, silviculture recovery biomass or non-commercial whole trees in its inventory.

Table 3.3 shows estimated harvest residue volumes at roadside for the ten provinces, estimated by BIMAT to be 31.1 million BDt annually. This estimate is a maximum sustainable level based on the allowable annual cut in each jurisdiction. In fact annual harvest has been below the allowable annual cut for several years, and the market factors related to US housing have even more reduced harvest levels. A better estimate of actual available harvest residue in 2008 might be 22 million BDt.

Table 3.3- Harvest Residue at Roadside and Urban Wood

	<u>Roadside Residue</u>			2008 <u>Total</u>	<u>Urban</u>
	BIOMAT Max Sustainable				
	<u>HW</u>	<u>SW</u>	<u>Total</u>		
BC	404	13,332	13,736	9,946	1,303
Alberta	1,397	1,972	3,368	2,544	1,017
Sask	275	467	743	424	251
Man	64	265	329	131	305
Ont	896	3,485	4,381	2,431	3,900
Que	1,367	5,447	6,814	5,213	2,490
NB	21	827	848	610	146
NS	175	448	623	419	198
PEI	0	0	0	0	24
NFLD	<u>0</u>	<u>239</u>	<u>239</u>	<u>239</u>	<u>116</u>
Total	4,599	26,482	31,081	21,957	9,750

Urban wood residue is already being used for bioenergy and it will increasingly be used if it is clean and low cost. Urban wood includes discarded wood products, whole trees, and pruned branches or stumps generated during street and park maintenance. Primary constituents of used wood residue include used lumber, trim shipping pallets and crates from construction, demolition, and other activities. BIMAT estimates urban residue volumes based on population size. An estimated 9.75 million BDt of urban wood residues are available annually for bioenergy, as estimated by BIMAT.

3.2. Agricultural Residues

Farmland occupies 67.5 M ha (million hectares) in Canada, or 6.7% of the total land base. Crops are grown on 36.4 M ha, or 54% of farmland. Agricultural activity produces millions of tonnes of biomass annually, which can be classified as: virgin biomass (grown for energy), waste biomass (residual fraction of primary harvest), and livestock wastes. Total crop production in 2001 was estimated at 78.3 M Odt¹², of which 70% was wheat, barley or tame hay. 56.1 M Odt of production was straw or stover, some of which must

¹² A Canadian Biomass Inventory- Feedstocks for a Bio-based Economy-2003 BIOCAP

be returned to the soil to maintain fertility and carbon content. Residues recoverable and sustainably removable were estimated at 29.3 Odt annually, however some of this goes to traditional uses such as animal bedding and mulching. Agricultural biomass available for energy may be 17.3 M Odt annually, or 309 TJ. A June 2007 estimate suggests that 2 million tonnes agricultural residues annually would be available based assumptions of 10 year average yields and collecting residue in 1 in every 4 years¹³.

Livestock manure is a readily available source of waste biomass. Manures are used extensively as soil amendments, though direct application causes contamination of surface and groundwater, and manure causes emission of methane gas and nitrous oxide, two potent greenhouse gases. Manure production is approximately 128 Mt⁸ (million tonnes) of which 58 Mt, or 46%, is considered recoverable. This represents a biogas potential of 3.2 billion M³ pa, or heating value of 65 PJ pa, although the energy is expected to supply on-farm requirements.

3.2.1. Ethanol Feedstock

In Canada in 2008 65% of ethanol was made from corn (all in Eastern Canada), and 35% from wheat (all in Western Canada). Ontario is the largest corn-producing province in Canada, and now 56% of Canadian ethanol production is in Ontario. In 2006 it was estimated that of 9 million tonnes corn was produced in Canada and 1.9 million tonnes were imported from the US for a total of 10.87 million tonnes, shown on Table 3.4. An estimated 8.4 million tonnes of corn were used for food and 635,000 tonnes were used for ethanol. Ontario and Quebec planted record amounts of corn in 2007, and an estimated 11.4 million tonnes were produced. 1.05 million tonnes corn was directed at ethanol production. To meet the feedstock supply required by the ethanol plants operating in 2009, 2.9 million tonnes corn will be needed.

Table 3.4 Agricultural Residues for Ethanol (000 tonnes)

	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>
Corn:							
Production	9,587	8,837	9,361	8,990	11,400		
Imports	<u>3,726</u>	<u>2,098</u>	<u>2,139</u>	<u>1,881</u>	<u>1,600</u>		
Total	13,313	10,935	11,500	10,871	13,000		
for Feed	9,500	7,951	8,297	8,400	8,700		
for Ethanol	320	362	560	635	1,054	1,854	2,867
Wheat:							
Production	23,500	25,860	26,775	25,265	22,140		
for Food	3,300	5,056	5,056	4,800	4,500		
for Ethanol	150	150	150	189	472	941	1,082

¹³ Mark Stumborg, presentation CanBio Bioenergy Conference Ottawa, June 2007

Wheat is the feedstock for almost all the rest of Canadian ethanol production, and it will be an increasing share of feedstock as more Western plants come online. Wheat production in 2008 was 25.5 million tonnes in 2008¹⁴. Only 2% of 2007 production, 472,000 tonnes, went to ethanol. Openings of Western ethanol plants in 2008-09 will increase demand of wheat to 1.08 million tonnes by 2009, as shown in Table 3.4. More importantly, production patterns of Canadian wheat farmers are expected to change from high protein/low starch varieties used by the milling industry, to low protein/high starch varieties preferred by ethanol producers. The Canadian Wheat Board, which controls the sale of wheat for human consumption, will have no involvement in the marketing of wheat for ethanol. It is estimated that there is potential for 4.1 million litres ethanol from Western Canada; 600,000 l from cereal residues, 1,182,000 l from cereal grain (10% of crop) and 2,350,000 l from perennial biomass¹⁵.

3.2.2. Biodiesel Feedstock

A 2% federal biodiesel mandate will alter the feedstock outlook for biodiesel. In 2007 feedstocks for biodiesel included 35 million litres of animal fats and 18 million litres of imported palm oil, as shown in Table 3.5. Abundant canola and soy beans can be used, but these crops are priced as food oils in international markets and sometimes carry a high price. Canola is in high demand as a healthy oil by the food industry. Rendered oils (yellow grease), rendered animal fats (tallow) and palm oil are priced as feed and industrial use and carry a low price. If canola prices are too high, sometimes palm oil must be imported as a feedstock. Recent estimates suggest that there are more than 100,000 tonnes recycled cooking oils, 500,000 tonnes rendered oils from animal fats and more than 800,000 tonnes vegetable oil, totaling 1.5 million tonnes, are available for biodiesel production or export¹⁶. Canada's canola production in 2008 is estimated at 12.5 million tonnes¹⁷ however most of it is sold as food. Some canola production cannot be sold into this market if it has been frozen or has other deficiencies, and this canola can be used for energy. The maximum potential biodiesel production based on 35 million ha in canola production and 10% of the crop in biodiesel is 2,620 million litres.

Table 3.5 Biodiesel Feedstock- million litres

	<u>2005</u>	<u>2006</u>	<u>2007</u>
Soybean Oil	0	0	0
Canola Oil	0	0	1
Palm Oil	0	0	18
Animal Fats	0	35	35
Recycled Veg. Oil	0	0	42

¹⁴ Statistics Canada

¹⁵ Ibid 15

¹⁶ Agricultural Feedstocks for the Bio-economy in 2020: Mark Stumborg, Agriculture and Agrifood Canada 2008

¹⁷ Canola Council Dec 5, 2008

3.3. Municipal Solid Waste

In Canada 33.2 million tonnes of municipal solid waste was generated in 2004¹⁸, a 13% increase over 2000. 13.4 million tonnes were from households (418 kg/capita), the remainder in all other sectors. Of 33.2 million tonnes generated, 7.9 million tonnes (24%) were recycled or composted, 24.5 million tonnes were landfilled, and 763,000 tonnes were thermally treated. There are 7 main treating installations (5 with energy recovery, 2 without); 1 in PEI, 3 in Quebec, 1 in Ontario, 1 in Alberta, and 1 in BC.

Emerging technologies at demonstration scales are;

- Plasco: Plasma technology producing Syngas (City of Ottawa)
- Enerkem: Gasification technology (City of Edmonton)

In 2002, 29% of disposed MSW was paper, 28% organics, 9% plastics, 7.6% wood, and 8% metals and glass.

¹⁸ Overview of Municipal Solid Waste Management in Canada, A. David, Environment Canada Oct 2007

4. Use of Biomass

What are the current uses of biomass, how much is used, and what are the trends for the future? Historically, the chief feedstock for bioenergy was mill residue from forest products operations. The primary use was generation of heat and power by pulp and paper mills, sawmills, and independent power plants. In 1989, Ensyn began using this feedstock to make Pyrolysis Oil, and in 2005 Dynamotive Energy began to use post-industrial wood to make Pyrolysis Oil. Corn and wheat are used to make ethanol, and also a small amount of biodiesel, and agricultural wastes are used to heat greenhouses.

4.1. Heat and Power

In 2004 Canada had 78.9 GW of capacity from renewable sources. 67% was from conventional hydro, 23% from low-impact (small) hydro, and 9.4% from biomass. For biomass, approximately 26% (1938 MW) was electrical and 76% (5454 MW) was thermal. Much of the biomass energy production was at pulp mills, many of which have shut down since 2004. A survey is needed to assess what is the current production and capacity. Wind power has increased capacity from 533 MW in 2004 to 2,578 MW in 2008, and produces at 33% efficiency on average. Hydro is approximately the same as in 2004. Table 4.1 shows 2004 data with wind and MSW updated to 2008.

