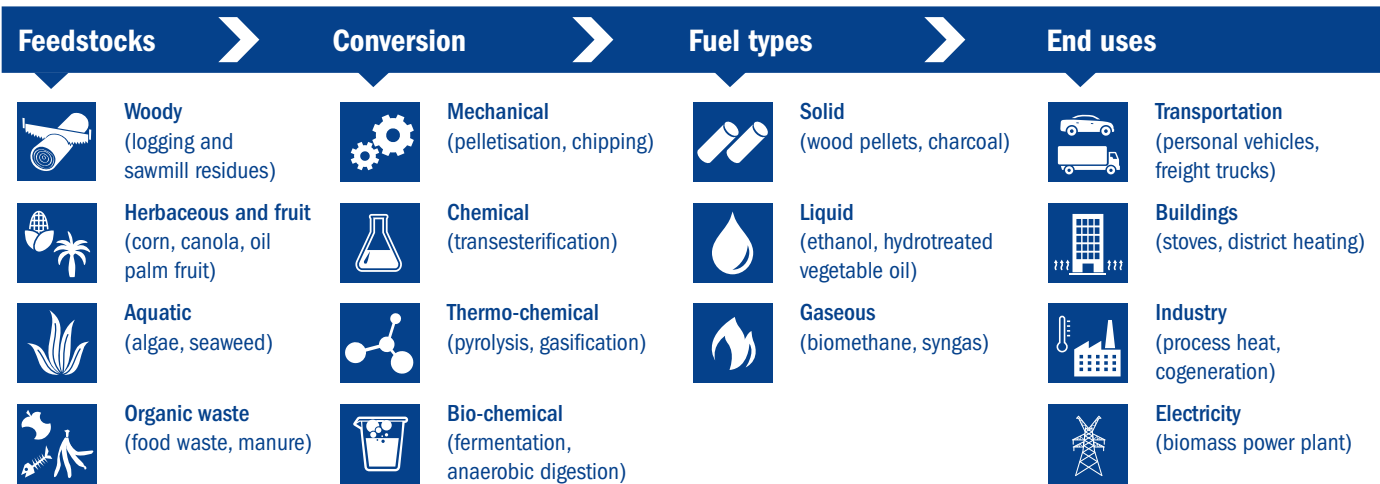




# Bioenergy in Canada

## What is modern bioenergy?

Modern bioenergy can be obtained from various biofuels and consists of energy produced cleanly and efficiently from renewable, biological sources. Biofuels are found in solid, liquid or gaseous forms and are produced from different feedstocks of biological origin by using a variety of conversion processes.



## Facts and figures

Canada has vast renewable biomass resources to supply clean energy and bioproducts. Bioenergy currently accounts for about 6% of Canada's total secondary energy supply. Forest biomass is the dominant source of bioenergy and is used to generate heat and electricity by industry and utilities.

### Canada's biomass energy generation

#### Total Capacity 2016

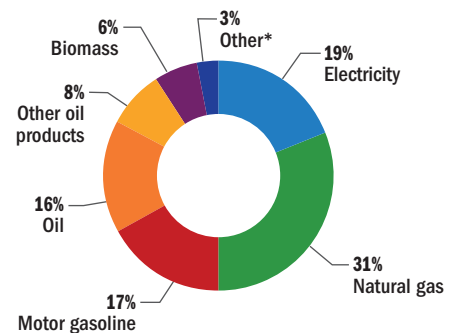
Electric	<b>3,2 GW</b>
Thermal	<b>12,9 GW</b>

Biomass provides a sizeable share of the energy used in the manufacturing sector, including over half of the energy used for pulp and paper manufacturing in 2014. Woody biomass is also used for residential, commercial and institutional space heating, as well as for pellet production. In 2016, over 80%

of Canada's pellet production (2.3 million tonnes) was exported, mostly to the United Kingdom, Japan and the United States.

Current federal *Renewable Fuels Regulations* require 5% renewable content in the volume of gasoline and 2% renewable content in the volume of diesel and heating oil. While liquid renewable fuels are mainly first-generation biofuels derived from grains and oilseeds, there are numerous Canadian pilot plants testing advanced biofuels.

## Canada's secondary energy by fuel type, 2014



\* "Others" includes coal, coke, coke oven gas, NGLs and steam and waste.

