The business case for investment in new wood fuelled heat plant

Presentation to BANZ Conference:

"Successful installation and operation of wood fuelled heat plant"

9 May 2014

Mike Suggate
East Harbour Energy

Prescribed topics

- Wood use economics
- Non economic benefits
- Drivers for wood fuel pricing
- Future price trends for wood fuels

east harbour energy

East Harbour Energy

- East Harbour: an independent, energy focused consulting business

- Specialising in biomass, geothermal, wind ….. and energy strategy

- Recent biomass-related projects:
  - Biomass fuel supply/procurement
  - Biomass availability, supply chain design, supply contracting
  - Biomass gasification for electricity generation
  - Energy efficiency, wood processing sites

east harbour energy

Domestic heat costs (as a scene setter)

Consumer magazine says this week that:

- Heat pumps are the cheapest form of heating
- Wood:
  - Adds a premium of around 70% (Consumer)
  - Similar price
- Gas is not covered, but likely to be between wood and electricity
- Pellets are around 30% higher than wood
- Electricity around three times heat pumps
- Coal not mentioned

Other consumer groups all put wood down the cheaper end of the scale

east harbour energy

The business question

What are:
- Your costs of heat, and
- What are the other costs and benefits

Using:
- Wood
- Coal, or
- Gas

Considering costs of:
- Capital charges,
- Operations and maintenance costs
- Fuel costs

east harbour energy

Questions considered

- The technology
- Fuel availability, and fuel supply security
- Costs:
  - Capital
  - Operations and maintenance
  - Fuel
  - Escalation and future cost drivers
- Other
  - Environment
  - CO2 emissions (and future costs of these)
  - Marketing/reputational/feel good

east harbour energy

Wood boilers

- Modern (almost exclusively imported from Europe) biomass boilers are
  - Highly efficient
  - Automated
  - Reliable and last a long time
  - Very clean burning
  - And quite expensive (c.f. gas or coal boilers)

- So
  - No issues with biomass boilers – they are generally very good
  - The economic proposition for heat from wood fuel is relatively high capital costs, offset by lower cost fuel

- But boiler selection is important
  - You will need to consider the quality/availability of fuel
  - the need for fuel flexibility:
  - The poorer the fuel and the greater the required flexibility, the dearer the boiler

east harbour energy

Costs for heat plants

- Relative boiler costs (indicatively, circa 2 MW)
  - Gas - (say) $560k
  - Coal – $1m
  - Wood, including fuel handling – $1.4 m
- Operating costs
  - Gas – low
  - Coal – moderate
  - Wood: costs are relatively high given a complex and variable low calorific value boiler fuel
- Costs of conversion from coal to wood fuel
  - Boiler de-rating
  - may be quite high, and not in all cases possible

east harbour energy

Wood fuel

- You may have a choice
  - Hogged forest residues – "by-product" of harvest process (wet)
  - Chipped processing residues or pulp logs (dry, semi dry or wet)
  - Pellets (not covered in this presentation)
- Variable in quality, wet, low calorific value (CV), expensive to transport and difficult to contract long term
- Alternatives:
  - Gas: easy to use, reliable easy to contract, low emissions, low cost boiler, low staffing and maintenance ……
  - Coal: homogeneous, high CV, easy to contract, familiar to owners and operators, but high emissions of CO_2 and other particulates
- Wood fuel suppliers are not yet operating in all regions

east harbour energy

Fuel: wood is low cost

- Prices vary considerably
- Hogged wood costs (say $52/tonne or $6/GJ wet, CNI), plus transport
- Coal – $8/GJ (delivered).
- Gas – $9 - 14/GJ. Location, volume related

Fuel type	Source/ processing	CV (GJ/tonne)	Moisture content %	Ash content %	Boiler efficiency %	Fuel density (kg/m^3)	CO_2 emission factor
Natural gas	Mined	N/A	N/A	Nil	86	N/A	55
Waikato coal	Mined	19.9	27	4	82	700	140
Pulp chip	Chipped from harvested logs	8.6	55 - 57	0.5 – 1	61	320	Nil?
Hogged wood	Ground or hogged harvest residues	8.6	55 - 57	2 – 4	61	320	Nil?

