WOOD PROCESSING STRATEGY: GAS PRICE INCREASE AND CARBON CHARGE EFFECTS ON HEAT AND ELECTRICITY COSTS

Report to

Energy Efficiency and Conservation Authority

and

Forest Industries Council

By

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GAS PRICE INCREASE AND CARBON CHARGE EFFECTS ON HEAT AND ELECTRICITY COSTS

1. Executive Summary

Producing heat from bioenergy is currently only economic if on-site woody process waste is available as a fuel. With the current price of electricity it is not presently economic to produce electricity from bioenergy.

Analysis of a number of scenarios of; increasing gas price because of:
- the decline of the Maui gas field;
- the imposition of a carbon charge through the Government's Climate Change Policy; and
- increasing costs of wood waste disposal to land fill

show that the economics of bioenergy are significantly improved to the level that bioenergy should be the energy source of choice for the wood processing industry.

Based on current forest residue cost assumptions it does not appear that sourcing forest residue as a fuel for bioenergy will be economic under these scenarios. However the results do indicate that further analysis of the economics of forest residue as a fuel source should be undertaken.

By 2008 increases in the gas price and the introduction of a carbon charge will increase the relative price of coal and gas to the extent that in the North Island heat from coal and gas could be around twice the cost of heat from process residue, and 60% more expensive in the South Island.

Generating electricity from bioenergy is generally still not economic except in the case where process residue is used as a fuel and where it would otherwise have had disposal costs in excess of $60/t, and plant output size is at least 10 MW_e. The cost of generating electricity could be offset by using some of the heat generated for process use.

Cogeneration using process residue will become a more economic option particularly for larger plant facing high process residue disposal costs.

2. Introduction

Biomass based companies often have a choice of fuels for their energy needs. Depending on location these can be electricity gas, coal, biomass waste materials, and geothermal heat. With the expected early depletion of Maui gas, gas and coal prices are expected to rise in the foreseeable future. In addition carbon charges are to be imposed on carbon dioxide equivalent emissions.

This paper examines the effects of those changes on heating costs and electricity generating costs in wood processing based industries. The significance of woody process waste on bioenergy fuel costs is also evaluated.

3. Background

The base supply curve used in this report is sourced from the report "Availability and Costs of Renewable Sources of Energy For Generating Electricity and Heat" produced by East Harbour Management Services and available from the Ministry of Economic Development website.

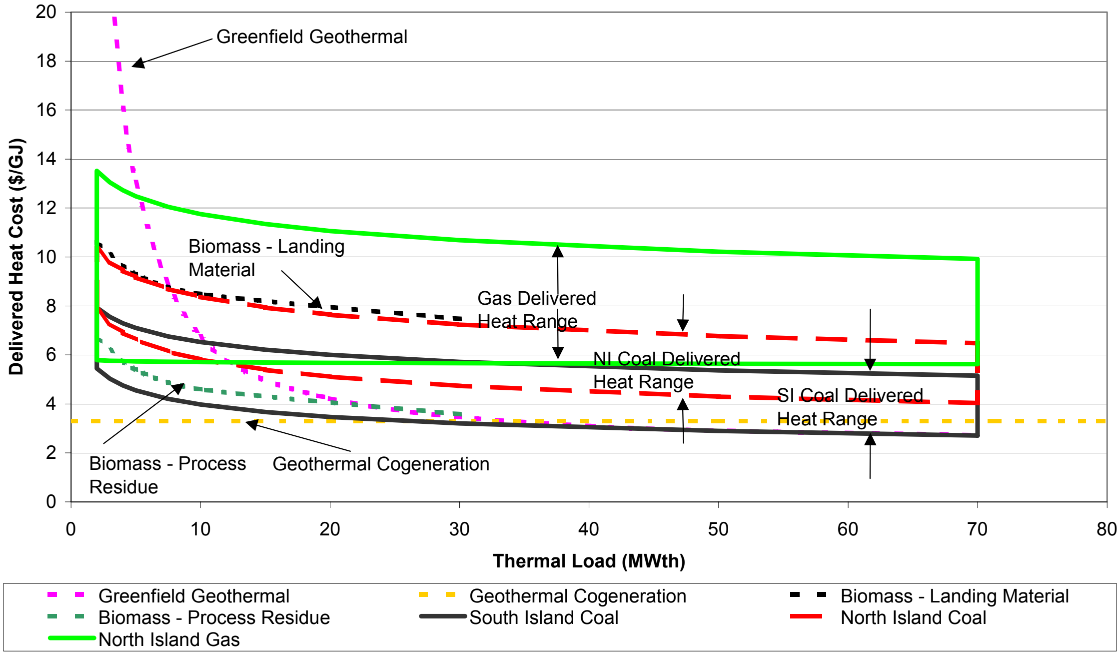
For the analysis in this report the base information has been adjusted according to a number of scenarios for further gas cost, carbon charge and woody waste disposal cost. The analysis is based on the best information available but because of the poor nature of some data the results should be considered as indicative only.

The analysis is by its nature based on representative data that will not reflect many specific situations. It is recommended elsewhere that further work be undertaken to improve the quality of some base data.

