How Renewable Energy and Other Generation Options Can Reduce Wood Processing Costs

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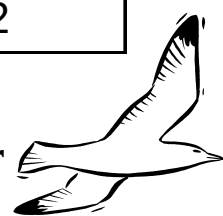
Move to Total Energy Solutions

- Wood processors have a range of energy options available
- Integrate renewable with other options, not replace
- Integrate with energy management tools
- Renewable energy often optimised by use of other fuelled plant/storage
- Phased introduction
  - As economic
  - As plant is replaced
- Embed into site energy system to produce maximum benefits
- Think total energy costs

Renewable Techologies

Resource	Electricity	Heat	Uses	Electricity c/kWh
Biomass (Process Waste)	Yes	Yes	Combined heat and electricity	9 - 11
Biomass (Forest Residue)	Yes	Yes		16 - 25
Biomass (Liquid Waste)	Yes	Yes		7-17
Wind	Yes	No	Water pumping	7 - 22
Solar Thermal	Yes	Yes	Hot water, kiln drying	7 - 10
Solar Photovoltaic (PV)	Yes	No	Niche off-grid electricity	> 31
Hydro	Yes	No	Irrigation	8 - 15
Geothermal	Yes	Yes	Minerals	7-12



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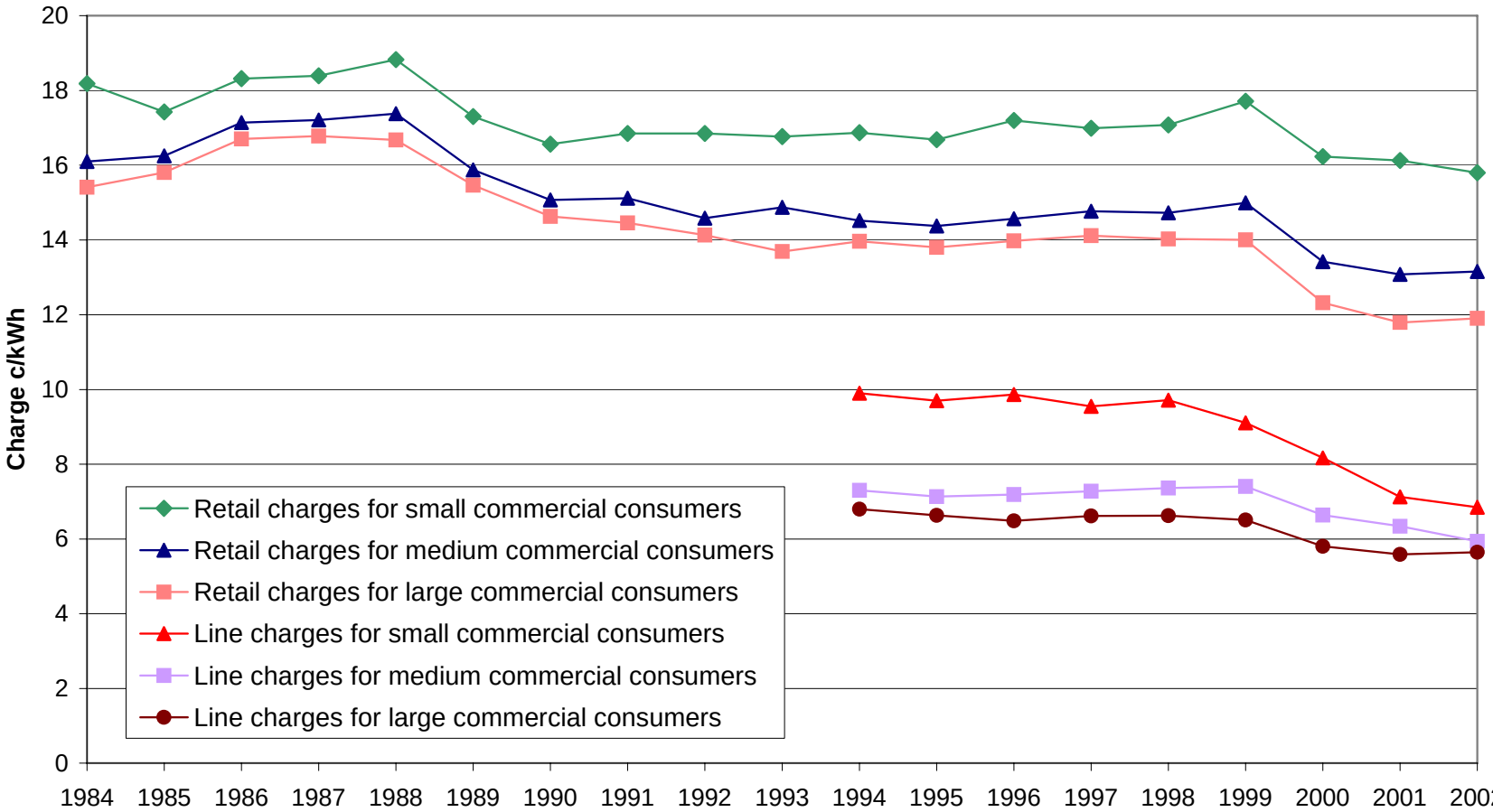
Average Commercial Retail and Line Charges