- But …….

east harbour energy

The "buts"

- Wood has a low CV
  - Around 8.6 GJ/tonne (c.f. coal at 20)
  - Semi-dry wood has a CV of around 12 GJ/tonne
  - Dry wood (15% moisture) around 16 GJ/tonne
  - Drying wood:
    - Drying costs are high
    - But boiler may be cheaper
- Requires transport handling, storing …. 2.3 times the weight, 5 times the volume
  - Significantly different boiler and fuel handling feed systems
  - Substantially more cost: Capital and operating
- Boiler efficiency: wet wood: 61%, coal: 82%, gas: 86%
- This means that for the same output 35% more energy in is required than for coal

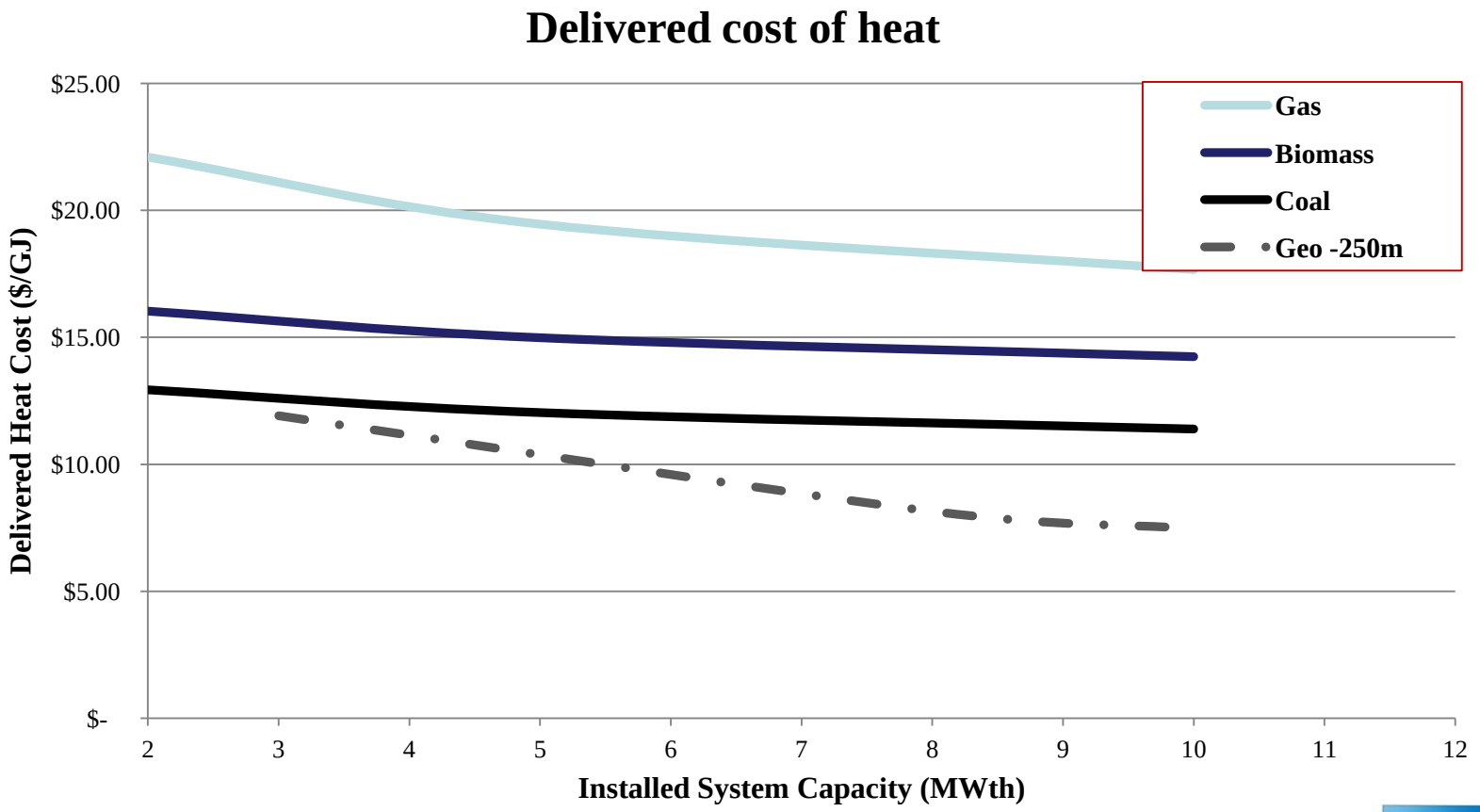
east harbour energy

Multiplying it all out

- To displace 2,000 tonnes of coal requires around 6,000 tonnes of green wood fuel
- Factoring in CV, transport costs and boiler efficiency
  - Heat from wood costs is a minimum of $10.50/GJ
    - Varies greatly with quality, moisture content, location
    - May be much greater
  - Coal at around (Waikato) $9.70/GJ
  - Gas $10.5 - $16/GJ
- To these figures must be added the operating costs and capital recovery charges (Higher for wood)
  - Gap significant
  - So the economics are challenging
  - But there are opportunity areas