4. Base Case Heating Costs

Base case heating costs for biomass based technologies are compared with those from coal, gas (without the effects of extra fuel price increases and carbon charge) and geothermal plant and shown in Graph1. These costs are based on new plant with an 85% load factor and 10% WACC and a 25 year life. Wood processing industry investments may have a much higher WACC than this so the costs will rise accordingly. Note that a unit of heat at $25/GJ is equivalent to a unit cost of 9c/kWh.
Process residue has been assumed to have an average cost of $2/m^3$ equivalent to $0.25/GJ. Minimal allowance has been made for the avoidance of waste disposal costs.

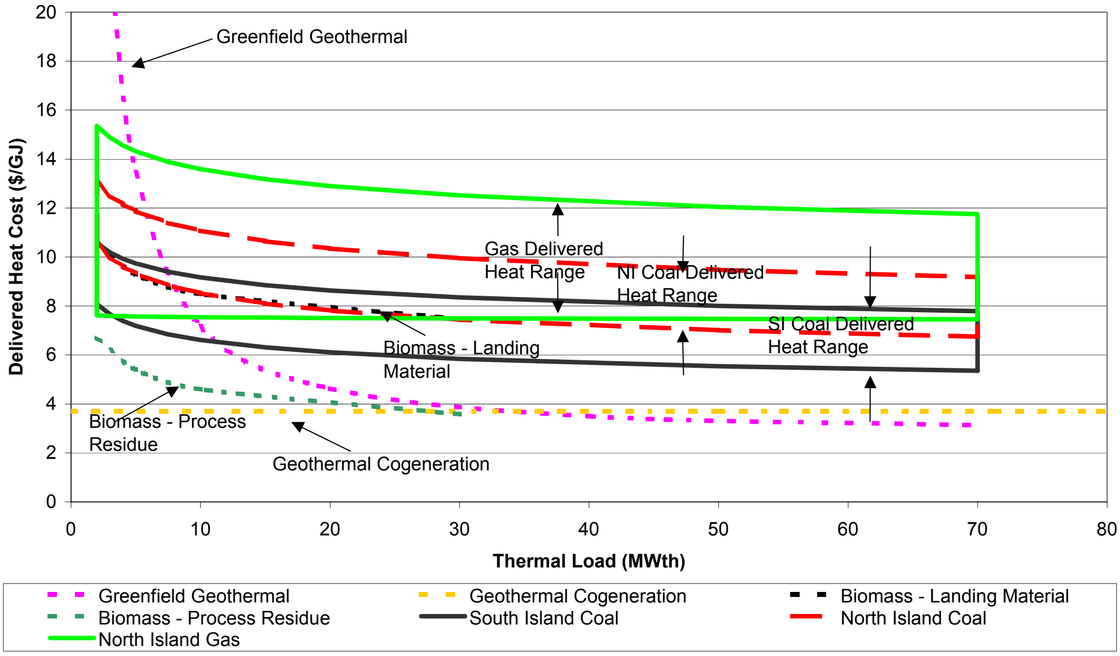
Graph 1. Base Case Heating Costs Without Carbon Charge and No Gas and Coal Cost Increases



4.1 Increased Gas and Coal Prices

With the decline of delivery of gas from the Maui gas field, gas prices are expected to rise and also coal prices to a lesser extent. Gas is expected to rise by at least $2/GJ with some sources suggesting $3 /GJ and higher. For this analysis a $2/GJ gas price rise is assumed. Coal is also under upwards price pressure, particularly in the Waikato where much of the cheaper coal has been mined out. The expected price rise will not be as great as that for gas as the coal suppliers will want to maintain a competitive price margin over gas. For this analysis North Island coal has been increased in price by $1.5/GJ and South Island coal by $1/GJ. The effects of these price rises are shown in Graph 2.

Graph 2. Future Heating Costs Without Carbon Dioxide Charge and With Gas and Coal Cost Increases



