



Bioenergy Options

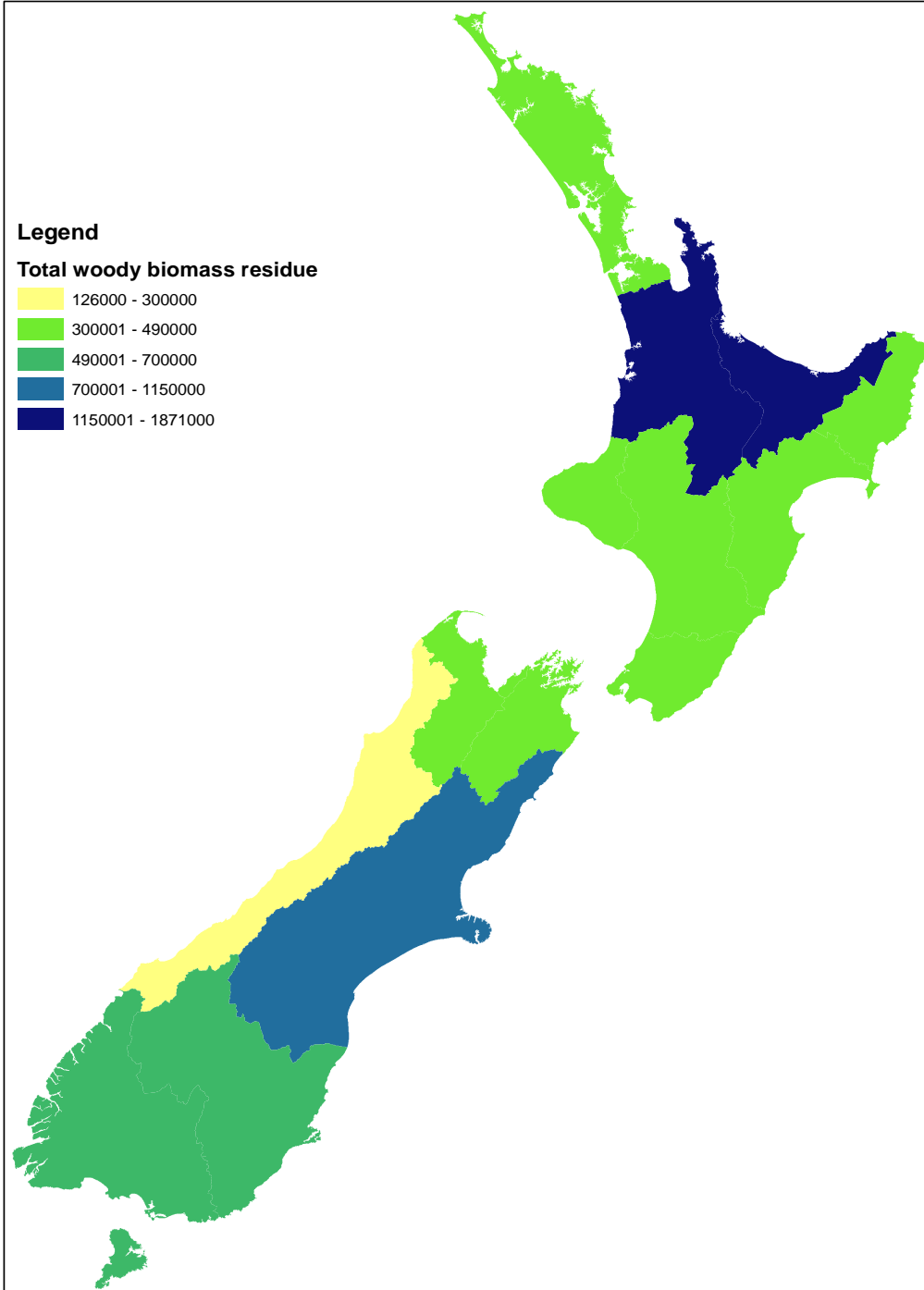
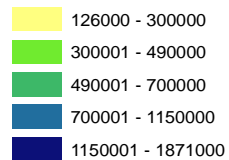
Peter Hall

Type / source	2005	2030	2050
Forest Residues	14.6	34.4	29.5
Wood Process Residues	7.0	9.1	18.4
Municipal wood waste	3.5	2.2	2.9
Horticultural wood residues	0.3	0.3	0.3
Straw	7.3	7.3	7.3
Stover	3.0	3.0	3.1
Fruit and Vegetation Culls	1.2	1.2	1.2
Municipal Biosolids	0.6	0.7	0.7
Municipal solid waste, putrescible	2.2	2.3	2.3
Municipal solid waste , landfill gas	1.9	2.0	2.0
Farm Dairy	1.2	1.2	1.3
Farm Piggery	0.1	0.1	0.1
Farm Poultry	0.0	0.0	0.0
Dairy Industry	0.4	0.4	0.5
Meat Industry (effluent only)	0.5	0.5	0.6
Waste oil	0.2	0.2	0.2
Tallow	3.6	3.6	3.6
Total	47.8	68.5	74.0
Available Biomass as % of consumer energy	8.9	9.5	8.4
Available Biomass as % of Primary Energy	6.9	7.7	6.8