## Canada's biofuel supply and demand 2015

Activity	Ethanol	Biodiesel and HDRD
	Mb/d (million L)	
Canadian production	29.6 (1,720)	5.3 (307)
Imports	19.0 (1,100)	6.6 (383)
Exports	negligible	4.1 (238)
Domestic use	48.6 (2,820)	7.8 (452)

## Biomass and the carbon cycle

The “carbon cycle” refers to the movement of carbon from the land and water through the atmosphere and living organisms. As part of the biological cycle, carbon taken up by plants becomes biomass that eventually dies, decays, or is combusted, releasing carbon that is in turn absorbed by renewed growth. Biomass that comes from sustainably managed land constitutes a renewable source of feedstock.

Burning fossil fuels releases carbon that was trapped in geological formations for hundreds of millions of years, whereas burning biomass is part of the biological carbon cycle, which has a significantly shorter time scale. Even though fossil fuels are used to produce biofuels over their life cycle, using biofuels instead of fossil fuels can be an effective way to achieve a net reduction in greenhouse gas (GHG) emissions.

## Challenges of bioenergy

### Feedstock availability and cost

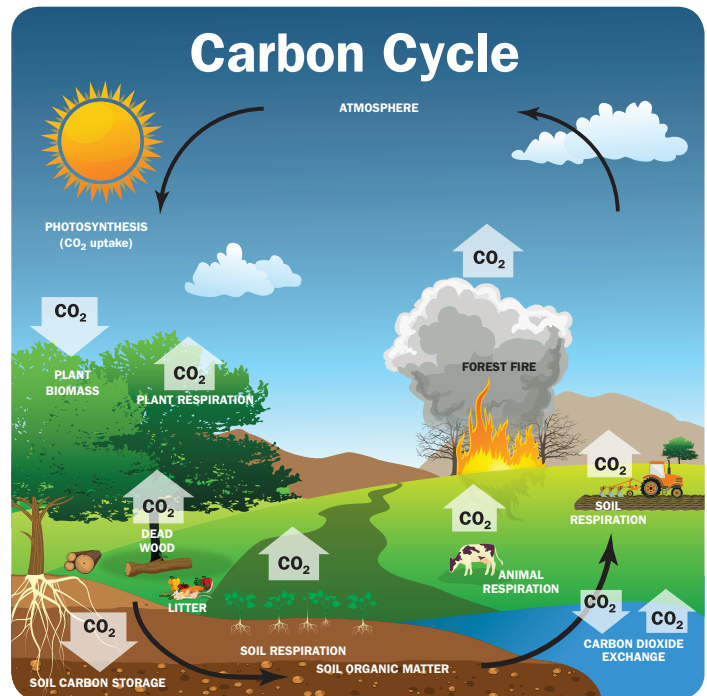
In Canada, biomass is grown commercially to produce fibre, food and feed. Biofuels are produced mostly from industrial and agricultural residues and from municipal solid waste. In some locations, larger amounts of biomass could be sustainably harvested, in conjunction with better valorization of waste, to meet a larger share of Canada’s energy demand. Although biomass is easier to store than other renewable sources of energy, it is typically a low density, high-moisture material available in disperse locations. This can cause high transportation and feedstock costs.

### Land use change and deforestation

First generation biofuels produced in Canada are derived from starch and oilseed crops and waste greases. Rising demand requires greater crop yields, higher conversion efficiencies or the use of other feedstocks. It can also increase demand for agricultural land and contribute to deforestation or grassland conversion. Advanced biofuels based on non-food feedstocks can generate greater environmental benefits but are currently more expensive than first-generation biofuels.

### Fuel properties

Today, most biofuels cannot be used in existing equipment without being blended with conventional fuels. For example, ethanol is blended as up to 10% of the volume of gasoline, and wood pellets are often burned with coal in coal power plants. However, “drop-in” fuels that have similar properties to their fossil counterpart and that are compatible with existing infrastructure are being developed.



## The emerging bioeconomy

The bioeconomy refers to the economic activity generated from the conversion of renewable biological resources into value-added bio-products that can replace fossil fuels and petrochemicals.

Managing the transition toward a bioeconomy hinges in part on the development of biorefineries. A biorefinery can transform biomass into biofuels, chemicals, animal feed, carbon dioxide for industrial purposes, and even electricity and heat.

Many Canadian pulp and paper mills have started integrating new conversion processes to produce a wide range of non-traditional products, such as bio-methanol, cellulose filaments and high-grade lignin.