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Energy from wood is good for New Zealand and the climate

Wood grown in sustainably harvested and replanted forests and converted to energy can have positive effects on climate change.

Decarbonising, or replacing fossil energy with other energy sources is necessary for climate change mitigation.

Wood is already used within the wood processing industry in the form of sawdust, bark and black liquor from pulp and papermaking as fuel sources to provide heat and electricity.

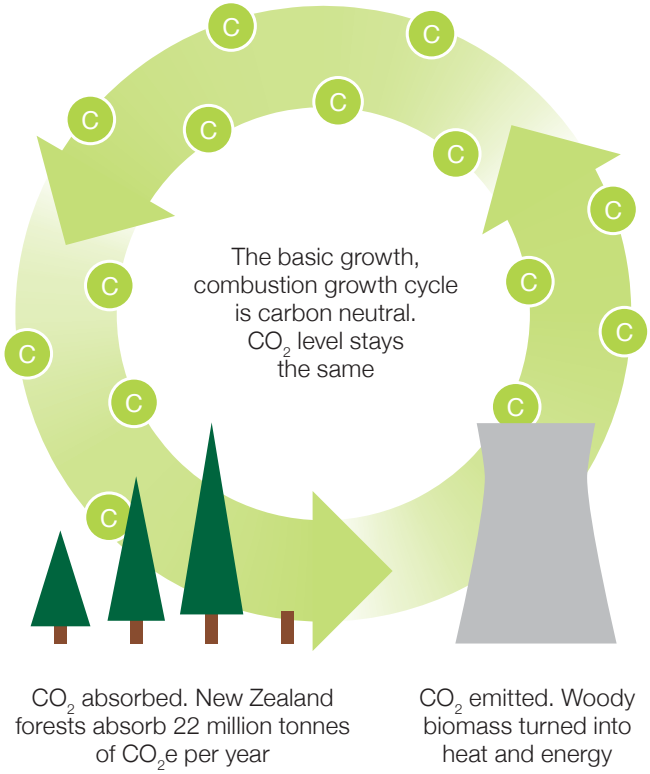
Using these residues and other sources of woody biomass in place of coal, gas and fuel oil reduces greenhouse gas (GHG) emissions and New Zealand's dependence on imported fuels.

The key to ensuring that energy from wood is low carbon is sustainable forestry with low production emissions.

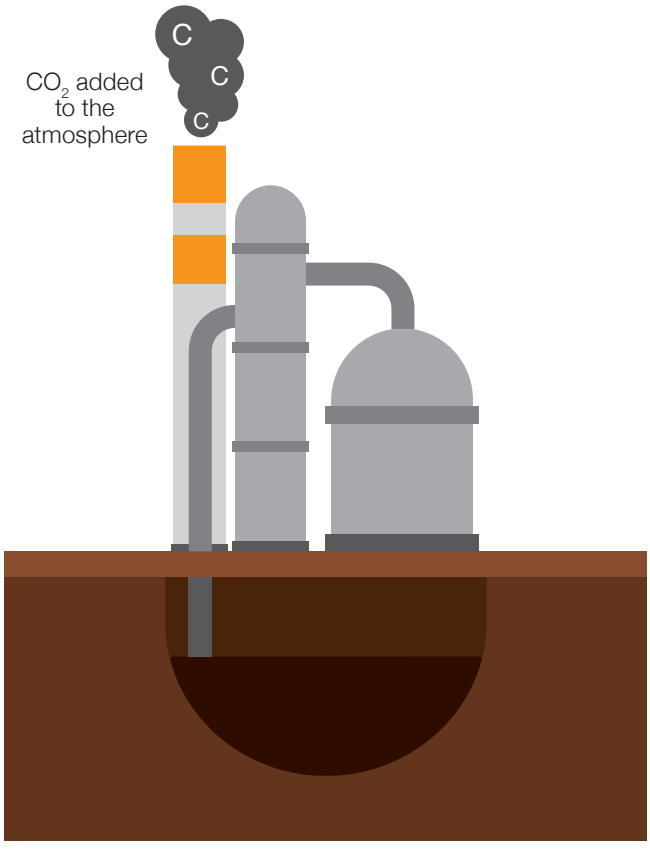
Conditions in New Zealand are different to the rest of the world. Planted forests are grown, harvested and replanted specifically to supply timber, fibre and energy for local users.

This type of sustainable forestry is a low carbon source of energy as the CO_2 released when woody biomass is burnt is reabsorbed by the growth of the remaining forest estate as part of the biogenic carbon cycle.