Table 4.1 Renewable Heat and Power Capacity 2004 (MW) (Wind and MSW Updated to 2008)

	Conven Hydro	Lo- Impct Hydro	Biomass	Wind (08)	Solar, Tidal & Earth	Biogas	MSW (08)	Total
BC	7,507	4,680	3,726	0	1	130	5	16,049
Alberta	807	66	633	524	0	5		2,036
Saskatchewan	854		537	171	0			1,562
Manitoba	4,992		28	104	0			5,125
Ontario	7,757	1,511	1,601	964	24	174	4	12,035
Quebec	22,477	11,530	305	532	1	31		34,875
New Brunswick	930	0	396	96	0			1,422
Nova Scotia	396	4	165	59	20			643
PEI			1	72			1	74
Newfdld & Labr	6,902	44		55				7,001
Nunavut & NWT	37	22		0				59
Yukon	<u>77</u>		<u>0</u>	<u>1</u>				<u>78</u>
Canada	52,735	17,857	7,392	2,578	46	340	10	80,958
	65.1%	22.1%	9.1%	3.2%	0.1%	0.4%	0.0%	

CIEEDAC- Dec 2005 except for wind and MSW

Table 4.2 shows that electrical generation capacity from biomass was approximately 1,866 MW in 2005. With new construction, 2008 capacity would be 2,051 MW. However some pulp mills closed in the 2006-07 period, shutting cogen capacity.

Table 4.2 Installed Biomass Power Capacity (MW)

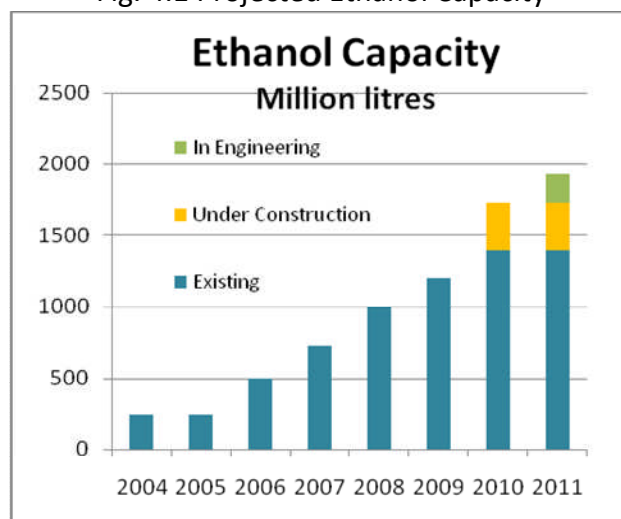
	<u>P&P</u>	<u>IPP</u>	<u>Total</u>	<u>underway</u>	<u>2008</u>	<u>closures</u>
			<u>2005</u>	<u>2005-08</u>		
BC			648	73	721	
Alberta	217	62	255	25	280	
Sask			77		77	
Manitoba			23		23	
Ontario			321	13	334	
Quebec	126	179	305	74	379	
New Brunswick	164	0	164		164	
Nova Scotia		25	55		55	
PEI			0		0	
Newfoundland			<u>18</u>		<u>18</u>	
			1,866	185	2,051	

4.2. Biofuels Production

4.2.1. Ethanol

In 2004, Canada had 6 ethanol plants producing 238 million litres (ml) of ethanol, primarily from corn. As a result of government policies, by 2007 there were 10 plants with total capacity of 890 ml; 546 ml from corn, and 339 ml from grain. Three more plants came on-stream in 2008 adding 500 ml for a total built capacity of 1,390 ml. Actual production hit 1 million litres in December 2008. There are four more plants now under construction that will bring capacity to 1,731 ml, as illustrated in Fig 4.1. In addition, engineering is currently underway for a 200 ml expansion for corn-based ethanol in Sarnia Ontario. Canada's target for 5% ethanol in gasoline requires 1.4 ml ethanol. This target will be reached with capacity now underway.

Fig. 4.1 Projected Ethanol Capacity



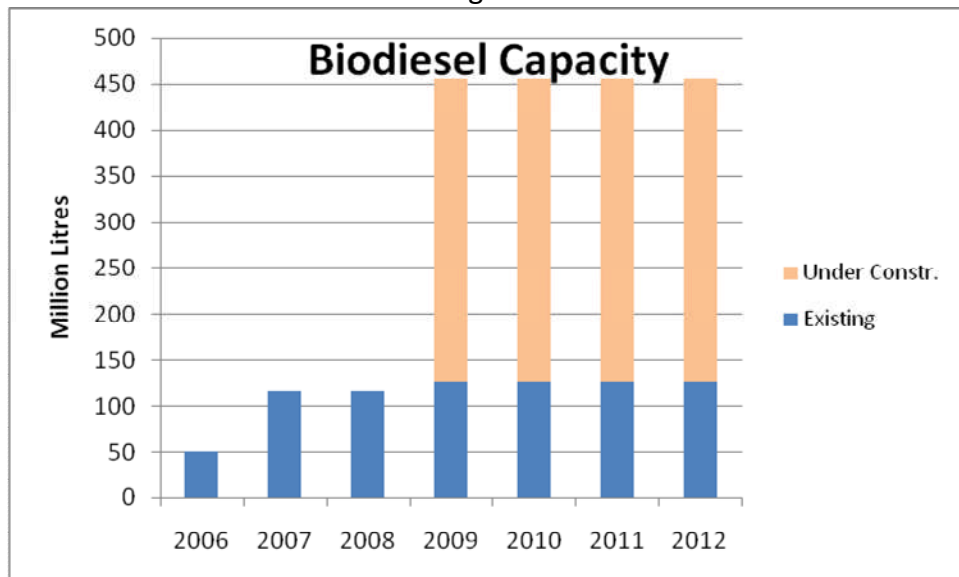
Due to questionable environmental benefits of corn ethanol, Quebec has outlawed any future corn ethanol plants, and it is possible that other provinces may do likewise. Canada is at the leading edge in 2nd generation ethanol technology, and it has been said that all future plants will be 2nd generation ethanol. Enerkem is leading the way in Quebec. After testing its Sherbrooke plant using various feedstocks and producing 0.5 million litres annually of alcohols, it just completed a 2nd generation ethanol plant at nearby Westbury that will produce 5 million litres annually made from old electricity poles. In addition, construction is starting in 2009 for a 2010 completion of a plant in Edmonton that will use 100,000 tonnes annually of MSW to make 36 ml of ethanol.

Lignol of Vancouver is a leading technology company in cellulosic ethanol from wood. After successfully running its pilot plant in Vancouver, in 2008 Lignol signed an agreement with the US Department of Energy to build a \$30US million commercial scale plant in Colorado, which will produce 7.6 ml ethanol.

4.2.2. Biodiesel

Canada consumes 26 billion litres of diesel fuel per year. Production of biodiesel went from 9 million in 2006 to almost 100 million litres in 2007-08 due to new capacity and expansions. Capacity in 2008 was 126 ml. A 2% renewable mandate for 2012 would require a 5-fold increase in production to 520 million litres per year. As of Jan 2009 there are 6 plants under construction that will add capacity of 330 ml biodiesel; 4 with a combined capacity of 259 ML will use canola oil as a feedstock, and 2 will use a mix of feedstocks. Total built capacity will be 456 ml, as shown in Fig 4.2.

Fig 4.2



4.3. Pyrolysis Oil

Fast Pyrolysis is a process by which small particles of biomass waste are rapidly heated to high temperatures in the absence of oxygen, vapourized, and then condensed into

liquid fuel. Products of the process are typically 65-72% liquid Pyrolysis Oil, 15-20% solid char and 12-18% non-condensable gases (NCG), depending on the type of feedstock and other factors in manufacture. Common feedstock for Pyrolysis Oil is forest waste, such as sawdust and bark, and agricultural waste, such as sugar cane bagasse, though pyrolysis oil has been made successfully from over 100 different biomass feedstocks.

Pyrolysis Oil from fast pyrolysis is a brown, free-flowing liquid fuel that has a density of 1.2 kg/litre. Its heating value is 40% of diesel by weight, 55% by volume. It can be stored, pumped and transported like petroleum products and can be combusted directly in boilers, gas turbines and slow to medium speed diesels for heat and power. It is acidic, with pH 2-3, so special tanks and piping are required for storage and transportation.

Canada is a leader in Pyrolysis Oil technology and development with two systems at a commercial scale;

- Ensyn Corp, Ottawa
- Dynamotive Energy Systems, Vancouver

Ensyn has been making Pyrolysis Oil from wood waste in the US since 1989, primarily for chemical and fuel products markets. In 2004 Ensyn built its largest plant, located in Renfrew Canada. It uses 100 BDt of sawmill residues (33,000 tonnes per annum) to produce pyrolysis oil. Ensyn has focused on food and chemicals markets, but trends in energy prices are motivating Ensyn to enter the energy market by way of expansion.

Dynamotive in 2005 built a 100-tpd commercial scale demonstration plant at West Lorne Ontario, and in 2008 it completed a 30-tpd expansion. The plant uses up to 130-tpd of wood fibre, primarily from the adjacent Erie Flooring and Wood Products plant, to produce up to 94-tpd or 31,000 tonnes p.a. of pure Pyrolysis Oil. Some of the pyrolysis oil is fed into a 2.5 MW turbine to make power that is subsequently fed into the Ontario grid, and some is exported to the US to replace light or heavy oil in stationary engines. Dynamotive is also part-owner in a 200-tpd pyrolysis oil plant in Guelph, Ontario, just completed in 2007. It is currently the largest pyrolysis oil plant in the world. This plant uses post-industrial wood from Megacity recycling operations. The sub-prime housing crisis in the US has led to 30% reduction in Canadian sawmill production, and Dynamotive Lorne is suffering the same lack of mill residue that is currently affecting the entire forest industry. Also, Dynamotive has a number of customers for Bio-oil but several have shutdown due to the current economic recession. As a result all customers are being supplied on an as-needed basis from the West Lorne mill. The Guelph plant will be idle until better economic conditions ensue.

In terms of trends for the future, Ensyn contemplates expanding by way of partnerships with either biomass owners, or Pyrolysis Oil customers, or both. It is anticipated that plants will be much larger than the current 100-tpd Renfrew plant, however since mill residues have been the first choice for feedstock, the current shortage of such residues in Canada makes it more difficult to garner large volumes of feedstock.

Traditional target markets for pyrolysis oil have been the small chemicals and food products market, replacement of light and heavy fuel oils in stationary engines, and for industrial heating. However, since pyrolysis oil is still essentially a new product, energy markets remain to be built. Current research is to promote use of pyrolysis oil as a feedstock to produce green gasoline in existing refineries. Early in 2009, Dynamotive successfully produced significant amounts of renewable gasoline and diesel through a 2-stage upgrading process. Pyrolysis was hydro-reformed to a stage-1 gas-oil equivalent liquid fuel that can either be blended with hydrocarbon fuels for use in stationary power and heating applications, or further upgraded in a stage-2 hydrotreating process to make green gasoline or diesel. Dynamotive estimates that it can deliver advanced, 2nd generation biofuels at a cost of \$2US/gal of ethanol-equivalent fuel from a 200-tpd plant (= \$2.82Cdn/imperial gallon = 0.38€/litre). It is quite possible that green transportation gasoline will supplant heating and stationary engines as primary markets. In this case, pyrolysis oil could become one of the primary destinations for abundant wood fuel.