(inflation adjusted to August 2002)



Small commercial 6,000 kWh/year, Medium commercial 18,000 kWh/year, Large commercial 42,000 kWh/year

Ministry of Economic Development

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Bioenergy

- Fuel most within control of wood processors
- Uses waste materials
  - Forest residue
  - Process waste
- May require backup from coal, gas, forest residue or imported fuel
- Need to focus on fuel handling and processing
- Economics improved when biomass processed to be homogenous fuel

Bioenergy Trends

- 6% (30 PJ) of total consumer energy (546 PJ) is provided by bioenergy (2003)
- Process heat = 34% of NZ energy demand (Excl. Comalco)
- Bioenergy growth projected at 1.9% p.a. over next 20 years (= 1 * 15 MWth boiler p.a.)
- Consumer energy expected from bioenergy;
  - 36PJ by 2012,
  - 41PJ by 2020
- Use of biomass waste for energy is;
  - economic today for heat
  - close to economic for electricity generation
- Forest residue as fuel currently adds 5c/kWh to cost of electricity generation

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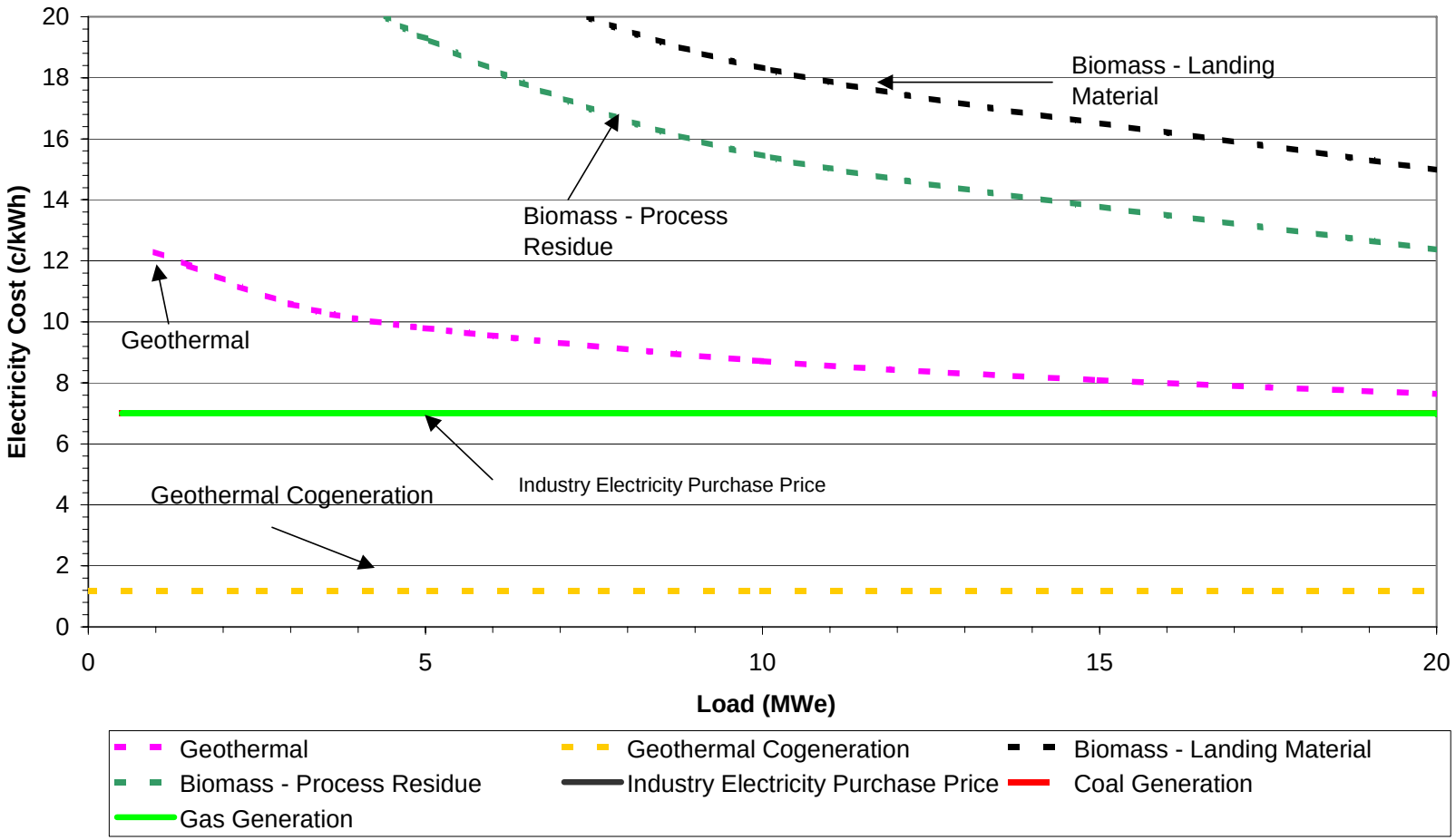
Cost of Biomass Electricity