Biogenic carbon



Fossil fuels



Fossil fuels that have been locked underground

Biogenic carbon vs fossil carbon

Carbon emitted by burning biomass is part of a cycle driven by living plants.

The carbon is then reabsorbed by growing plants to make more biomass. This is known as the biogenic cycle. Each hectare of pine forest In New Zealand absorbs, on average, around 13 tonnes of CO_2 per year.

Plants that are not harvested are still part of the cycle. When they die and decay naturally the CO_2 emitted during the decay process is reabsorbed by growing plants.

Coal and other fossil fuels have been locked in the ground for millions of years. The carbon they contain is not part of the biogenic cycle. Burning fossil fuel increases the total amount of CO_2 in the atmosphere. There is not enough forest or enough land available for planting new forests to reabsorb all the CO_2 released from all the fossil fuels we use.

The sustainable forestry advantage

Sustainable forestry, with planned planting, harvesting and replanting, is the key to maintaining healthy and productive forests to maintain or increase carbon stocks in forests.

In New Zealand, timber and woody biomass are sourced from exotic trees grown in purposely planted forests. Indigenous forests are largely protected from harvesting.

New Zealand's 1.7 million hectares of planted forest is managed on a sustainable basis. Radiata pine is the main species grown and it reaches a harvestable size in the relatively short time of 25 to 30 years. Planted forests are generally replanted after harvest, ensuring a continuous supply of wood, and a continuous stock of carbon.

The area and volume of wood harvested varies from year to year based on how many trees were planted around 25 - 30 years ago. Each year, only around 3 to 4% of the total forest estate is harvested. The 97% that remains unharvested, and the replacement plantings, continue to grow, absorbing CO_2 from the atmosphere, maintaining the total carbon stock of the forest estate.

Forests and forest residues left after forest harvesting operations are the most likely source of biofuels in the future in New Zealand.

Comparing energy sources and emissions

The easiest way to compare energy sources and their emissions is on the basis of a unit of energy, or joule (J). This allows the comparison of more and less concentrated energy sources, and gas, oil, solids and electricity that are measured in different units like tonnes, litres and Watts.

Joules are small, meaning multiples are often used, such as kilojoules (kJ) or gigajoules (GJ). One gigajoule of energy is enough to power 10 to 12 houses for a day, or an average car for a week, or to provide 100 ten minute showers.

The net GHG of different energy sources is not just determined by comparing emissions at the point of combustion. Emissions along the entire life cycle need to be considered, including emissions during production, processing, transport and biogenic carbon flows.

Fuel type	kg CO2e per GJ (NZ)
Coal	~100
Gas	54
Fuel oil	91
Hydro electricity	4*
Wood	2

*Construction and distribution emissions

On a GJ basis, woody biomass from sustainable forests emits far less CO_2 over its life cycle than other common fuels.

The energy needed to produce woody biomass is one tenth of its total energy

Harvesting machines and logging trucks may appear to use a lot of fuel to produce a log. However, the energy contained in the wood is about 10 times greater than that needed to produce it.

A tonne of green logs can be converted into 75 litres of diesel. A fully loaded logging truck carries 29.5 tonnes of logs roughly equivalent to 2,210 litres of diesel, enough to travel from Kaitaia to Bluff and back.

Harvesting, and transporting logs to a port or mill 100 km away uses around 7.6 litres of diesel per tonne of logs, or one tenth of the logs' potential energy.

Conclusion

Wood from sustainably managed forests is a low carbon option for energy production that reduces GHG emissions. The majority of the CO_2 emitted during the life cycle of woody biomass is reabsorbed by the unharvested areas of forest. The emissions from harvesting and transport are low in comparison to the energy they contain. In contrast, the GHG emissions for fossil fuels are far greater.

Replacing coal, gas and fuel oils with woody and other biomass will help New Zealand meet its international commitments to reduce emissions under the Paris Climate Agreement, and move towards becoming a net zero carbon economy.

New Zealand is in a unique position. Using a combination of sustainable forestry management, fast forest growth and efficient use of biomass the country is well situated to produce energy with life cycle emissions approaching 2 to 4% of those from coal and gas.

Key links and references

Find out more about a biofuelled future for New Zealand

http://www.scionresearch.com/science/bioenergy/nz-biofuels-roadmap

https://www.bioenergy.org.nz

www.ieabioenergy.com

http://task38.ieabioenergy.com

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About Scion

Scion is the Crown research institute that specialises in research, science and technology development for forestry, wood and wood-derived materials, and other bio-material sectors.

Scion's purpose is to create economic value across the entire forestry value chain, and contribute to beneficial environmental and social outcomes for New Zealand.

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Prosperity from trees *Mai i te ngahere oranga*

January 2021