Ensyn has also embarked on a trail to make transportation fuel. Ensyn and UOP, a Honeywell Company, formed a joint venture, Envergent Technologies, in 2008 to deploy Ensyn's commercially proven RTP technology globally. The joint venture will also design and build oil-refinery-scale equipment that will allow pyrolysis oil to be upgraded to green gasoline, green diesel, and green jet fuel, with equipment available in 2011.

The byproduct of fast pyrolysis is char, the remains of solid biomass that has been incompletely combusted. It is a black powder and similar to charcoal. Char is 65-76% carbon by weight, 5-12% ash, and less than 2% moisture. It has heat value of 28-30GJ/tonne. It is a charcoal powder with particle size less than 1 mm, and has bulk density of 0.25-3 tonnes/m³. Dynamotive has just completed a year-long test in the application of biochar into commercial framing test plots that increased crop yields from 6% to 17%.

4.4. Wood Pellets

Manufacture and export of wood pellets in Canada has grown exponentially in the past several years, primarily on the west coast. As shown in Table 4.3, capacity grew from 500,000 tonnes in 2002 to 2.0 million tonnes in 2008. Canada was the #1 producer in the world in 2007, but fell to #4 in 2008 due to lack of traditional sawmill residue feedstock. The severe economic downturn and subsequent drop in new home building in the US has caused Canadian sawmills to shut down or curtail production, causing a severe shortage of mill residues. For many pellet manufacturers, the primary fibre source is now harvest debris and non-commercial roundwood, in some cases 70% of feedstock, supplemented by mill residues. Supply chains to draw from this source have not been fully developed. Raw material costs have increased 3-4 fold, requiring export contracts to increase 30-40% in order to sustain financial viability for pellet mills. While Ontario and Quebec are politically smoothing the way to enable forest fibre availability for pellets, BC has been slow to enable transition of fibre from the forest products

industry. Pellet production is projected to return to 1.4 million tonnes in 2009. Pellet production can reach 20 million tonnes sustainably¹⁹.

Table 4.3 Canadian Pellet Manufacturing- 000 tonnes p.a.

	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009E</u>
Capacity	500	540	730	950	1,300	1,600	2,000	2,000
Production	499	533	727	936	1,135	1,485	1,335	1,400
Domestic	99	88	87	88	135	250	230	230
US	230	210	265	265	400	495	335	320
Offshore	<u>170</u>	<u>235</u>	<u>375</u>	<u>583</u>	<u>600</u>	<u>740</u>	<u>770</u>	<u>850</u>
	499	533	727	936	1,135	1,485	1,335	1,400

4.5. Trends in Biomass Production and Consumption

Cyclical Reduction in Residue Production:

Historically 80% of Canadian lumber has been exported to the US. The housing crisis in the US and the resulting decline in housing starts has sharply reduced US demand for lumber. In addition, the rising Canadian dollar vs the US dollar has made Canadian mills less competitive forcing the closure of many Canadian sawmills, particularly small ones. Since mill residue is a by-product of lumber production, there has been a corresponding decline in production of mill residue. The timing of a US housing market recovery is conjectural, but it is safe to say that some Canadian sawmills will never re-open, however most mill residue production should recover, since larger sawmills will take some wood supply from shut mills. Table 4.4 shows a decline in lumber production from 83.5 million m³ in 2004 to an estimated 58.7 million m³ in 2008. Mill residue is produced primarily in sawmills, but also pulp and board mills. Residue from sawmills is estimated to have declined from 21 million BDt in 2004 to 14 million BDt in 2008. Both lumber production and residue production are projected recover within five years, also shown in Table 4.4.

Table 4.4 Mill Residue Production- Sawmills

	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>
Production								
Lumber (000m ³)	83,514	82,890	78,222	71,844	58,693	56,685	67,300	79,400
Mill Residue (000 BDt)	21,229	21,070	19,884	18,263	13,960	13,482	16,673	19,671

Pulp Mill Closures:

Many pulp mills use internally generated residue and also residue purchased from surrounding sawmills for heat and power. Since 2005 there have been several pulp mill shutdowns, which often resulted in closure of bioenergy facilities. Full closures free up biomass that mills formerly absorbed from local sawmills. Partial closures may result in their purchasing either more or less residues from local sawmills.

¹⁹ John Swaan

Calls For Power:

European incentives have been a key driver for turning residue into pellets for export. Now the provinces are seeing the environmental and socioeconomic benefits of bioenergy and are beginning to provide incentives for power from biomass. The 2007 Ontario Standard Offer program provided superior rates for new renewable power (shown in section 2.3), and a new offer program will provide incentive rates in 2009. Quebec has issued “calls for power” with bid rates. BC Hydro made calls for power in both 2008 and 2009, also under price bids. Power incentives may divert some biomass away from transportable biomass products.

Use of Harvest Waste and hog piles:

With the ceiling for mill residue now reached, hog fuel piles and forest residue are seen to be the new sources for energy wood. BC is now promoting use of harvest waste and in standing MPB wood. In its call for power BC Hydro requests a feedstock plan including mill residue, harvest waste and standing timber. In Ontario the 50 MW Abitibi-Bowater biomass cogen facility at Ft. Frances is now starting up. The planned feedstock was 247,000 BDt sawmill residues and 115,000 BDt of harvest slash and mill sludge, but now harvest slash will have to form a much higher proportion of the feedstock with the current shortages of mill residue. This mill will pave the way for use of harvest waste in energy plants in Ontario. In future, cogen plants will also draw on existing hog fuel piles to complete their feedstock mix. Boralex Senneterre is drawing on hog piles now.

European Incentives:

Strong European incentives will continue to drive bioenergy activity in any region with a port. BC policy supports both domestic power AND exportable products such as pellets. Quebec wants to find viable uses for its large amount of harvest waste, and will consider power or transportable products. New Brunswick has roadside biomass and 12-month ocean ports, however, whether harvest slash will be used to make transportable products or local heat and power is open to conjecture. A large amount of biomass is privately owned by JD Irving, which may use its energy internally. Nova Scotia has no roadside harvest waste, only insitu, and this source has not been part of current government thinking. However, private wood harvesters are already planning projects that will make pellets from standing timber, in situ slash, and small amounts of mill residue. Newfoundland has surplus mill residue, hog fuel piles, unused annual allowable cut, and 12-month ocean ports. It can become a biomass product centre.

Alternative Transportable Products:

Pellets will utilize white mill residue, harvest waste and standing timber, and eventually a proportion of bark. Heat and power projects will use bark, hog piles, mill sludge, and any mill residue that remains. Pyrolysis Oil is essentially a new product. Although Ensyn has produce pyrolysis oil for two decades, it is still not a widely known product. However, with oil prices rising again and two Canadian companies on the verge of expansion, pyrolysis oil may become a factor in bioenergy production and exports.

5. Current Biomass Users

5.1. Heat and Power

Nationally 82% of biomass power generation (1473 MW) is in pulp & paper mills, which have long used spent pulping liquor, bark and other wood residues to generate heat and power. Nationally about 16% of power (288 MW) is produced by IPPs, chiefly in BC, Ontario, Quebec and Nova Scotia, while 2% is generated in the wood products industry.

The largest IPP in BC is the Epcor 65 MW power plant at Williams Lake, which uses 400,000 BDt sawmill residue annually. In Ontario, shown in Table 5.1, four IPPs operate biomass cogen plants that produce 56MW power. In Quebec four IPPs including Boralex and Probyn produce 171 MW heat and power from biomass. In New Brunswick, Fraser Paper operates a separate 45 MWe power plant in Edmunston. AbitibiBowater produces 28 MW power at Brooklyn, Nova Scotia. Production difficulties in 2008 were common due to the lack of mill residue. AbitibiBowater used non-merchantable wood in its feedstock in 2008, but is well supplied with mill residue in 2009. Boralex shut its power plant at Senneterre for 2 months and reduced power production at Dolbeau by 50% due to lack of residues. Boralex is making the biofuel transition; 40% of Senneterre is now fueled from old hog fuel piles. Including US plants, Boralex now sources 83% of its fibre from forest residues, and finds them equal to or better than mill residue in quality.

Table 5.1 Independent Power & Heat Producers (MW)²⁰

<u>Biomass Plants</u> (non pulp & paper)	<u>Location</u>	<u>Prov</u>	<u>Elec Cap'y</u> MW	<u>Steam</u> 000 Lb/hr	<u>Fuel</u>
Epcor	Williams Lake	BC	65	610	wood
LP Engineered Wood Prod.	Golden	BC	7.5	20	wood
Riverside Forest Products	Kelowna	BC	6.3	59	wood waste
Canadianoxy Ind, Chem.	N. Vancouver	BC		400	gas, hog waste
Whitecourt Power Partnership	Whitecourt	AB	24		wood
Canadian Gas & Electric	Grande Prairie	AB	25		wood
Drayton Valley Power	Drayton Valley	AB	12		wood refuse
Northland Power	Kirkland Lake	ON	20	60	wood
TransCanada Calstock	Calstock	ON	35	0	wood
Northland Power	Cochrane	ON	13	100	wood
Chapleau Generation	Chapleau	ON	7.2	70	wood
Energy+2000	Ajax	ON	0.7	100	Wood, oil
Boralex	Senneterre	QC	35	340	wood
Boralex	Dolbeau	QC	26	60MW	wood
Societe en Commandite Gazmont	Montreal	QC	23		wood refuse
Probyn	Chapais	QV	27 MW heat & power		
St. Felicien Biomass Cogen	Saint-Felicien	QC	21.4	250	wood
U. of New Brunswick	Fredricton	NB		40	wood
AbitibiBowater	Brooklyn	NS	28	330	wood
PEI District Energy USEnergy	Charlottetown	PE	2	50	MSW, wood

²⁰ Primarily CogenCanada CHP data

5.2. Biofuels

5.2.1. Ethanol

Table 5.2 shows the location, company, feedstock and capacity of Canada's ethanol plants. 15 plants with a combined capacity of 1390 million litres are in operation; 7 in Ontario, 2 in Quebec, 4 in Saskatchewan, and one each in Alberta and Manitoba. All of the eastern plants use corn as a feedstock except Enerkem, which will use wood poles after the ethanol module is in operation, and Iogen, which uses a mix of straws in its demonstration plant. All the plants in the west use wheat as a feedstock, except Husky in Manitoba, which also uses some corn.