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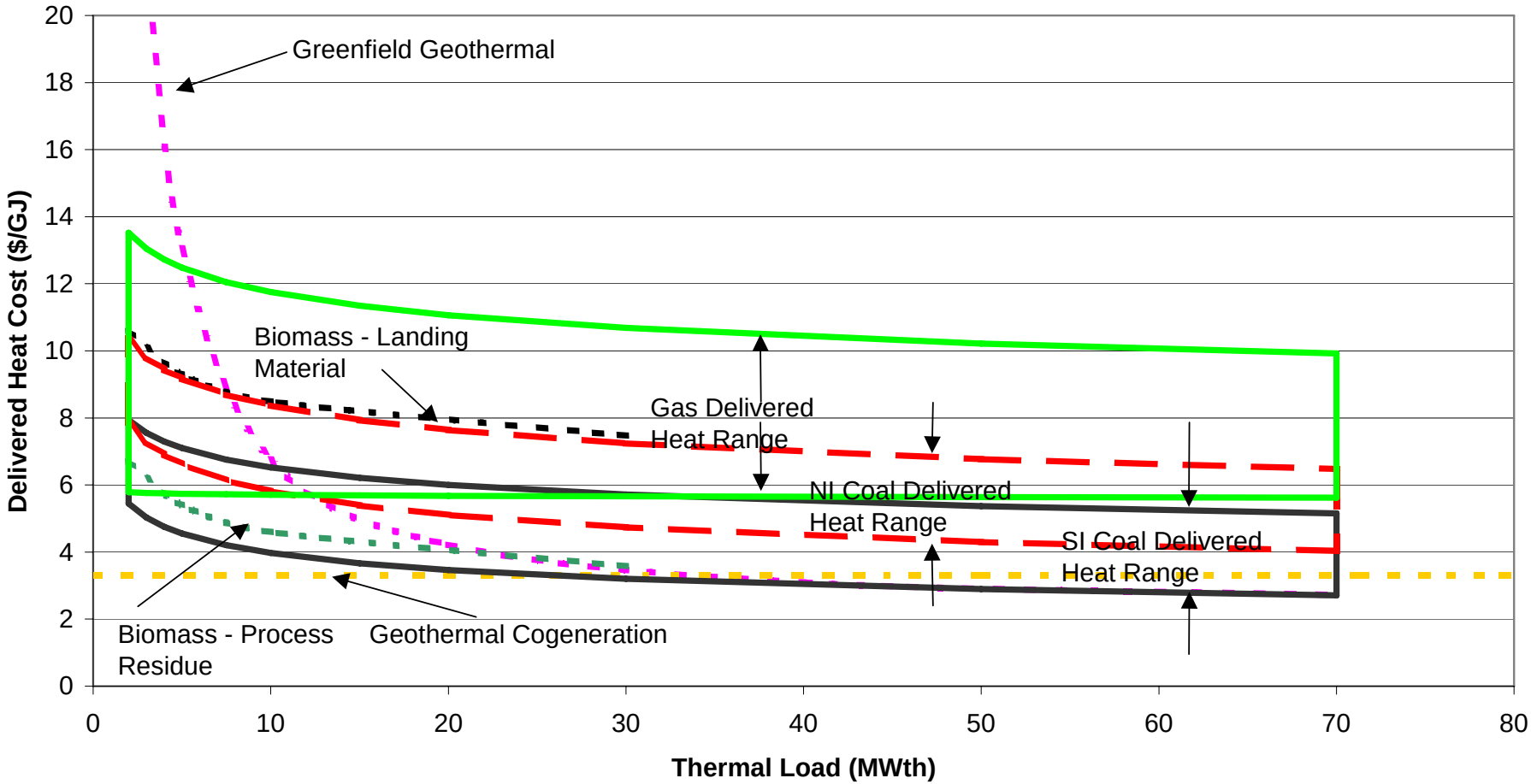
Cost of Biomass Heat