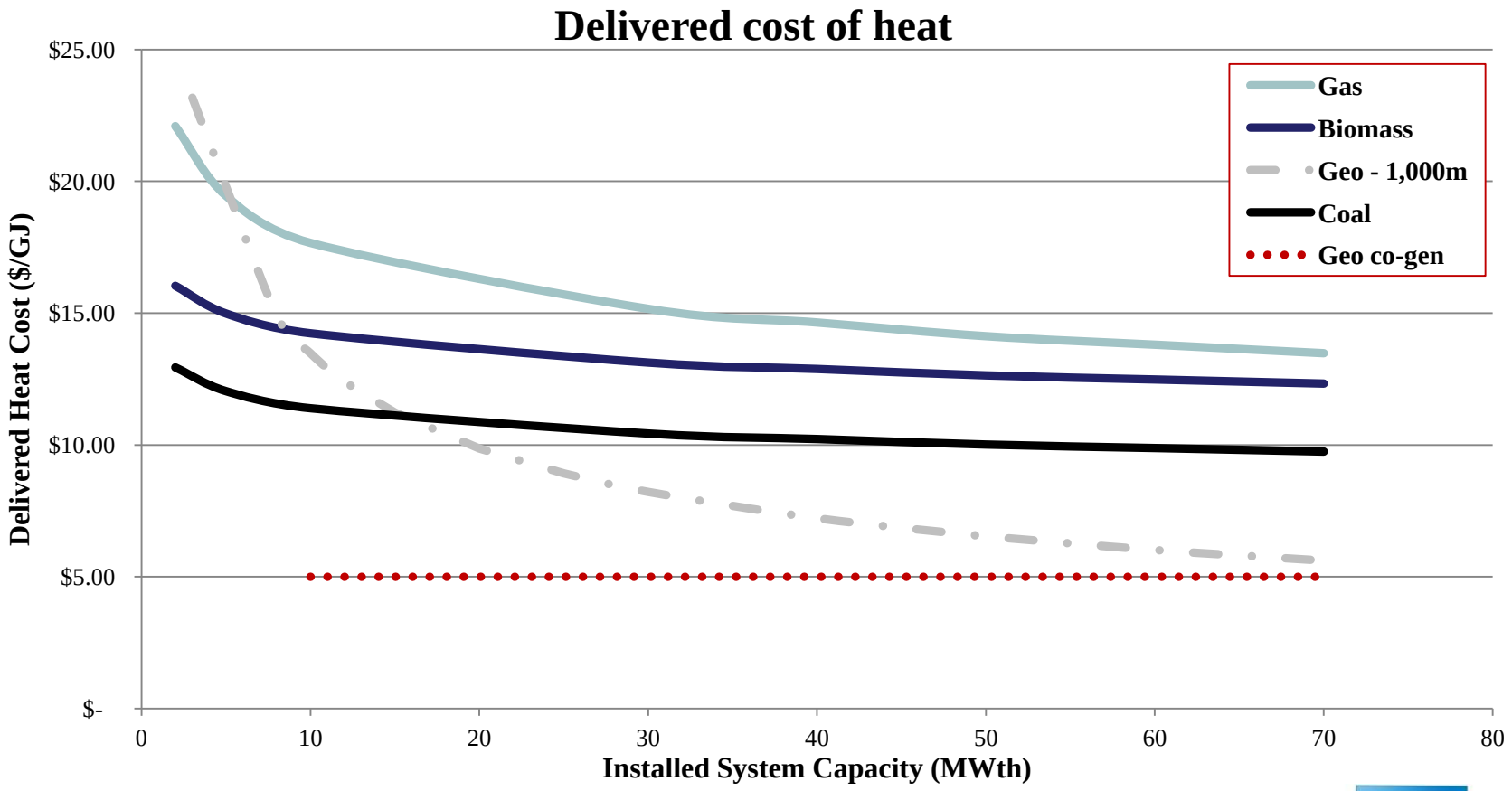
east harbour energy

Industrial heat costs



east harbour energy

Industrial heat costs



Two clear plusses for wood fuel

- CO_2 emissions
  - Coal has an emissions factor of around 140 KT CO_2/PJ
  - Gas is around 50
  - Wood is deemed to be zero
  - At half the $25/tonne nominal rate coal emissions cost around 50c/GJ
    - But current carbon price close to zero on international markets
- Ash disposal costs:
  - Around 20c/GJ for coal
  - Essentially zero for wood