4 plants with a combined 341 ml are under construction, including 2 corn-based plants in Ontario, and 2 plants in the west, 1 wheat-based and 1 MSW based. Fig 5.1 gives the location of these plants. Sarnia startup is projected for 2010.

Table 5.2 Ethanol Plant Capacities-Jan 2009 (million litres)²¹

<u>Map</u>	<u>Plant</u>	<u>Province</u>	<u>Company</u>	<u>Start</u>	<u>Feedstock</u>	<u>Capacity</u>
5	Tiverton	Ontario	Greenfield Ethanol	1989	corn	26
17	Lanigan	Sask	Poundmaker	1991	wheat	12
16	Red Deer	Alberta	Permolex	1996	wheat	40
6	Chatham	Ontario	Greenfield Ethanol	1996	corn	150
12	Ottawa	Ontario	Iogen	2004	straw	2
2	Westbury	Quebec	Enerkem	2005	wood waste	5
14	Weyburn	Sask	NorAmera BioEnergy	2005	wheat	25
18	Sarnia	Ontario	Suncor St. Clair	2006	corn	200
9	Lloydminster	Sask	Husky	2006	wheat	130
4	Varenes	Quebec	Greenfield Ethanol	2007	corn	120
10	Minnedosa	Manitoba	Husky	2007	wheat, corn	130
1	Collingwood	Ontario	Collingwood Ethanol	2007	corn	50
19	Belleplaine	Sask	Terra Grain Fuels	2008	wheat	150
3	Johnstown	Ontario	Greenfield Ethanol	2008	corn	200
11	Aylmer	Ontario	IGPC	2008	corn	<u>150</u>
1390						
<u>Under Construction:</u>						
15	Unity	Sask	North West Bioenergy	constr.	wheat	25
13	Havelock	Ontario	Kawartha Ethanol	constr.	corn	80
7	Hensall	Ontario	Greenfield Ethanol	constr.	corn	200
8	Edmonton	Alberta	Enerkem/Greenfield	constr	MSW	36
18	Sarnia	Ontario	Suncor Expansion	planned	corn	200
	Prince Albert	Sask	Iogen Commercial	planned	wheat/barley	100

²¹ Canadian Renewable Energy Association- web site <http://www.greenfuels.org/>



Fig 5.1- Locations of Biofuel Plants

5.2.2. Biodiesel

Canada's 2% target for renewable fuel in diesel and heating oil by 2012 will require 550 ml of biodiesel. With the startup of the Biodiesel Quebec, capacity of Canadian plants reached 126 ml in 2008, shown in Table 5.3. Six plants now under construction will add 330 ml capacity for a combined total of 456 ml.

Table 5.3 Biodiesel Production Plants- million litres

<u>Map</u>	<u>Company/Plant</u>	<u>Plant</u>	<u>Province</u>	<u>Start</u>	<u>Feedstock</u>	<u>Capacity</u>
28	Milligan Biotech	Foam Lake	Sask	1996	canola	1
29	Rothsay	Montreal	Quebec	2005	tallow, yel. grease	30
30	Western Biodiesel	Calgary	Alberta	2005	multi-feedstock	19
22	BIOX	Hamilton	Ontario	2006	multi-feedstock	66
21	Biodiesel Quebec	St-Alexis	Quebec	2008	yellow grease	10
						126
Under Construction at Jan 2009:						
26	Kyoto	Lethbridge	Alberta	constr	multi-feedstock	66
23	Canadian Bioenergy	Sturgeon	Alberta	constr	canola	225
20	Bifrost Bio-Blends	Arborg	Manitoba	constr	canola	3
24	Eastman Biofuels	Beausejour	Manitoba	constr	canola	11
25	Greenway	Winnipeg	Manitoba	constr	canola	20
27	Methes Energies	Mississauga	Ontario	constr	multi-feedstock	5
						330

5.3. Pyrolysis Oil

There are three existing Pyrolysis Oil plants in Canada:

- West Lorne, Ontario, owned by Dynamotive, uses 130 tpd of waste wood from the adjacent flooring plant to produce pure Pyrolysis Oil;
- Guelph Ontario, owned by Megacity Recycling and Dynamotive, uses 200 tpd of waste wood to produce "BioOil Plus" Pyrolysis Oil²², and
- Renfrew, owned by Ensyn, use 100 tpd sawdust to make pure Pyrolysis Oil

5.4. Wood Pellets

There are 29 pellet plants operating in Canada; BC-12, Alberta-1, Manitoba-1, Ontario-4, Quebec-6, and Maritimes-6 as shown in Table 5.4 below. The dominant producer is Pinnacle Pellet which operates four plants in BC; Williams Lake, Quesnel and Armstrong, and is in partnership with CanFor and the Moricetown First Nations in the 150,000-tonne plant in Houston. Williams Lake is being expanded in 2008, and a new pellet plant is being built adjacent to Dunkley Lumber. BC and Nova Scotia plants sell primarily to Europe CHP plants, while Ontario and New Brunswick plants sell primarily to the Eastern US. Data on the table is incomplete since most plants are sensitive about their production and capacity.

Table 5.4- Pellet Plants in Canada- 000 tonnes

Manufacturer			2007 Capacity	2007 Production	2007 Exports	Key Market
1 Pellet Flame Inc		BC	100	60		Europe
2 Pinnacle Pellet	Williams Lake	BC				
3 "	Quesnel	BC				
4 "	Armstrong	BC	50	50		Europe
5 Pinnacle + Canfor	Houston	BC				
6 Premium Pellet	Van der Hoof	BC	200	120	108	Europe
7 Pacific Energy Corp	Prince George	BC	140	130	124	Europe
8 Princeton Co-Generati	Princeton	BC	90	90	6	Europe
9 Westwood fibre Prod		BC				
10 Dansons-Vanderwell	SlaveLake	Alberta	80	40	32	US
11 Alberta #3		Alberta				
12 Manitoba #1		Manitoba				
13 Ontario #1		Ontario				
14 Ontario #2		Ontario				
15 Ontario #3		Ontario				
16 Ontario #4		Ontario				
17 Energex		Quebec				Europe
18 Lauzon	Papineauville	Quebec				
19 Lauzon	St. Paulin	Quebec				
20 Quebec #1		Quebec				
21 Quebec #2		Quebec				
22 Quebec #3		Quebec				
23 Advanced Wood		New Bruns.	10	10	10	US
24 Shaw Resources		New Bruns.	20	20		US
25 PEI #1		PEI				
26 Mactara		Nova Scotia	120	80	80	Europe
Total Mill Estimate			810	600	360	
Total				1,600	1,215	76%

²² Mixture of pure Pyrolysis Oil and up to 20% char

5.5. MSW

Though much waste still goes to landfill, some communities have limited combustion programs. Concerns about emission of particulates led to a decline in support for MSW incineration, however this reflects open incineration common in small communities. Modern combustion technology shows emission of particulates to be manageable and there are obvious benefits in energy capture and reduced need for landfills.

The City of Charlottetown in Prince Edward Island built Canada's first MSW to energy facility, three small district heating plants in 1981–85. The first system burned all the provinces municipal solid waste to provide steam heat to a hospital, a second burned woodchips to provide steam and hot-water heat to buildings in the downtown area, and a third system was based at the local university. In 1995, Trigen Energy Canada purchased and connected the three separate systems together, consolidated heat generation, installed a new heat-recovery boiler for the garbage combustion system, and added a high-efficiency biomass plant to burn sawmill waste. State-of-art emissions controls were installed at that time. A 1.2-MW turbine generates electricity to operate the plant with any surplus is exported to the grid. The capacity is 1.2 MW of electricity and 33 MW heat, fueled 41% from MSW, 42% from wood residue and 17% from oil.

There are 8 MSW treatment centres as shown in Table 5.5. Six produce usable energy, two do not. Four produce a total of 26 MW of electricity, or 9.6 MW from an average biomass fraction of 37% in MSW. Three plants also produce 1,688 TJ heat.

Table 5.5 Energy From MSW Biomass²³

	<u>Owner</u>	<u>Location</u>	<u>MSW</u>		<u>Biomass Energy</u>	
			<u>tpd</u>	<u>2006</u>	<u>MWe</u>	<u>Heat (TJ)</u>
1	GVRD	Vancouver	720	273318	4.9	867
2	Algonquin Power	Peel	455	147700	2.5	0
3	Incinerateur de Quebec	Quebec	920	293300	0.0	639
4	Trigen	Charlottetown	99	25623	0.4	183
5	Wainwright Energy	Wainwright-AB	27	3681	0.0	?
6	Incinerateur de Levis	Levis- QC	80	24768	0.0	0
7	MRC des Iles de la Mad.	Iles d.l. Madelaine	31	4500	0.0	0
8	Plasco (2008)	Ottawa	85	30600	<u>1.8</u>	<u>0</u>
Total					9.6	1,688

Energkem of Montreal and Greenfield Ethanol have entered into a joint venture to produce ethanol from MSW. They have concluded a 25-year contract with the City of Edmonton for 100,000 tonnes annually of MSW and will produce 36 million litres of ethanol. Phase 1 construction is to start in 2009 with plant completion in 2010.

²³ Municipal Solid Waste Thermal Treatment in Canada (2006)- Genivar Ontario Inc Mar 2007. Updated for Plasco in 2008.