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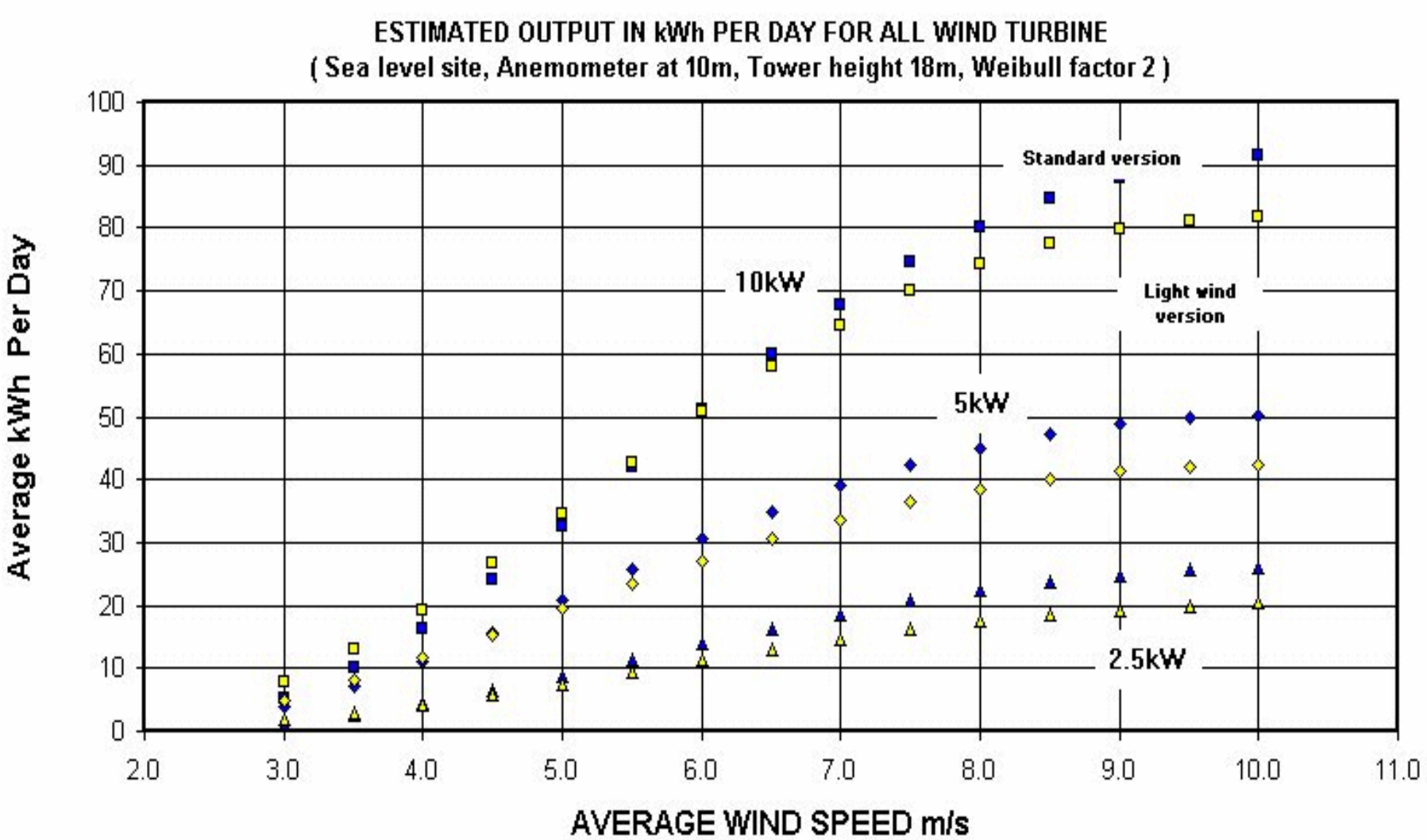
Wind Energy

- Power output proportional to speed cubed
- Requires backup energy supply / storage
  - Wind fluctuates and is not directly stored
  - Diesel or hydro make for suitable backup
- Depends on having (non-weak) grid
  - Output fluctuates with wind speed
- Size suitable for embedding into site
- Can locate nearly anywhere
- Highest energy from tall towers