4.2 Carbon Charge

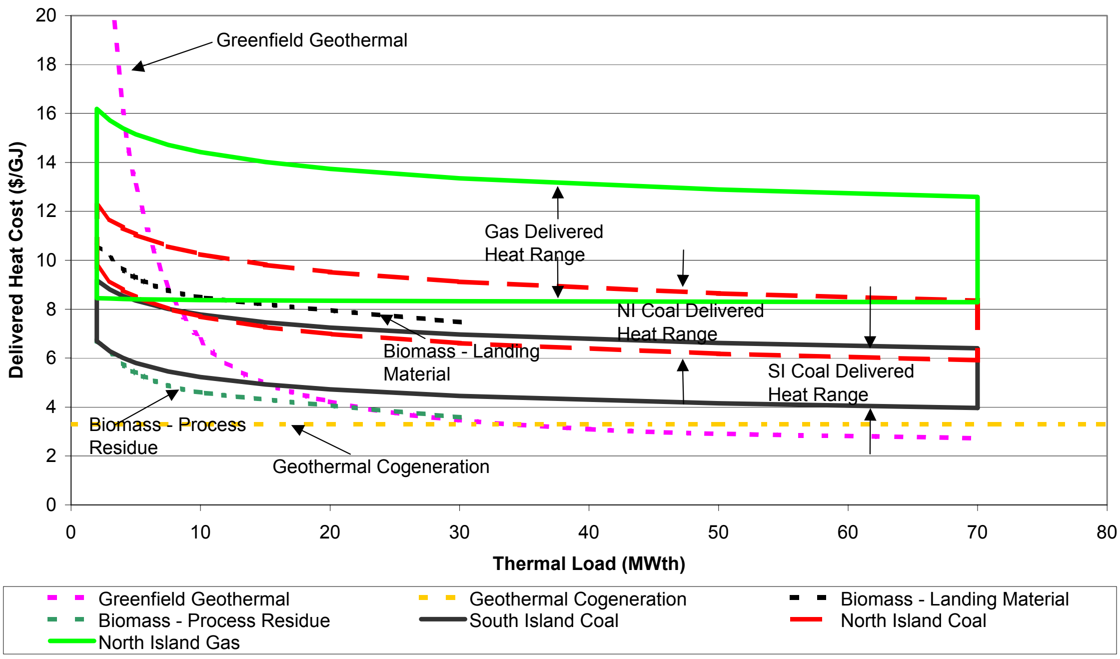
The Government in its Climate Change Preferred Policy has estimated the kind of price increases that New Zealand households and businesses might face from an emissions charge, based on the likely international price range for a tonne of carbon. Their results are given in Table 1.

Table 1. Estimated Price Increases Resulting from Possible Emissions Charges

Estimated Price Increases				
Commodity	**$10/t CO_2**		**$25/t CO_2**	
	Residential	Industrial	Residential	Industrial
Petrol	3 cents/litre (2%)		6 cents/litre (6%)	
Diesel	3 cents/litre (5%)		7 cents/litre (12%)	
Electricity	4%	6%	9%	16%
Gas	3%	9%	8%	24%
Coal	8%	17%	19%	44%

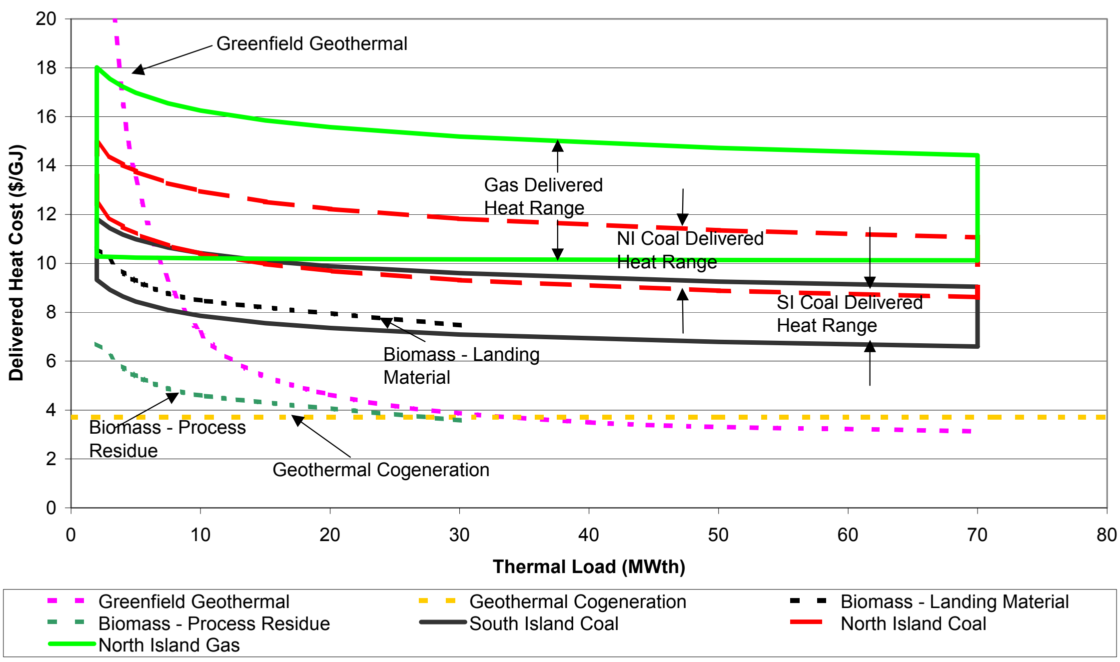
The Government carbon charge has a cap of \$25/t carbon dioxide (CO_2) equivalent. This carbon charge will apply to gas and coal and to geothermal heat but not biomass based fuels. Carbon dioxide equivalent emissions are much lower for geothermal heat than for coal and gas. The level of CO_2 emissions from geothermal sources varies from field to field. An average for all geothermal fields has been used. Graph 3 shows the effect of applying the \$25/t CO_2 charge to the heating costs.