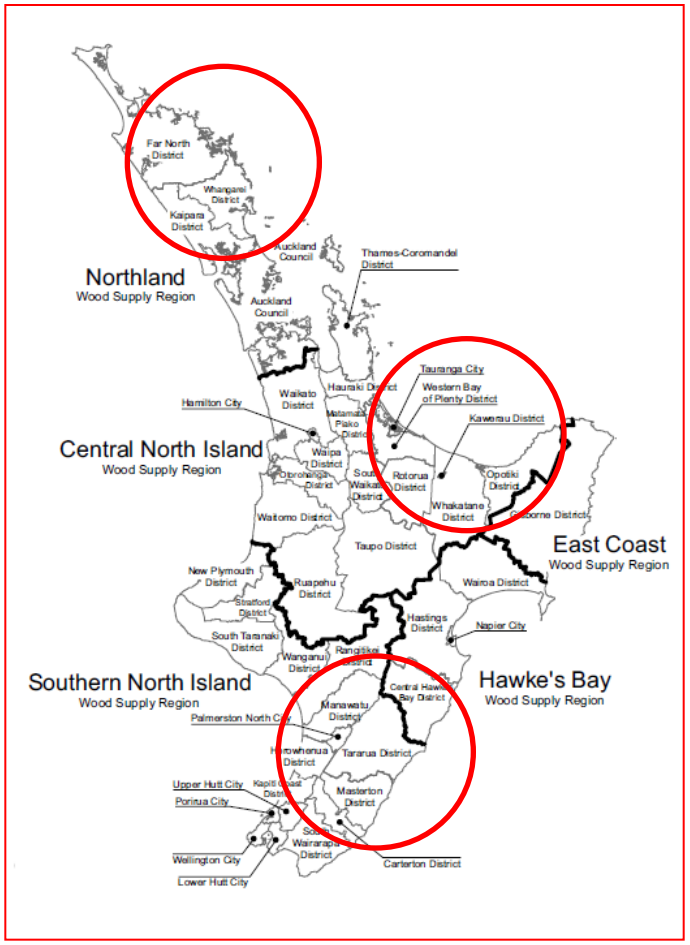
east harbour energy

Other considerations

- Coal and gas are familiar, "comfortable" fuels
  - Change offers risks, and challenges
- Some businesses value carbon for its "green" attributes
  - But few large industrials will actually pay for this
- Wood is more difficult to contract
  - Long-term to match heat plant investment horizons
  - On an acceptable price path
- In many areas  and 
  - Contractors to supply volume are not established and fully credible to customers, and
  - High volume customers are not available
- There are areas in which wood is cheap and plentiful
  - Including pulp chip

east harbour energy

Regional opportunity areas



Northland

- High and increasing wood volumes
- Well priced chip, residues available
- Some industry using wood and gas
- Alternative fuels expensive

Western CNI/BOP

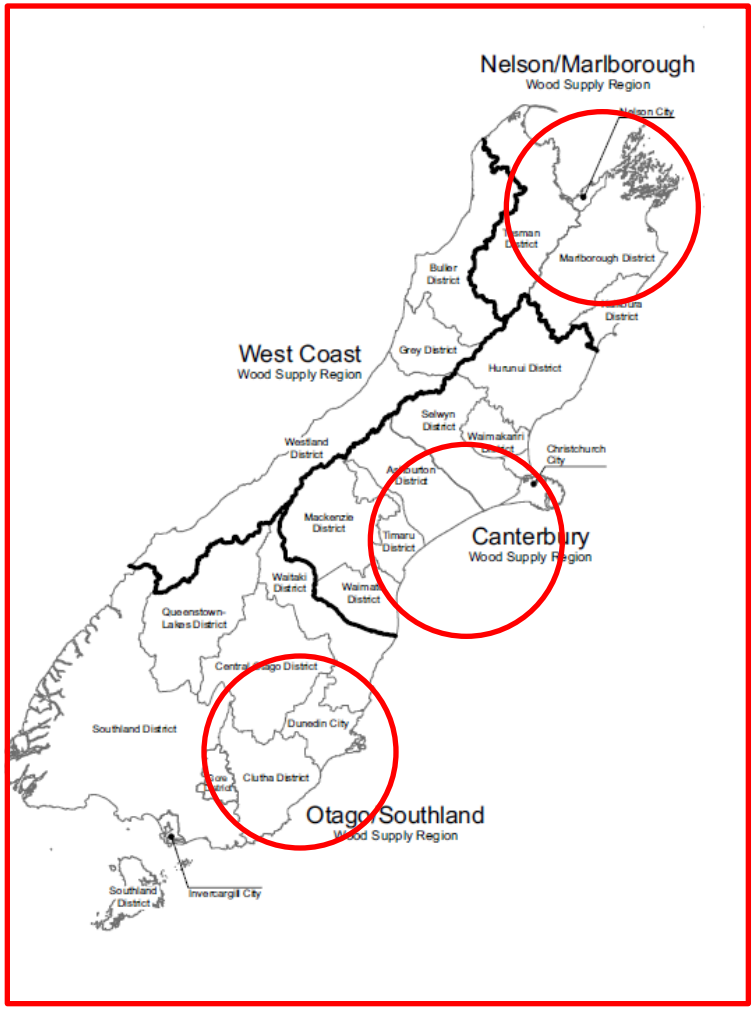
- Vast wood resource
- Decline in wood processing (Kawerau, Solid Energy) and under-recovery of residues means supply is available