6. Biomass Prices (This section has not been updated from 2008)

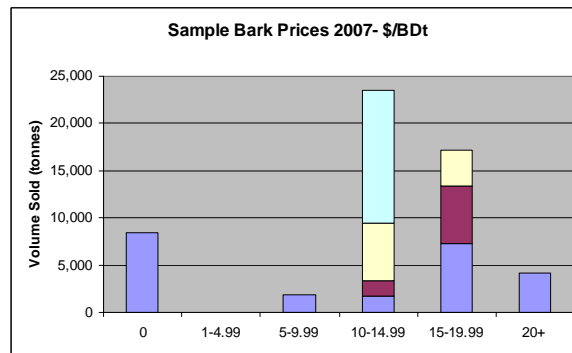
6.1. Mill Residue and Hog

A commodity market for biomass does not yet exist, and there is no “market” price. In recent years sawmill owners were happy to have biomass removed from the property at no charge. Now many sawmill owners are aware of its value and sell only on short-term contracts, sometimes keeping some for the spot market to get the highest price. Prices for mill residue are set by negotiation and are usually for a maximum of one year, sometimes even one load. There is a tremendous range in prices. As shown in Table 6.1 and Fig 6.1, some bark was given away in 2007, while some sold for up to \$22.50/BDt (15€). The weighted average for price for bark was \$13.80/BDt (9.2€). Sawdust sold in the \$2.90-32.50/BDt range, with the average \$23.60/BDt (15.7€). Most historic mill pile bark was given away, but the weighted average price was \$2/BDt (1.3€).

Table 6.1- 2007 Prices Eastern Ontario-
\$/BDt

	<u>Low</u>	<u>High</u>	<u>Avg</u>
Bark	0	22.50	13.80
Sawdust	2.90	32.50	23.60
Bark Piles	0	7.80	2.00

Fig 6.1



6.2. Forest Harvest Waste and Standing Timber

Currently all of the forest products provinces are examining options to allow harvest waste to be taken away for energy. In 2007 the Ontario Ministry of Natural Resources tabled a proposed policy on harvest waste for review by stakeholders, and is expected to finalize a policy in the next few months. It is the intent of the Province to allow applicants to take away harvest residue essentially at “no charge”. The draft policy indicated favour would be shown to biomass projects that can support the fledgling forest industry, or otherwise provide the most jobs within the local community. Private woodlot owners may charge stumpage fee for harvest residue.

There will be a range in costs to gather and transport forest harvest residue, the most expensive being unharvested wood on Crown land in remote locations, the lowest cost being roadside slash on private lands. Generally, Crown wood is more expensive than private wood due to fees and mandatory costs for forest management including: Crown dues (stumpage), Renewal Trust Fund, Forestry Futures Fund, road building and maintenance rules, and a number of additional environmental rules and regulations. Private lands have guidelines only for forest management.

There is a considerable volume of standing timber that can be used for biomass including non-commercial timber and wood impacted by fire, insects, disease, blow down etc. However, this wood has to bear the cost of harvesting, and thus may be a back-up wood supply only. Wood already harvested is lower cost than wood that is not. Tops and branches are already on the ground. Costs can vary greatly depending on landscape, distance to roadside, technology used, labour, and even moisture content of the slash. In BC the estimated cost of standing MPB wood is \$80/BDt (53€).

FPIinnovations, a forestry research group, estimated the achievable cost of the roadside slash supply chain with roadside grinding. Three cases are shown in Table 6.2. If tops and branches are pre-piled at roadside in the roundwood harvest, the cost of chipping and transporting roadside residue 100 km would be approximately \$43.60/BDt (29€).

Table 6.2 Roadside Waste Costs \$/BDt

	Optimistic	Realistic	Pessimistic
	50 km	100 km	150 km
Pre-piling	2.64	2.64	0.00
Comminution (grind)	10.25	13.04	18.56
Transport	12.4	21.51	30.02
Stumpage	0	0.00	0.00
Road Improvement	1	3.00	7.96
Planning & Supervision	1	2.25	2.25
Overhead	0	2.25	2.25
Compliance	0	0.50	0.50
Silviculture Rebate	-3.18	-1.59	0.00
	24.11	43.60	61.54

While chipping and trucking harvest residues has been practiced for a long time in Scandinavia, bundling technology which is now the lowest cost method for long distance transportation. Table 6.3 provides estimates of delivered costs of the two technologies adapted to the Canadian situation. Chipping and trucking would cost \$34.49/BDt (23€) over 50 km, while bundling would cost \$38.07/BDt (25€). Cost savings will be achieved by 2015 after practice and innovation has perfected these systems. Though chipping is the better option at short distances, bundling is the lower cost method over longer distances. Costs over 100 km are estimated at \$43.60/BDt (29€) for chipping but

\$41.76/BDt (28€) for bundling. Note that bundling is not currently practiced in Canada, and that costs can be expected to be higher in the first 1-2 years.

Table 6.3 Roadside Residue Costs 2010-15 (\$/BDt)

	50 km		100 km	
	<u>2010</u>	<u>2015</u>	<u>2010</u>	<u>2015</u>
Chip	34.49	31.32	43.60	39.79
Bundle	38.07	33.99	41.76	37.39

7. Imports and Exports

7.1. Ethanol and Biodiesel

No official trade statistics exist for trade of either fuel ethanol or biodiesel. Canada does not have excess capacity to export, but cross-border trades often occur just to save east-west transportation costs. Net imports of Ethanol from the US to Canada in 2008 were estimated at 165 MI²⁴. Net ethanol imports are projected to grow to over 300 MI by 2010.

7.2. Pyrolysis Oil

Production at the Ensyn Renfrew plant depends on customer demand and fibre availability, which was tight in 2008. Since all production is exported to a customer in the US, production and export volumes are confidential. Capacity of the plant is approximately 23,000 tpa. At the Dynamotive West Lorne plant, a major portion of normal annual production of 23,000 tonnes fuels a 2.5 MW turbine to make power for the Ontario grid, the rest is exported to the US as a fossil fuel substitute.

Future markets for pyrolysis oil and prospects for export will depend totally on price. It is anticipated that Europe will have a strong demand for products such as pyrolysis oil for co-firing in 100% biomass plants. Europe imports over 1 million tonnes wood pellets annually, much of it from as far away as BC in Canada, yet pyrolysis oil is twice as energy dense as pellets and has an opportunity to become a favoured export fuel. Currently the UK and Belgium have dominant incentives to use biomass. Also, ocean freight costs are now at a historical low, thus promoting the alternative of exporting pyrolysis oil.

In Canada, there are incentives for renewable power, but none for bio-products, and carbon trading is still not a factor. These factors favour exporting, however, if recent research on pyrolysis oil as a feedstock for gasoline production in existing oil refineries becomes commercially viable, then it could be that domestic targets and incentives will keep a meaningful proportion of pyrolysis oil at home.

²⁴ FAPRI- 2009

7.3. Wood Pellets

In 2002 46% of Canadian production was exported to the US and 30% to Europe. In 2008, only 25% of production was exported to the US while 58% went to Europe, including the Netherlands, Sweden, Denmark, Belgium, Italy, Ireland and Germany. Production fell in 2008 due the severe shortage of mill residue. Producers are now making the transition to using harvest residues and standing MPB wood, which bear a much higher cost than mill residues.

Table 7.2 Pellet Exports- 000 tonnes

	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	Est <u>2009</u>	Est <u>2010</u>
Domestic	99	88	87	88	135	250	230	230	350
US	230	210	265	265	400	495	335	320	400
Offshore	<u>170</u>	<u>235</u>	<u>375</u>	<u>583</u>	<u>600</u>	<u>740</u>	<u>770</u>	<u>850</u>	<u>1,250</u>
	499	533	727	936	1,135	1,485	1,335	1,400	2,000

In BC, pellet export potential is almost limitless, but it will depend on European power plants' ability to absorb the increased costs of fibre. Thankfully ocean shipping rates have collapsed since mid 2008, helping cost competitiveness of Canadian pellets offshore. Vast amounts of harvest slash from Mountain Pine Beetle harvest are available. Domestic markets are growing only marginally, so most of new production would be exported. BC pellets destined for Europe are loaded onto 100 tonne rail hopper cars for the coast and then loaded into cargo ships holding 4,000-15,000 tonnes. The Fibreco Terminal and Kinder Morgan Terminal in North Vancouver have capacity to handle 1 million tonnes of pellets annually and can be expanded to 2 million tonnes. Northern BC pellet plants would rail to the Ridley terminal in Prince Rupert. Trade is through the Panama Canal to Europe, with most going to the Netherlands and Sweden.

Mactara in Nova Scotia exports primarily to Europe via the port of Halifax. Quebec mills also export by way of the port of Montreal, however Montreal is not a winter port.

8. Barriers and Opportunities to Trade

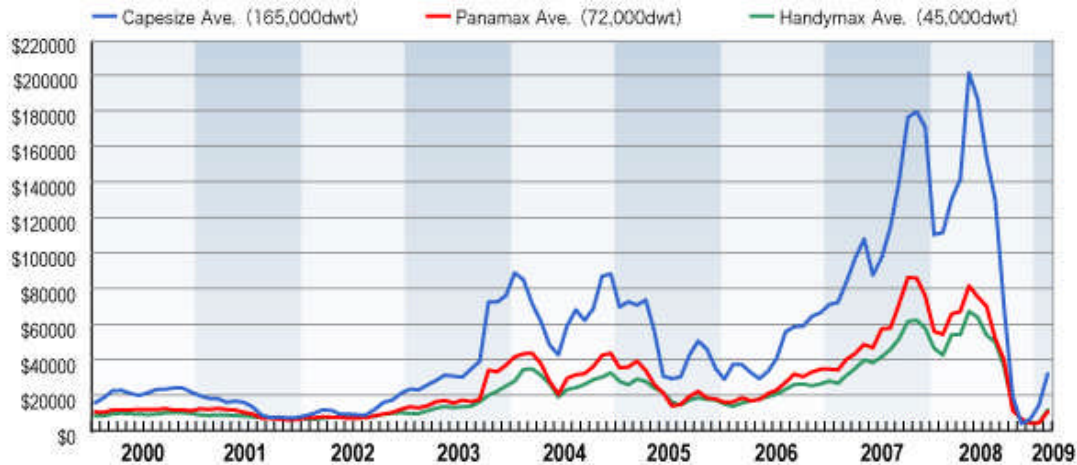
8.1. Barriers

8.1.1. Ocean Transport Costs

Rising ocean freight rates have been a barrier to long-distance maritime trade. As shown in Fig 8.1, the charter rates for dry bulk goods, such as wood pellets, rose steeply early in the decade and skyrocketed to all time highs in 2007-08. Prices rose largely due to the huge demand for shipping by Chinese manufacturing, and the inability of new shipping capacity to keep up with demand. The onset of recession in 2008 caused demand for shipping to collapse, along with prices.