Graph 3. Future Heating Costs With \$25/t Carbon Dioxide Charge and No Gas and Coal Cost Increases



The combined effects of increased gas and coal price and a carbon charge on heating costs is shown in Graph 4

Graph 4. Future Heating Costs With Increased Gas and Coal Prices and a \$25/t Carbon Dioxide Charge



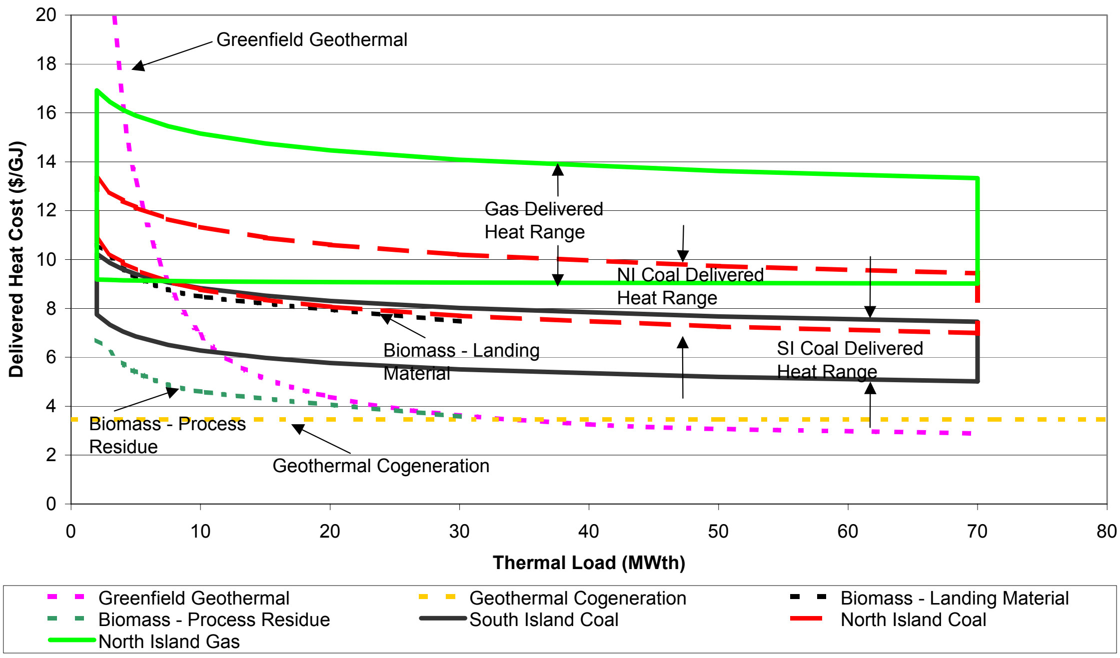
It can be seen that with each of these scenarios biomass process residue will be competitive with coal in all areas, and biomass residue landing material will be competitive with North Island coal and gas and much of the South Island coal.

Fuel price and carbon charge sensitivities need to be factored into any investment proposals especially where the fuel cost is a significant component. Increases in fuel prices should also be factors in future risk management strategies.

In the first commitment period, 2008-2012, the Government proposes the General Energy Users group will be subject to a price on emissions. This group will face an emissions charge on carbon dioxide emissions from fossil fuels, which will approximate the international price of carbon but will be capped at NZ$25 a tonne of CO_2 equivalent.

If the international price of carbon was say the equivalent of \$10/t CO_2 and this was levied, the combined effect on heating costs with the gas and coal price rise is shown in Graph 5.

Graph 5. Future Heating Costs With Increased Gas and Coal Prices and a \$10/t Carbon Dioxide Charge



Additional heating costs imposed for each scenario are shown in Table 2. These costs will vary according to individual circumstances but give an indication of the magnitude of the increase.

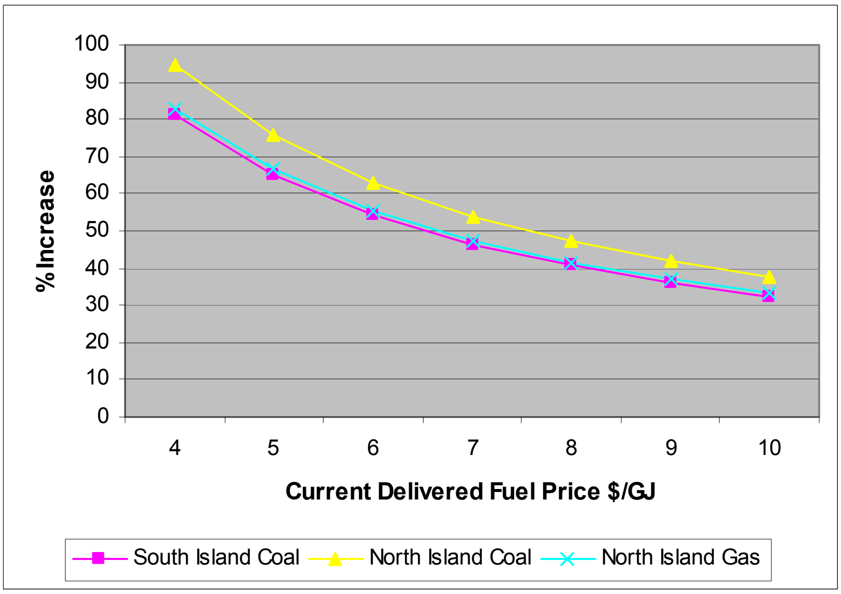
Table 2. Additional Heating Costs *

Individual Cost Increases	Additional Heating Costs * $/GJ			
	South Island Coal	North Island Coal	North Island Gas	Geothermal
Increased gas and coal cost only	1.43	2.14	2.50	0.00
$25/t CO_2 charge only	3.09	3.01	1.65	0.41
$10/t CO_2 charge only	1.24	1.21	0.66	0.16
Combined Increased costs $/GJ				
Gas $2/GJ plus $25/t CO_2	4.52	5.16	4.15	0.41
Gas $2/GJ plus $10/t CO_2	2.67	3.35	3.16	0.16