Wind Speed & Power Output



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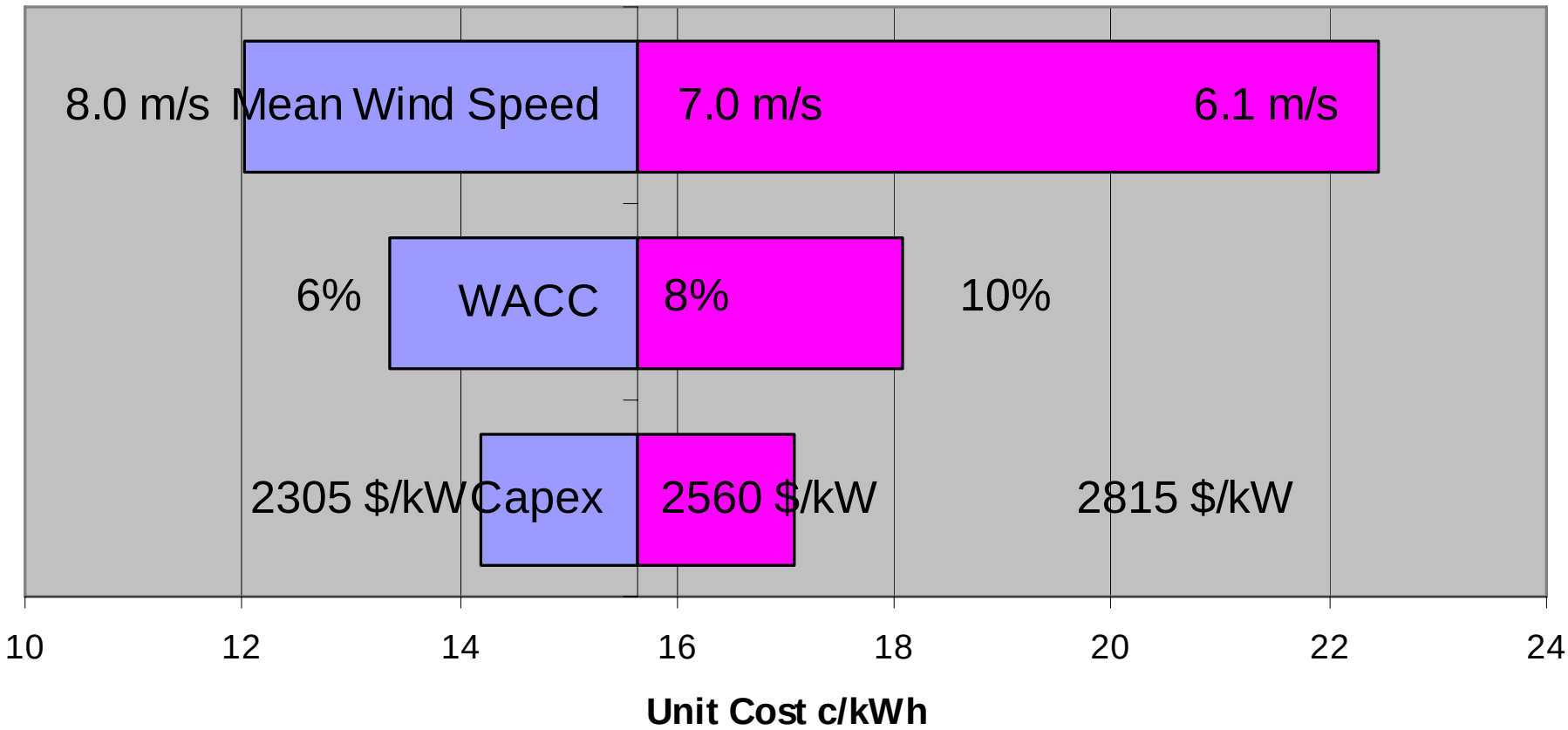
Cost of Wind