Lower North Island

- Local markets for chip, residues small
- Long-distance transport of chip to market
- Little residue recovery

east harbour energy

Regional opportunity areas



Nelson/Marlborough

- Nelson has air shed problems
- Fuel available despite Nelson Pine demand
- But few potential customers

Canterbury

- Forests not large, but some fuel available
- No gas, and coal relatively expensive
- Air quality issues
- Limited current residues recovery

Lower South Island

- i.e. Dunedin no longer exports chip
- But lignite is very cheap

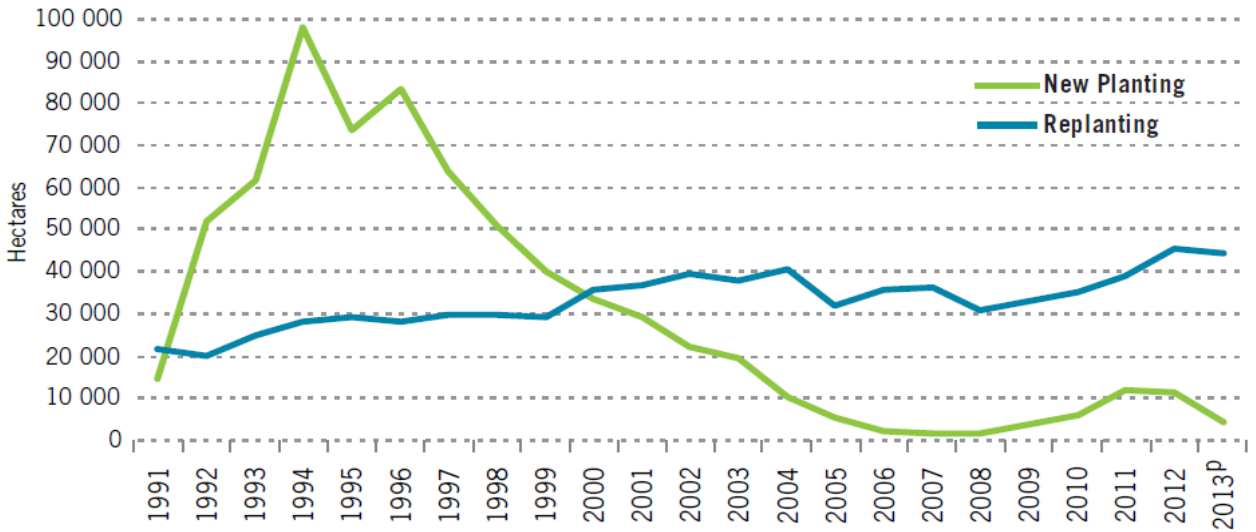
east harbour energy

Predicting the future.....

- NZ's planting rates have declined from a peak in the mid '90's (source MPI)

Figure 1 provides a visual outline of the estimated areas of new planting and replanting since 1991.