Although BC exports 775,000 tonnes of pellets to Europe, they must travel 14,000 km through the Panama Canal, and freight costs are critical to maintaining a competitive supply. Many of the pellet exporters had 3-year contracts at low shipping rates during the period of peak prices, but when the contracts ended they were hard pressed to make a profit at new, higher freight costs. While ocean transport costs are at historically low levels now, producers are at risk to surging freight costs again.

Fig 8.1 Dry Bulk Market Trends, time charter rates in US-\$/day, Period: January 2000 - February 2009; Source: NYK Researched



8.1.2. Location of Biomass

While BC has considerable biomass and is well positioned to export, much of Canada's biomass is in the far interior, such as Ontario, too far from ocean ports. Also, with much of the centralized biomass already developed, many remaining biomass sources are smaller and widespread.

8.1.3. Funding Investments

The subprime financial crisis begun in the US has put tremendous pressure on banking worldwide. Banks have limited funds to lend, and only at higher rates. Equity investors are also limited in financial resources and often now can fund perhaps 5 in 100 biomass projects. Until the financing crisis is over, it will be difficult to add capacity for tradable bioenergy products to increase trade.

8.1.4. Four Season Ports

Vancouver and Prince Rupert in BC and Halifax in Nova Scotia are year-round ports and can handle a constant supply of transportable biomass for export. Montreal and Quebec have ocean ports but they are not open year-round, owing to Canada's cold winter. The port of Saguenay off the St. Lawrence River is a 12-month port

8.1.5. Undeveloped Supply Chains

Biomass projects are now targeting to utilize forest harvest biomass and Canada does not have low-cost supply chains established for this biomass. It will take a major effort

by Nordic and Canadian Associations, companies and governments to transfer technology and learning to Canadian forests. The Canadian Bioenergy Association is arranging trade missions to and from Scandinavia to enable transfer of technology and know-how.

8.1.6. Domestic Pressure to Keep Biomass at Home

Although exports are expanding rapidly there are factions in Canada that feel more biomass should be used domestically. The challenge will be to develop resources fast enough so that there will be sufficient volumes both for export and domestic use.

8.1.7. Increasing Domestic Incentives

Over time, domestic incentives have been increasing, and while development of bioenergy has been extremely slow (Except for pellets, and ethanol) eventually local packages of incentives may be sufficient develop projects for domestic energy in meaningful volumes.

8.1.8. European Trade Barriers

There are indirect trade barriers for import in certain areas of Europe. For example, the UK is promoting domestic supply of biomass and restricts subsidies if the imports exceed certain limits, resulting in almost no trading of pellets into the UK. Consequently, no receiving facilities exist for Panamax size vessels, a requirement for BC producers. UK utilities continually request millions of tonnes of pellets, but none are able or willing to invest in receiving facilities due to government subsidy policies.

8.1.9. Pyrolysis Oil A New Untested Product

Testing has been underway on many applications for pyrolysis oil and product markets are very promising, however to-date it there has been too little volume produced to test any one application over a long period. Similarly, volumes have not been large enough to prove the reliability and competitiveness of long distance supply chains.

8.2. Opportunities

The greatest opportunities for trade are to

- Establish pellet plants in Quebec and 5,000 km ocean supply chains to the EU
- Establish partnerships between prospective EU pyrolysis oil customers and domestic biomass owners to build pyrolysis plants dedicated to export
- Succeed in research on super-densified pellets
- Raise ocean shipping capacity dedicated to biomass products to keep shipping rates down
- Establish a biomass industry in Newfoundland Labrador, on Canada's East Coast
- Continue to turn Mountain Pine Beetle wood into transportable energy products

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Appendix 1- Government Programs

Canadian Bioenergy Initiatives and Programs

Initiative / Program	Start Date	End Date	Type of Initiative / Program	Existing Legislation	Target Area	Description	Funding		Contact		
								Repayable	Name	Telephone	E-mail
FEDERAL											
FEDERAL DEPARTMENT											
Agriculture and Agri-Food Canada (AAFC)											
Agri-Opportunities Program	Announced January 23, 2007 / Launched February 2007	March 31, 2011	Incentive	Yes	Agriculture	Aims to accelerate the commercialization of new agricultural products, processes or services that are currently not produced or commercially available in Canada, and are ready to be introduced to the marketplace by providing a maximum repayable contributi	\$134 M	Yes		1-866-367-8506	agri-ops@agr.gc.ca
Agricultural Bioproducts Innovation Program (ABIP)	Announced December 20, 2006		R&D / Education		Government / Industry / University	Supports new and existing research networks and encourages the development of clusters to build greater research capacity in agricultural bioproducts and bioprocesses. Through supporting networks and clusters, the program promotes research, development, t	\$145 M			1-866-912-ABIP (1-866-912-2247)	abip-piba@agr.gc.ca
Agriculture - Co-operative Development Initiative (Ag-CDI)	October 2007	March 2009	Education / Support	No	Transport Fuels (Agricultural Producers)	Provides support to individuals, groups, and communities wishing to develop co-operatives as a way to take advantage of opportunities associated with biofuels and other value-added opportunities in the agricultural sector. The Co-operatives Secretariat wi	\$3.25 M	No		1-888-781-2222 613-759-7193	coops-progr@agr.gc.ca
Biofuels Opportunities for Producers Initiative (BOPi)	Announced July 2006	2008	Education / Support		Transport Fuels (Agricultural Producers)	Helps farmers and rural communities hire experts who can assist in developing business proposals and undertake feasibility and other studies necessary to create and expand biofuels production capacity involving significant (greater than 1/3) ownership by	\$20 M (Up to \$13 M was available in 2006-2007 and \$7 M is available in 2007-2008)	No			

ecoAgriculture Biofuels Capital Initiative (ecoABC)	Announced December 2006 / Launched April 23, 2007	March 31, 2011	Incentive	Yes (Authority under Section 4 of the Department of Agriculture and Agri-Food Act)	Transport Fuels (Agricultural Producers)	Provides repayable contributions of up to \$25 M per project or 25% of eligible project costs (which ever is less) for the construction or expansion of transportation biofuel production facilities. Funding is provided for projects that use agricultural feedstocks to produce biofuels and that have new agricultural producer equity investments in the projects equal to, at minimum, 5% of the total eligible project costs. This initiative provides an opportunity for agricultural producers to diversify their economic base and participate in the biofuels industry through equity investment / ownership in biofuels production facilities helping them overcome the challenges of raising the capital necessary for the construction or expansion of biofuel production facilities.	\$200 M (\$186 M is available for contributions)	Yes		1-866-367-8506	ecoABC@agr.gc.ca
Agriculture and Agri-Food Canada (AAFC) and Natural Resources Canada (NRCan)											
Ethanol Expansion Program (EEP)	Announced August 12, 2003 / Launched October 20, 2003	March 31, 2007	Incentive	Yes (Authority under the federal Energy Efficiency Act (1992); and the Department of Agriculture	Transport Fuels (Industry / Infrastructure)	Aims to increase the production and use of fuel ethanol in Canada and reduce transportation related GHG emissions by providing repayable contributions, amounting to \$99.3 M for the construction or expansion of ethanol plants. The EEP sets the goal of having 35% of the consumption of gasoline-type fuels be E10 by 2010, ethanol demand should represent 3.5% of all gasoline-type fuels by 2010. Although project submissions to the EEP terminated in 2005, program activities are expected to last until 2018 (9 ethanol projects are supported for which contributions are repayable in the coming years). This program is a component of the Future Fuels Initiative.	\$100 M	Yes	Claude Robert	613-996-5377	E-mail
Future Fuels Initiative	2001		Incentive / Education		Transport Fuels (Industry / Infrastructure / Consumers)	Plans to accomplish a four-fold (by 750 M litres) increase in Canada's annual ethanol production and use. That could mean 25% of Canada's total gasoline supply would contain 10% ethanol. Contingent loan guarantees are provided to encourage financing for new plants that produce ethanol from biomass if all or part of the excise gasoline tax on ethanol is imposed before December 31, 2010. This initiative promotes increased supply and use of ethanol produced from biomass; provides for funding of activities such as public education on fuel ethanol, analysis of fuel ethanol markets, and producer economics; and provides a liaison with provinces/territories and industries that are interested in ethanol plant expansion. This initiative is part of the Government of Canada's Action Plan 2000 on Climate Change and renews the National Biomass Ethanol Program (NBEP) launched in the mid-1990s to help overcome lender resistance to investing in ethanol plants as a result of uncertainty about the excise tax policy.	\$3 M over 5 years to provide market information to retail consumers \$140 M in contingent loan guarantees from the NBEP	Yes			
Department of Finance Canada											
Accelerated Capital Cost Allowance for Class 43.1	1996		Incentive	Yes	Industry	Encourages business and industry to reduce energy waste and to use renewable energy sources for energy production equipment by providing an accelerated capital cost allowance at a rate of 30%. Eligible investments include co-generation and specified waste-fuelled electrical generation systems, heat recovery systems, and specified waste-fuelled heat production equipment.		/	Class 34/43.1 Secretariat	613-996-0890	
Removal of Excise Tax Exemption for Renewable Fuels	April 1, 2008		Incentive	No (Under Development)	Transport Fuels	Eliminates the excise tax exemptions for ethanol and biodiesel. This measure is in accordance with the implementation of the ecoENERGY for Biofuels Initiative.		/			
Tax Exemptions for Renewable Fuels (Excise Tax Act)	1992 (ethanol) 2003 (biodiesel)	March 31, 2008	Incentive	Yes	Transport Fuels (Producers / Suppliers)	Encourages the production and use of renewable fuels in Canada by implementing an exemption from the federal excise tax of \$0.10/litre on ethanol and \$0.04/litre on biodiesel.		/			