Inland Wind 600 kW



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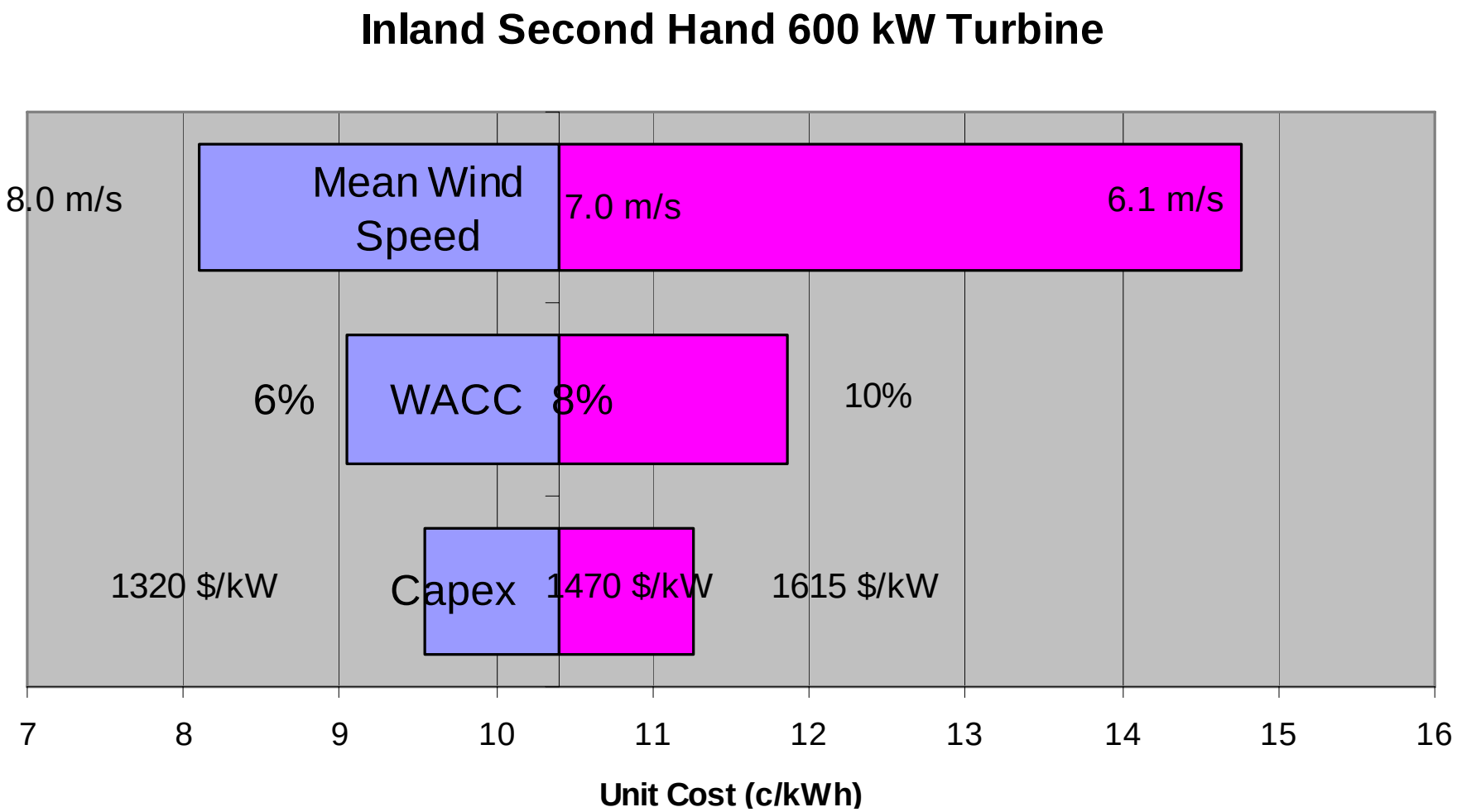
2nd Hand Cost of Wind



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Solar Energy

- Solar Thermal
  - Simple, mature technology
  - Solar hot water reduces grid load
  - Can be used as a preheater < 60-100 ^{o}C
- Photovoltaic
  - Maturing technology
  - Requires battery for storage
  - Power inverter required for AC use
  - Suitable for remote niche applications