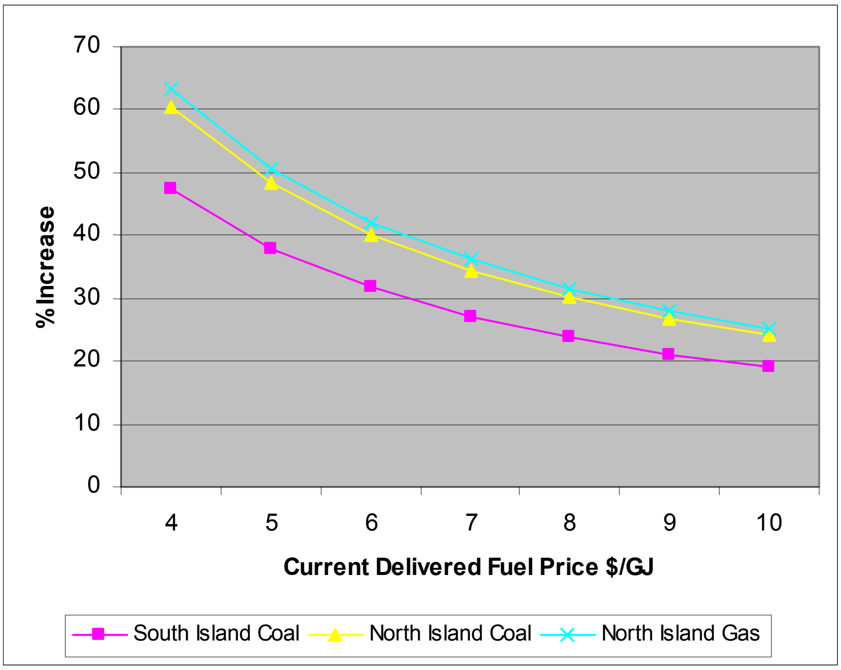
*These heating costs are based on boiler efficiencies of 70% for coal and 80% for gas and geothermal

The increases in delivered fuel prices including a carbon charge expressed as percentages are shown in Graphs 6 and 7.

Graph 6 Delivered Fuel Prices Including a $25/t Carbon Dioxide Charge



Graph 7 Delivered Fuel Prices Including a $10/t Carbon Dioxide Charge



These are significant cost increases for those companies using coal or gas for heating. The carbon charge represents an additional cost for those using geothermal energy.

In the case of the imposition of a $25/t CO_2 charge combined with the gas and coal cost increases, this will place increased cost pressure on those companies using North Island coal in particular.

All these increases improve the attractiveness of using biomass as a process fuel.

5. Implications for Biomass Fuels for Heating

The effects of these changes will be significant on the relationship between biomass fuels and other heating sources. Heating costs using other heat sources for the scenarios presented are compared with biomass heating costs as a base in Tables 4 and 5. These costs are average ones covering a wide range of sizes and situations. They give an indication in the likely changes in costs as the result of fuel cost increases and the imposition of a carbon tax.

Table 4. Other Heating Sources Costs as a Percentage of Average Process Residue Material Heating Costs

	Heating Costs %			
Individual Cost Increases	**South Island Coal**	**North Island Coal**	**North Island Gas**	**Geothermal**
Increased gas and coal cost only	26%	74%	122%	0%
$25/t CO_2 charge only	53%	91%	105%	77%
$10/t CO_2 charge only	22%	59%	84%	72%
Combined Increased costs $/GJ				
Gas $2/GJ plus $25/t CO_2	78%	128%	158%	77%
Gas $2/GJ plus $10/t CO_2	47%	96%	136%	72%

Table 5. Other Heating Sources Costs as a Percentage of Average Biomass Landing Material Heating Costs