Environment Canada (EC)										
Federal Regulation Requiring Renewable Fuels	Announced December 2006		Target / Criteria	No (Under Development)	Transport Fuels	Will require 5% renewable content based on the gasoline pool by 2010 and 2% renewable content in diesel and heating oil by 2012, upon successful demonstration of renewable diesel fuel use under the range of Canadian conditions. This requirement is approximately equivalent to a renewable fuel content requirement for 5% of on-road diesel fuel. These new regulations will require enough renewable fuel to reduce GHG emissions by about 4 megatonnes per year, the GHG equivalent of taking almost 1 M vehicles from the road.		/		
Natural Resources Canada (NRCan)										
Biodiesel Initiative	Announced August 2003	2007	Education		Transport Fuels (Industry)	Addresses technical and market barriers to the development of a Canadian biodiesel industry based on low-cost feedstocks such as yellow grease and severed canola. This initiative is part of the Climate Change Plan for Canada and builds on the federal government's announcement under Budget 2003 to exempt biodiesel from the fuel excise tax for diesel (\$0.04/L).	\$11.9 M	No	Cara-Lynn Baas	613-995-9043 Cara-Lynn.Baas@nrcan.gc.ca
Biomass for Energy Program	2000		R&D		Biomass Supply	Assesses biomass resources in the fields of forestry and agriculture and develops methods to grow fibre for the production of bioenergy. This includes harvesting technologies, transport system efficiencies, and storage systems as well as designing scenarios to improve supply. This program identifies sources of increased biomass supply, for both existing and new biomass; develops efficient methods of growing, harvesting, collecting and transporting biomass; and demonstrates the sustainability of increased biomass supply which can potentially be employed for bioenergy production.	Funded by the Canadian Forest Service (CFS)			
Canadian Transportation Fuel Cell Alliance (CTFCA)	2001	March 2008	R&D		Transport Fuels	Demonstrates and evaluates fuelling options for fuel cell vehicles in Canada and encourages advancements in hydrogen and fuel cell technologies that are potentially transferable for use with other bioenergy sources. This initiative is part of the Action Plan 2000.	\$33 M	No	Richard Fry	613-943-2258 rify@nrcan.gc.ca
ecoENERGY for Biofuels	Announced July 5, 2007 / Effective April 1, 2008	March 31, 2017	Incentive		Transport Fuels (Producers)	Aims to boost Canada's production of renewable fuels such as ethanol and biodiesel by providing operating incentives to producers of renewable alternatives to gasoline and diesel based on production levels and other factors. This initiative will make investment in production facilities more attractive by partially offsetting the risk associated with fluctuating feedstock and fuel prices. Incentive rates will be up to \$0.10/L for renewable alternatives to gasoline and up to \$0.20/L for renewable alternatives to diesel for the first 3 years, then decline thereafter. Incentives are available to eligible facilities meeting a minimum production volume (undetermined) constructed before March 31, 2011, subject to program volume limits (2 B litres of renewable alternatives to gasoline and 500 M litres of renewable alternatives to diesel with a cap of 30% of program volume limits per facility) for up to 7 years.	Up to \$1.5 B	No		E-mail
ecoENERGY for Renewable Power	April 1, 2007	March 31, 2011	Incentive		Electricity Suppliers	Aims to increase Canada's supply of clean electricity from renewable sources including biomass by providing \$0.01/kWh for up to 10 years to eligible low-impact, renewable electricity projects. The program will encourage the production of 14.3 terrawatt hours of new electricity from renewable energy sources, enough electricity to power about one million homes.	\$1.48 B	Yes		ecoenergyrp@nrcan.gc.ca

ecoENERGY Technology Initiative (ecoETI) Bio-based Energy Systems Portfolio	Announced January 17, 2007	2011	RD&D		Government / Industry / University	Harnesses the potential for bioresources to produce bioenergy, biofuels, industrial bioproducts and bioprocesses to help Canadian industry and communities meet the challenges of improving efficiency and reducing toxic air emissions. Planned activities will develop new and improved technologies for producing energy from plants, wastes and microorganisms; develop the knowledge for moving towards a bio-based economy; support the development of associated regulations; and contribute to the revitalization of rural economies and Aboriginal communities.	\$230 M for ecoETI	No			ecoeti-iet@nrcan-mcan.gc.ca
Program of Energy Research and Development (PERD) Bio-based Energy Systems and Technologies (BEST) Program		On-going	R&D		Government / Industry / University	Supports the development of cost-effective technologies using biomass feedstock to produce bioenergy, biofuels, biomaterials, biochemicals, and bioprocesses to reduce the energy and greenhouse gas (GHG) intensity of Canadian industries and provide sustainable energy and product alternatives to consumers. Activities focus mainly on: existing and new biomass supply; biomass conversion and utilization technologies; integrated bio-applications and cross-cutting activities.	Funded by the Office of Energy Research and Development (OERD)	No	Lesley Dawes	613-947-3481	Lesley.Dawes@NRCan.gc.ca
Promoting Forest Innovation and Investment (Forest Industry Long-Term Competitiveness Initiative)	Announced February 8, 2007	2009	R&D		Government / Industry	Supports 3 initiatives: 1) Restructuring the Forest Innovation System - Consolidation of Forest Engineering Research Institute of Canada (FERIC), Forintek Canada Corporation, and the Pulp and Paper Research Institute of Canada (PAPRICAN) into FPIinnovations for greater efficiency and strength in innovation and R&D; 2) Investing in Transformative Technologies - Investments in forest innovation will provide for pre-competitive, non-proprietary research to address the development and adaptation of emerging and breakthrough technologies, such as forest biomass, forest biotechnology, and nanotechnology; and 3) Implementing the Canadian Wood Fibre Centre (CWFC) - The CWFC will focus on wood fibre research from forest to end use to increase Canada's knowledge of wood fibre quality and how best to grow and utilize it in the long term.	\$70 M	No	Kathleen Olson	613-996-2007	kaolson@nrcan-mcan.gc.ca
Technology and Innovation Research and Development (T&I R&D) Biotechnology Program	2003	2008	R&D		Government / Industry / University	Supports R&D to increase biomass-derived energy and/or develop long-term solutions for GHG reduction. Activities focus mainly on: conversion of waste to bio-based gases; conversion of cellulosic materials into ethanol; more energy-efficient enzymes for separating natural fibres into valuable components; biomass conversion to heat and power; and combined heat and power technologies.	\$115 M for T&I R&D	No			
Technology Early Action Measures (TEAM)	1998	August 31, 2007	RD&D		Government / Industry	Supports late-stage development projects and first-time demonstration projects designed to reduce GHG emissions nationally and internationally, at the same time sustaining economic and social development. The TEAM program was transferred to the Office of Energy Research and Development (OERD) effective September 1, 2007.	\$56 M	No			E-mail
Natural Resources Canada (NRCan) and Agriculture and Agri-Food Canada (AAFC)											
Ethanol Expansion Program (EEP)	Announced August 12, 2003 / Launched October 20, 2003	March 31, 2007	Incentive		Transport Fuels (Industry / Infrastructure)	Aims to increase the production and use of fuel ethanol in Canada and reduce transportation related GHG emissions by providing repayable contributions, amounting to \$99.3 M for the construction or expansion of ethanol plants. The EEP sets the goal of having 35% of the consumption of gasoline-type fuels be E10 by 2010, ethanol demand should represent 3.5% of all gasoline-type fuels by 2010. This program is a component of the Future Fuels Initiative.	\$100 M	Yes	Claude Robert	613-996-5377	E-mail

Future Fuels Initiative	2001		Incentive / Education		Transport Fuels (Industry / Infrastructure / Consumers)	Plans to accomplish a four-fold (by 750 M litres) increase in Canada's annual ethanol production and use. That could mean 25% of Canada's total gasoline supply would contain 10% ethanol. Contingent loan guarantees are provided to encourage financing for new plants that produce ethanol from biomass if all or part of the excise gasoline tax on ethanol is imposed before December 31, 2010. This initiative promotes increased supply and use of ethanol produced from biomass; provides for funding of activities such as public education on fuel ethanol, analysis of fuel ethanol markets, and producer economics; and provides a liaison with provinces/territories and industries that are interested in ethanol plant expansion. This initiative is part of the Government of Canada's Action Plan 2000 on Climate Change and renews the National Biomass Ethanol Program (NBEP) launched in the mid-1990s to help overcome lender resistance to investing in ethanol plants as a result of uncertainty about the excise tax policy.	\$3 M over 5 years to provide market information to retail consumers \$140 M in contingent loan guarantees from the NBEP	Yes			
OTHER											
Sustainable Development Technology Canada (SDTC)	November 2001		RD&D		Industry / Infrastructure	Supports the late-stage development and pre-commercial demonstration of clean technology solutions: products and processes that contribute to clean air, clean water, and clean land, that arrest climate change, and improve the productivity and global competitiveness of the Canadian industry.	\$550 M (SD Tech Fund™)			613-234-6313	info@sdtc.ca
	2007	2015				Supports the establishment of first-of-kind commercial scale demonstration facilities for the production of next-generation renewable fuels and co-products and accelerates the commercialization of new technologies in order to encourage the retention and growth of technology expertise and innovation capacity for cellulosic ethanol and biodiesel production in Canada.	\$500 M (NextGen Biofuels Fund™)	Yes			
PROVINCIAL											
ALBERTA											
Ministry of Energy											
Bioenergy Infrastructure Development Grant Program	2008	2009	Incentive		Infrastructure	Leverages industry / investors / municipal funds (maximum is 35% of eligible costs for capital projects) to develop and expand the distribution infrastructure to connect Alberta produced ethanol, biodiesel, and biogas (methane) to the marketplace. This initiative accommodates micro-generation interconnections and biogas processing and pipeline infrastructure and supports rural development regional distribution priorities facilitating the application of new technology in biofuel and energy transmission and distribution infrastructure. This approved initiative is part of Alberta's Nine-Point Bioenergy Plan.	\$6 M		Alberta Ag Media Line	780-422-1005 310-0000 (toll free access outside Edmonton)	