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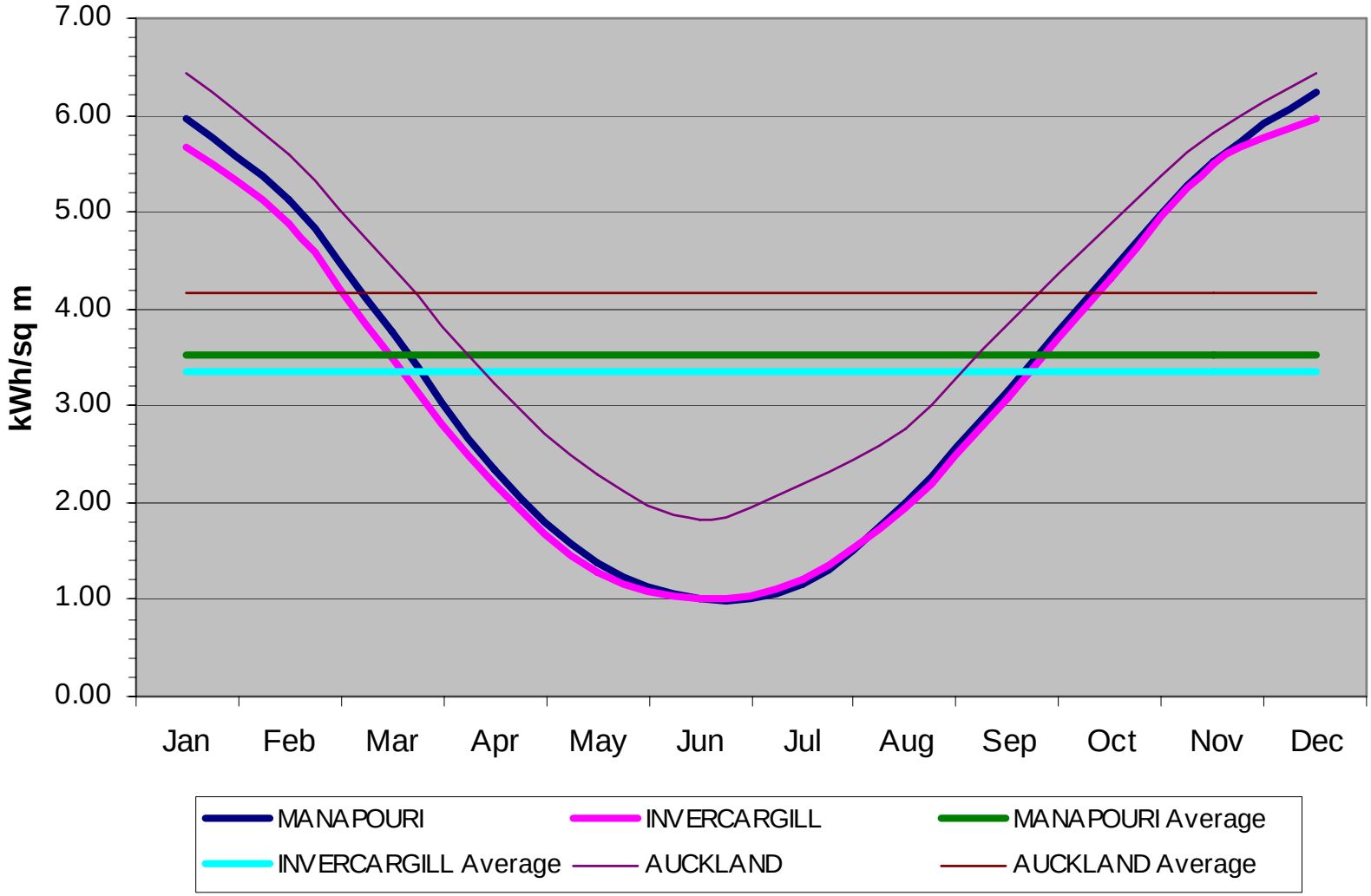
Seasonal Solar Radiation