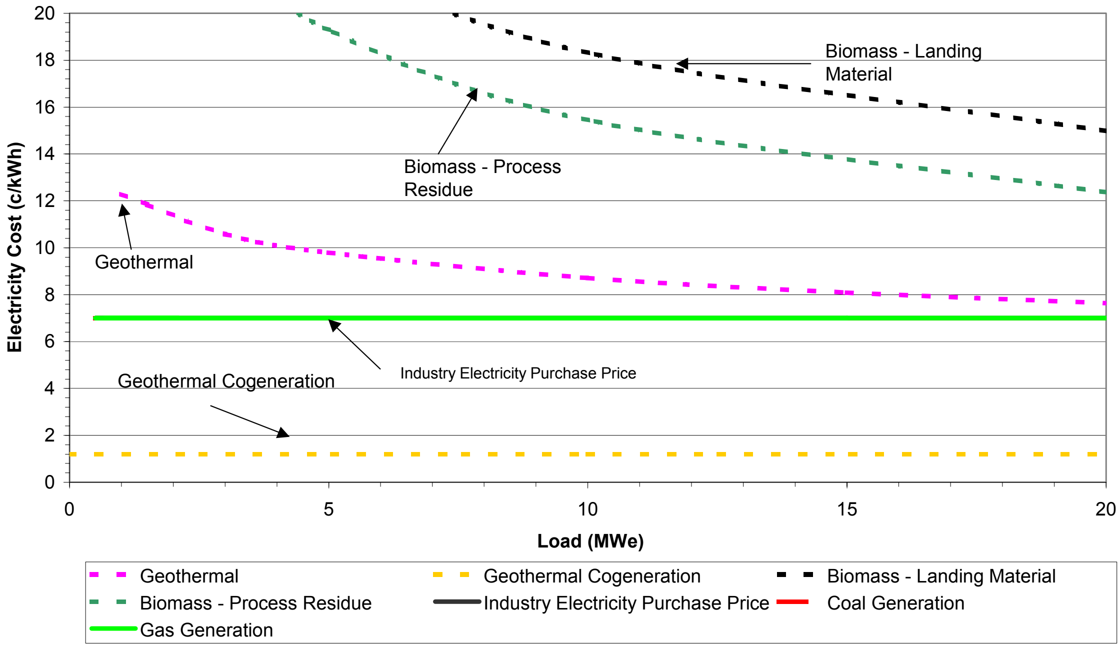
	Heating Costs %			
Individual Cost Increases	**South Island Coal**	**North Island Coal**	**North Island Gas**	**Geothermal**
Increased gas and coal cost only	-29%	-1%	25%	0%
\$25/t CO_2 charge only	-13%	8%	16%	0%
\$10/t CO_2 charge only	-31%	-10%	4%	-3%
Combined Increased costs \$/GJ				
Gas \$2/GJ plus \$25/t CO_2	1%	29%	46%	0%
Gas \$2/GJ plus \$10/t CO_2	-17%	11%	34%	-3%

It can be seen from Table 5 that heating costs using North Island coal with its increased costs, on average, is still slightly cheaper than the average biomass landing residue heating costs. However this changes once the carbon charge is added with the North Island coal heating costs being 29% dearer than the biomass landing residue costs.

6. Future Electricity Costs

Future electricity generating costs using new biomass based technologies are compared with the price that electricity could be sold back to the grid (without the effects of extra fuel price increases and carbon charge) and geothermal plant and shown in Graph 6. These costs are based on plant with an 85% load factor, 10% WACC and a 25 year life. Wood processing industry investments may have a much higher WACC than this so the costs will rise accordingly. Process residue costs are assumed to be \$0.25/J which is equivalent to \$2/m^3.

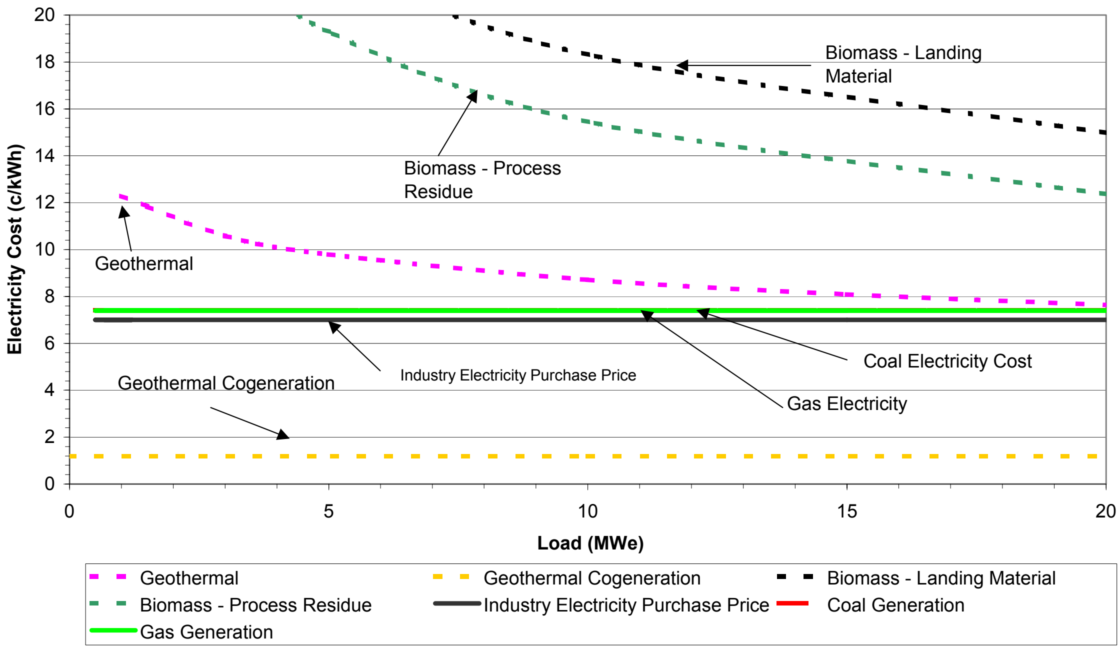
Graph 6. Base Scenario, No Gas and Coal Price Rise and No Carbon Charge



Under these conditions there is a large gap between the cost of electricity generation using biomass and the price it could be sold back to the electricity retailer.