Bioenergy Producer Credit Program	Announced October 2006 / Effective April 1, 2007	March 31, 2011	Incentive		Industry (Suppliers)	Encourages the production and incorporation of bioenergy products (ethanol, biodiesel, biogas-electrical) within the marketplace; helps Alberta industry effectively compete with other jurisdictions that provide programs and tax exemptions to distributors who blend biofuels; and enables the introduction of renewable products into the traditional fuels and energy marketplace. This approved initiative is part of Alberta's Nine-Point Bioenergy Plan and replaces the existing Alberta ethanol fuel tax exemption policy of \$0.09/litre. Credits are given to producers of biofuels or biogas of \$0.14/litre (production capacity less than 150 M litres/year, up to a maximum of \$15 M/year) or \$0.09/litre (production capacity of or greater than 150 M litres/year, up to a maximum of \$20 M/year and total of \$75 M for the project). Those generating electricity receive \$0.02/kWh (production capacity of or greater than 3 MW) or \$0.06/kWh (production capacity less than 3 MW).	\$209 M for renewable fuels \$30 M for commercialization support (from the Energy Innovation Fund)		Alberta Ag Media Line	780-422-1005 310-0000 (toll free access outside Edmonton)	
Bioindustrial Network Development			Policy Initiative (Strategy)	No	Industry	Facilitate the demonstration and integration of bioenergy processing with existing manufacturing processors for increased regional development and demonstrate "cluster" efficiency - through the strategic integration and clustering of key processors providing a significant improvement in competitiveness and reduced environmental impact. This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.		/	Alberta Ag Media Line	780-422-1005 310-0000 (toll free access outside Edmonton)	
Biorefining Commercialization and Market Development Program	2008	2009	Incentive / Education		Industry	Leverages industry funds (maximum is 20% of eligible costs for capital projects and 50% of eligible costs for non-capital projects) to focus on biofuel research commercialization, technology transfer, new generation co-operatives, capacity building, market development, and advocacy for ensuring market acceptance. This program develops / expands / strengthens Alberta's biodiesel, biogas, and ethanol production capacity in response to market opportunities. Feasibility studies, opportunity analysis, and product development costs related to concept and technology evaluation, technical assistance, and equipment development; in addition to market research costs related to specific product opportunities, costs related to buyer presentations, product reformulation, and transportation of samples are covered as part of this program. This approved initiative is part of Alberta's Nine-Point Bioenergy Plan.	\$24 M		Alberta Ag Media Line	780-422-1005 310-0000 (toll free access outside Edmonton)	
Energy Microgeneration Standards and Policy Revisions			Policy Initiative (Strategy)	No	Industry / Infrastructure	Clearly define the regulatory protocols required to establish processing plants like biogas digesters and biodiesel processing facilities and through a cross-ministry approach ensure a timely and transparent review of investment applications better meeting the needs of industry. This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.		/	Alberta Ag Media Line	780-422-1005 310-0000 (toll free access outside Edmonton)	
Investment Support through Existing Programs that Align with Bioenergy Development			Policy Initiative (Incentive)	No	Investment Programs	Programs include Agriculture Financial Services Corporation (AFSC) lending programs, New Generation Cooperative Initiatives, Industry Development Research Funds, AVAC commercialization funding, Municipal Industrial Wastewater Infrastructure for Agricultural Processing Program, and Rural Development Project Fund. This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.			Alberta Ag Media Line	780-422-1005 310-0000 (toll free access outside Edmonton)	

National Renewable Fuel Standard and Energy Market Targets			Policy Initiative (Target / Criteria)	No	Transport Fuels	Align to a 5% national renewable fuels standard by 2010 to create market stability that will benefit existing renewable fuel industries and establish a future market for newly established fuel technologies. Within the overall renewable fuels mandated target, support ethanol and biodiesel mandates should be specifically designated to ensure the emerging biodiesel industry has an opportunity to capture some of the benefits of a renewable fuels mandate. This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.		/	Alberta Ag Media Line	780-422-1005 310-0000 (toll free access outside Edmonton)	
Specified Risk Material (SRM) Disposal Protocol			Policy Initiative (Education)	No	Government	Investigate and establish regulatory protocol with the federal government in the safe disposal of SRMs through appropriate bioenergy technology adaptation. This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.		/	Alberta Ag Media Line	780-422-1005 310-0000 (toll free access outside)	
Taxation and Investment Instruments for the Bioenergy Sector			Policy Initiative (Education)	No	Government	Work with Federal counterparts to investigate options to improve capital flow to bioenergy industry. This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.		/	Alberta Ag Media Line	780-422-1005 310-0000 (toll free access outside)	
BRITISH COLUMBIA											
Ministry of Finance											
Renewable Fuels Incentive			Incentive	Yes	Transport Fuels	Road Tax Exemption: \$0.1375/L in the Greater Vancouver Service Region and \$0.0775/L outside of this region for ethanol; \$0.1425/L in the Greater Vancouver Service Region and \$0.0825/L outside of this region for biodiesel (provided the ethanol and biodiesel are consumed in British Columbia).		/			
MANITOBA											
Department of Science, Technology, Energy, and Mines											
Renewable Fuels Incentive		August 2007	Incentive		Transport Fuels	Provincial Fuel Tax Credit for ethanol: \$0.20/litre, provided the ethanol is produced and consumed in Manitoba.		/			
	September 2007	August 2010				\$0.15/litre, provided the ethanol is produced and consumed in Manitoba.		/			
	September 2010	August 2013				\$0.10/litre, provided the ethanol is produced and consumed in Manitoba.		/			
Renewable Fuels Incentive			Incentive		Transport Fuels	Provincial Fuel Tax Credit for biodiesel: \$0.115/L, provided the biodiesel is consumed in Manitoba.		/			
Renewable Fuels Mandate			Criteria		Transport Fuels	Requires 10% ethanol content in 85% of gasoline.		/			
NEW BRUNSWICK											
Renewable Portfolio Standard			Policy			Requires NB Power to purchase 10% of its electricity sales from new renewable sources by 2016.		/			
NOVASCOTIA											
Department of Finance											
Renewable Fuels Incentive	July 1, 2006		Incentive		Transport Fuels	Motive fuel tax exemption of \$0.154/L for biodiesel produced in Nova Scotia (biodiesel portion of blends only) that meets the American Society for Testing and Materials fuel-quality specification.		/			

ONTARIO											
Ontario Power Authority											
Standard Offer Program	March 21, 2006		Incentive		Electricity Suppliers	Sets a fixed price (feed-in-tariff) for small renewable energy (including biomass energy) generation projects in order to make it easier and more cost effective for businesses and entrepreneurs to sell renewable power to the provincial grid. All small-scale renewable energy producers will be able to sell renewable power to the grid for 20 years. Over the next 10 years, this will add up to 1,000 megawatts of renewable power to Ontario's electricity system.		/			
Ministry of Agriculture, Food, and Rural Affairs (OMAFRA)											
Ontario Biogas Systems Financial Assistance Program	Announced July 26, 2007 / Launched September 6, 2007	March 31, 2010	Incentive		Agricultural Producers and Agri-Food Businesses	The program is designed to promote sustainable biogas production in the Ontario agri-food and rural sectors. Biogas systems can help achieve reductions in GHG emissions, increase production of renewable energy, promote use of digestate as a land-applied nutrient, improve biogas utilization, and foster agricultural innovation and economic opportunities. Phase 1 will support 70% of the costs of feasibility, design and planning studies, to a maximum of \$35,000 per project. Phase 2 will provide 40% of construction, implementation and commissioning costs for biogas systems, to a maximum of \$400,000 (total of Phase 1 & 2 per project).	\$9 M			1-888-588-4111	biogas.program@ontario.ca
Ontario Ethanol Growth Fund (OEGF)	Announced June 17, 2005		Incentive		Transport Fuels (Producers) (Industry/ Infrastructure)	Provides 1) capital assistance (not exceeding \$0.10/L of plant capacity) in the form of capital grants or loan guarantees for eligible new or expanding ethanol plants being built in Ontario to help meet financial challenges; 2) operating grants (not exceeding \$0.11/L of ethanol produced in a particular year for a maximum of 750 M litres per year paid over a period of up to 10 years) to eligible producers in production from 2007-2016 to address changing market prices; 3) support for independent blenders of ethanol and gasoline; and 4) a R&D fund to pursue opportunities for research and innovation.	\$520 M over 12 years (up to \$32.5 M available for capital assistance for all proponents combined)				oegf@omaf.gov.on.ca
Renewable Fuels Incentive	June 2002		Incentive		Transport Fuels	Excise tax exemption of \$0.143/L for biodiesel, provided the biodiesel is consumed in Ontario.		/			
Ministry of Finance											
Renewable Fuels Mandate - Ontario Regulation 535/05	Passed October 7, 2005 / Effective January 1, 2007		Criteria	Yes	Transport Fuels	Requires an annual average of 5% ethanol in gasoline.		/			
QUEBEC											
Department of Finances											
Renewable Fuels Incentive (2005-06 Budget)	April 1, 2006	March 31, 2018	Incentive		Transport Fuels	Variable Rate Income Tax Credit for Ethanol: up to \$0.185/L, provided the ethanol is produced and consumed in Quebec. A maximum of \$182.4 M in financial assistance is available to an eligible corporation for a maximum of 10 years.		/			
Renewable Fuels Incentive	March 23, 2006		Incentive		Transport Fuels (Consumers)	Tax refund of \$0.162/L on the purchase of pure (B100) biodiesel fuel (> 3000 L) that is not blended with any other type of fuel (provided the biodiesel is consumed in Quebec).		/			
Department of Natural Resources and Wildlife											
Renewable Fuels Mandate			Target	No (Proposal)	Transport Fuels	Sets a goal of 5% ethanol in gasoline by 2012 and expected to be met by next-generation cellulosic ethanol.		/			

SASKATCHEWAN											
Department of Industry and Resources											
Renewable Fuels Incentive			Incentive	Yes	Transport Fuels	Fuel Distributor Tax Credit for Ethanol: up to \$0.15/L, 5 years, provided the ethanol is produced and consumed in Saskatchewan.		/			
Renewable Fuels Mandate	November 1, 2005	January 14, 2007	Criteria	Yes	Transport Fuels	Requires an average of 1% ethanol in gasoline.		/			
	January 15, 2007					Requires an average of 7.5% ethanol in gasoline.		/			
Department of Regional Economic and Co-operative Development											
Saskatchewan Biofuels Investment Opportunity (SaskBIO)	Announced June 2007 / Launched August 10, 2007	2011	Incentive		Transport Fuels (Agricultural Producers)	Provides repayable contributions of up to \$10 M per project for the construction or expansion of transportation biofuels production facilities in Saskatchewan that have a minimum of 5% farmer-community investment. This program provides an opportunity for farmers and communities to participate in the value-added biofuels industry in Saskatchewan through investment ownership in biofuels facilities.	\$80 M	Yes	Ken Magnus	306-787-4484	ken.magnus@gov.sk.ca