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Solar Kilns

Source: Solar Dryers Australia

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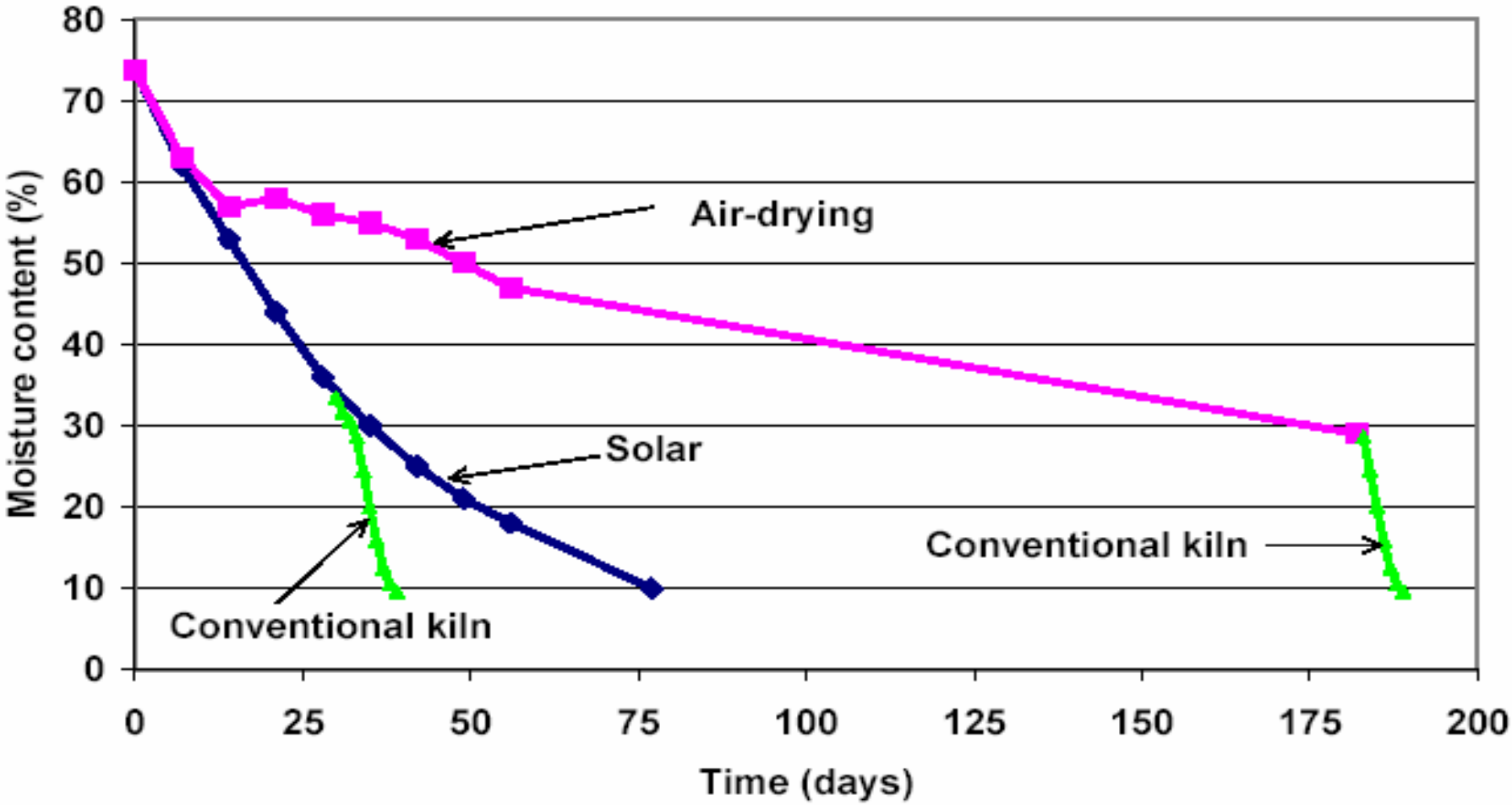
Solar Thermal – Kiln Drying



Drying times for air, conventional and solar drying and in combination for 30mm thick green boards of blackbutt. (Haque 2002)

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Photovoltaic – Stand Alone

- $10,000 / kW capital cost
  - Batteries and power inverter required
  - Dropping rapidly due to:
    - Maturing technology
    - Exchange rate effects
- Energy 31c / kWh in high sunshine areas
  - Maybe economic if avoids electrical cabling

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Diesel

- Ideal peak reducing
- Controllable, quick & reliable start
- Ease of
  - maintenance
  - availability of fuel
- High resale value
- Easily relocatable

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Small Hydro

- Proven technology
- Size can be embedded
- Low operating cost
- Widespread number of opportunities
- Can be distant from site

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Geothermal Energy

- Proven mature technology
- Dual energy opportunity
  - Electricity (~10% efficiency)
  - Heat (170°C to 340°C)
- Geographic location often suits forestry sector
- Consider when locating processing sites
- NZ world experts in geothermal energy

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Geothermal Resources

Region	Range of Maximum Spring / Well Temperatures (ºC)			
	30-69	**70-140**	**140-220**	**>220**
Northern	8	1	0	1
Hauraki	16	1	1	0
Rotorua – Taupo	5	9	6	14
Other North Island	4	1	0	0
South Island	19	2	0	0
New Zealand	**52**	**14**	**7**	**15**

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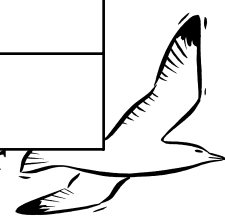
Use of Geothermal in NZ

Use	Installed Capacity (MWt)	Annual Energy Use TJ/y	Capacity Factor
Electricity generation	431 MWe	9,500	-
Space heating	>22	>700	-
Fish and Animal Farming	19	363	0.6
Agricultural Drying	29	>253	-
Industrial Process Heat	210	5,500	0.8
Bathing and Swimming	28	265	~ 0.3
Subtotal	308	7,081	-
Geothermal Heat Pumps	-	-	-
Total	**308**	**7,081**	



Coal and Gas

- Current cost advantage will reduce
- Use as a hedge against fuel supply risk
- Ideal backup fuel for bioenergy plant
  - Steady price
  - Reliable delivery
  - Ease of delivery
- Gas plant has low capital cost

Summary

- Current coal/gas benefits reduce over time
- Renewable energy is cost competitive
  - Maturing technologies
  - Reduced transmission costs
  - Well matched combinations
- Renewable energy optimised by use of coal/gas/diesel
- Hedge fuel supply risk with alternative fuels
- Using waste for energy is smart thinking