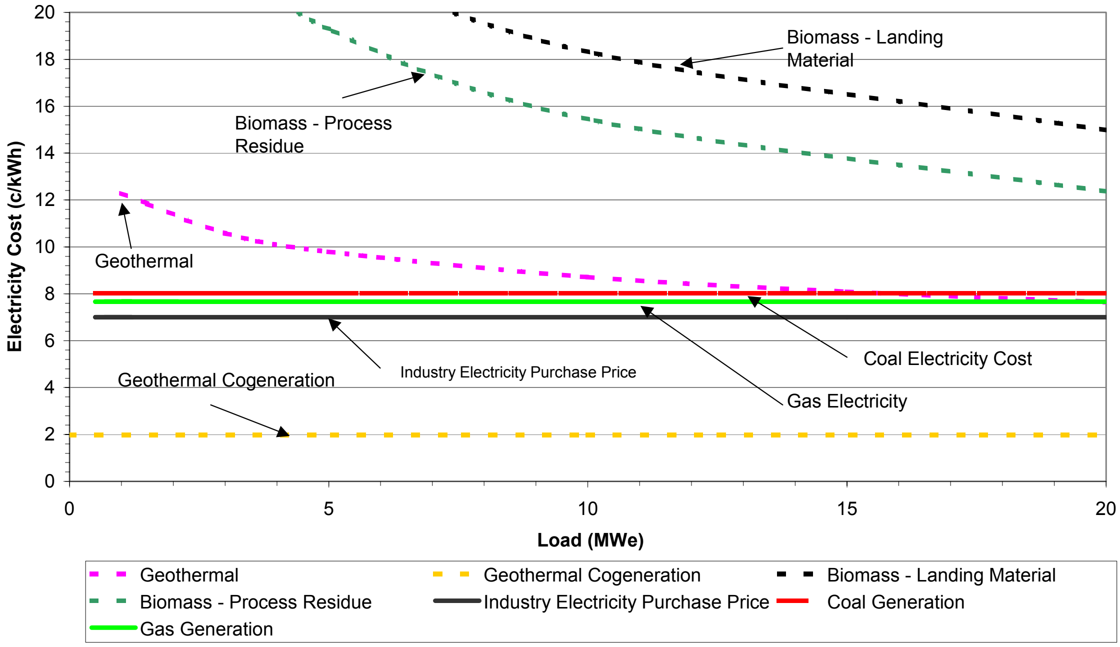
With a gas price rise of $2/GJ the purchase price of electricity would be expected to rise to cover these costs. It is assumed that the fuel price rises affect only 30% of the electricity purchase price. The effect is shown in Graph 7.

Graph 7. Gas and Coal Price Rise and No Carbon Charge



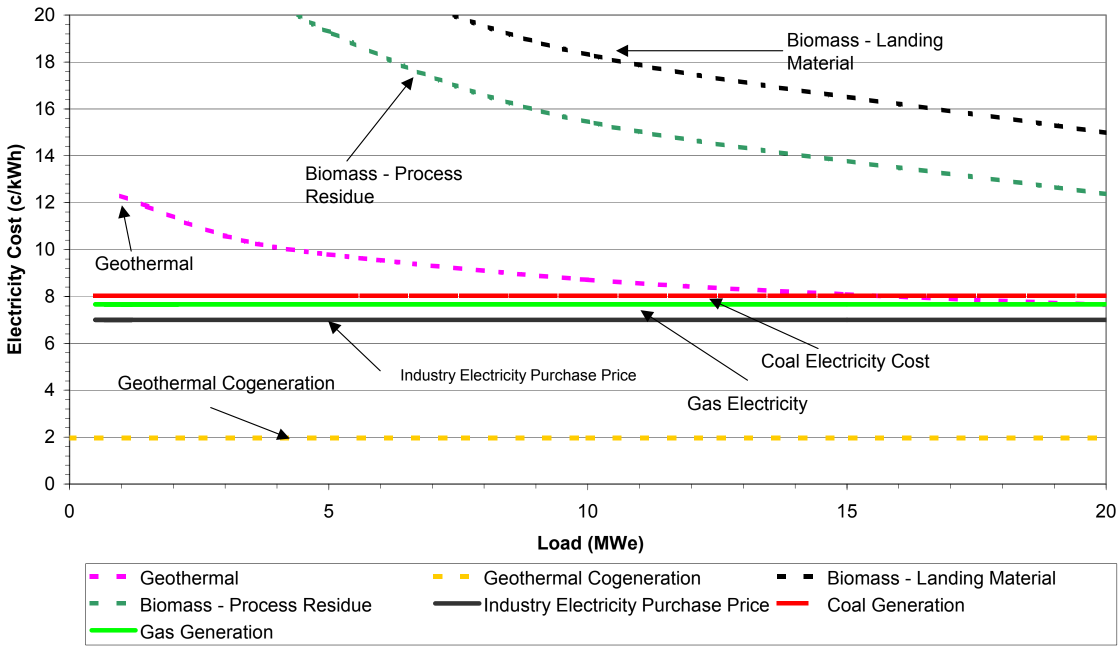
The effect of a $25/t Carbon Dioxide Charge only to the base scenario is shown in Graph 8.