Figure 1: Estimated areas of new planting and replanting



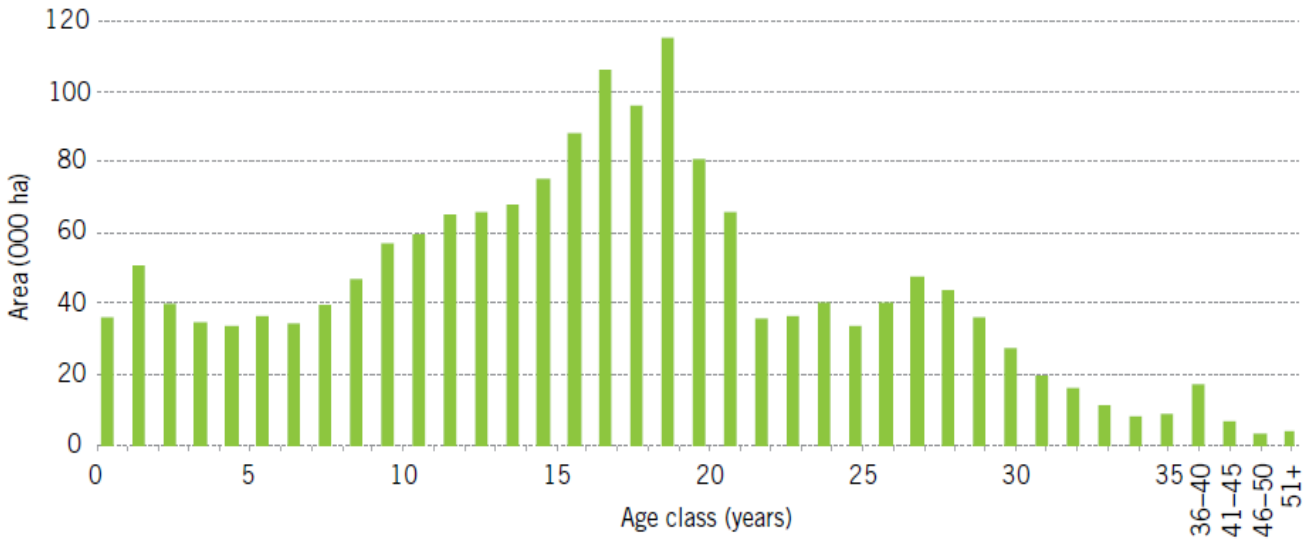
p Provisional.

east harbour energy

Predicting the future.....

- There will be a significant increase in wood availability as plantings reach maturity (source MPI)

FIGURE 2.1: TOTAL ESTIMATED PLANTED PRODUCTION FOREST AREA BY AGE CLASS, AS AT 1 APRIL 2013[1]



Note

east harbour energy

Future trends

- Wood fuel volumes will increase significantly in most regions
- Usage in NZ is likely to increase – leading to more competition, upward pressure on prices
- It seems likely that international demand and prices for logs and wood products will rise
- Residue recovery:
  - Volumes will increase as a larger proportion of residues is recovered (but at higher cost)
  - Costs of recovery should decrease with greater efficiencies
- Alternatives such as biofuel and chemical production have potential to compete strongly for supply in the longer term
  - On smaller scale in the medium term
- Don't see any signs yet of extensive plantings on shorter rotations for fuel/energy/chemical manufacture

east harbour energy

Future trends

So, overall, we can surmise that:

- **Supply**:
  - Will remain dependent on wood harvest
  - Is likely to increase overall, but remain regionally focused, as longer distance transport prohibitive
  - Face longer term competition from new, high-value uses

- **Prices:**:
  - Are likely to be driven up by increased competition for available fuel
  - And the higher costs of recovering more difficult resources
  - But will probably rise less than for hydrocarbon fuels including a carbon charges

east harbour energy

To recap: to use wood fuel

- Businesses require
  - Capital (or someone else's)
  - Relatively low wood fuel cost fuel
  - Long-term supply certainty, and
  - Insulation from excessive future cost escalation
- This choice will be assisted by
  - Good advice
  - High cost alternative fuel options
  - Green motivation
  - Wood supply close to point of use
  - Limited alternative regional uses for the wood fuel
  - Capable fuel supply contractors

east harbour energy

In summary: when does wood compete

- Capital is not a problem, or grants are available
- Alternative fuel options are high cost
- Green motivation
- Wood supply close to point of use
- No alternative regional uses for the wood fuel
- Capable fuel supply contractors offering
  - Reasonably priced fuel
  - Long-term supply certainty (look also at regional supply projections)

You should not be concerned about the quality or capability of modern boilers

east harbour energy

So, depending on location

Fuel in

Heat out

Indicatively, heat produced from the use of wood is 20 – 30% more expensive than that from coal, and probably around or a little below the cost of heat from gas

But it is cleaner, sustainable ……
And longer term may be even cheaper (relatively)

east harbour energy