Graph 8. No Gas and Coal Price Rise and a $25/t Carbon Dioxide Charge



Applying the gas and coal price rise and the $25/t carbon dioxide charge is shown in Graph 9.

Graph 9. Gas and Coal Price Rise and a $25/t Carbon Dioxide Charge



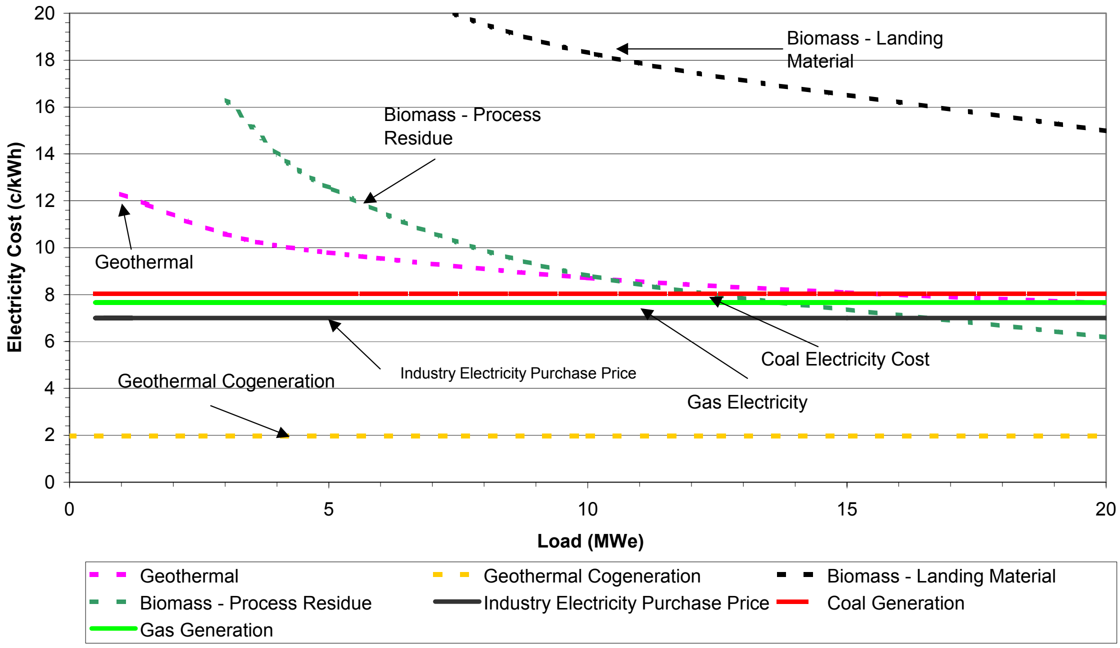
The gap between the bioenergy generated electricity is reduced but is still 4 c/kWh for a 20 MWe plant. However the cost of generating electricity could be offset by using some of the heat generated for process use. Geothermal generated electricity appears economic at the larger sizes.

6.1 Process Residue Disposal Costs

In the scenarios outlined previously process residue had a cost of \$0.25/GJ (\$2/m^3). However if not used by the plant process residue has a disposal cost which will vary according to the local transport and disposal fees. When this disposal cost is greater than \$0.25/GJ this gives the process residue a negative value when used as a fuel.

Assuming that the avoided cost of transport and disposal of process waste is \$60/t then the comparisons with other fuels is shown in Graph 10.

Graph 10. Gas and Coal Price Rise and a \$25/t Carbon Dioxide Charge and Avoided \$60/t Process Residue Disposal Cost



It can be seen that process residue is an economic fuel for electricity generation when disposal costs exceed \$60/t and plant output size is at least 10 MW_e. In some circumstances it will be economic already.

7. Cogeneration

Where process heating is required there is the potential to use any surplus heat to generate electricity. The electricity can be used internally in the plant or sold back to the local electricity supplier.

The allocation of costs in a cogeneration plant between heat and electricity is very site specific. It depends on several issues including the heating and electricity loads and their daily profiles, electricity tariff structure (avoided retail costs) and if surplus electricity can be sold back to the grid.

This report shows in a very simplistic way that cogeneration using process residue as a fuel could be economic particularly in larger plants.

8. Conclusions

By 2008 increases in the gas price and the introduction of a carbon charge will increase the relative price of coal and gas to the extent that in the North Island heat from coal and gas could be around twice the cost of heat from process residue heat, and 60% more expensive in the South Island.

Generating electricity from bioenergy is generally not economic except in the case where process residue is used as a fuel and where it would otherwise have had disposal costs in excess of $60/t and plant output size is at least 10 MW_e.

Cogeneration using process residue will become a more economic option particularly for larger plant facing high process residue disposal costs.