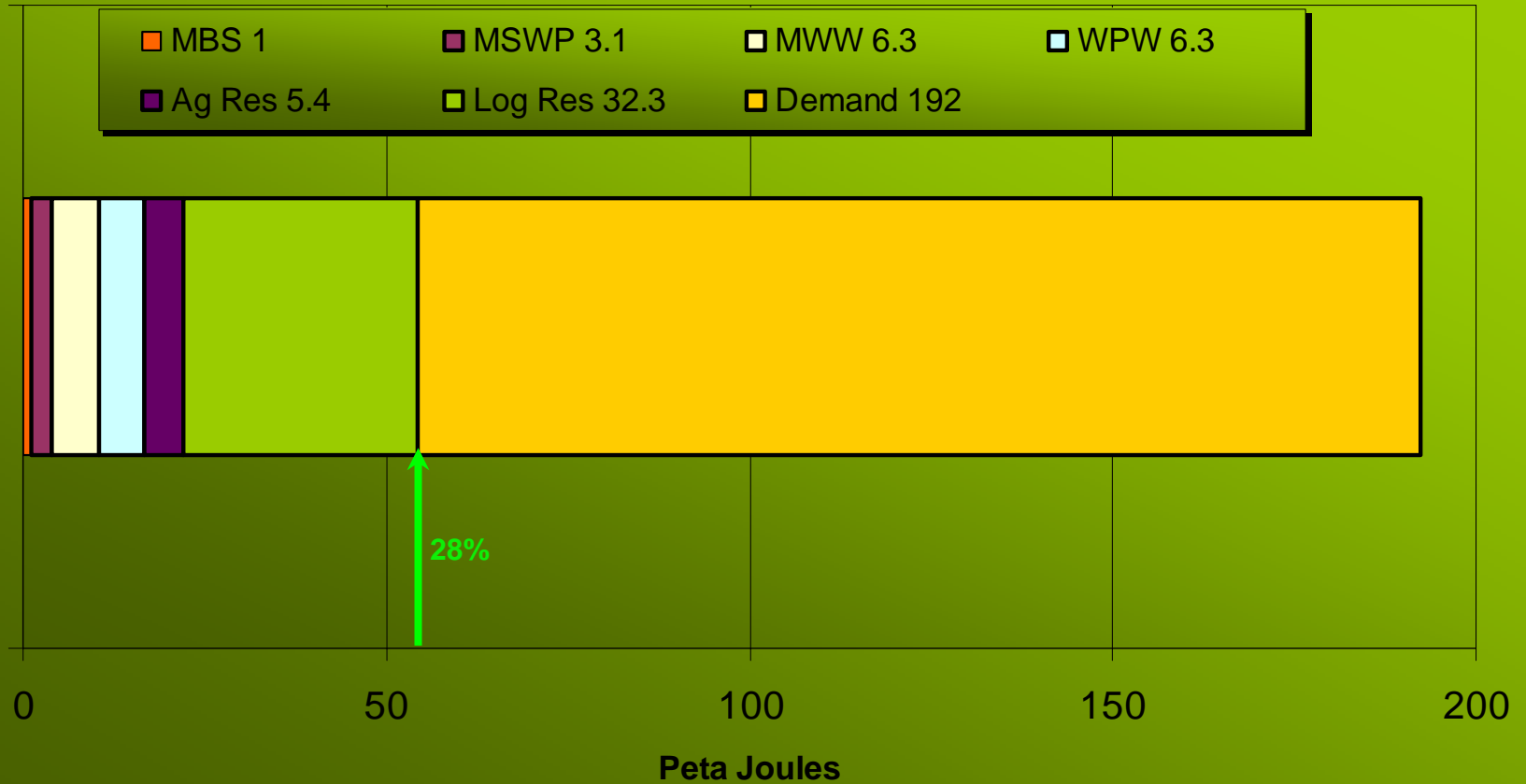
Mapping resource location

Legend

Total woody biomass residue

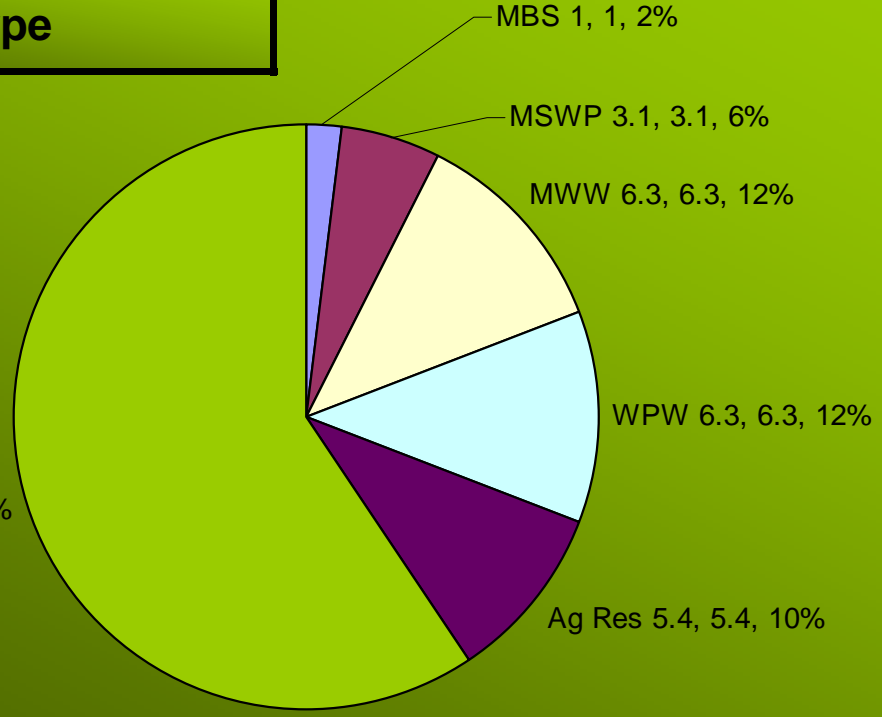




Heat demand and potential biomass contribution





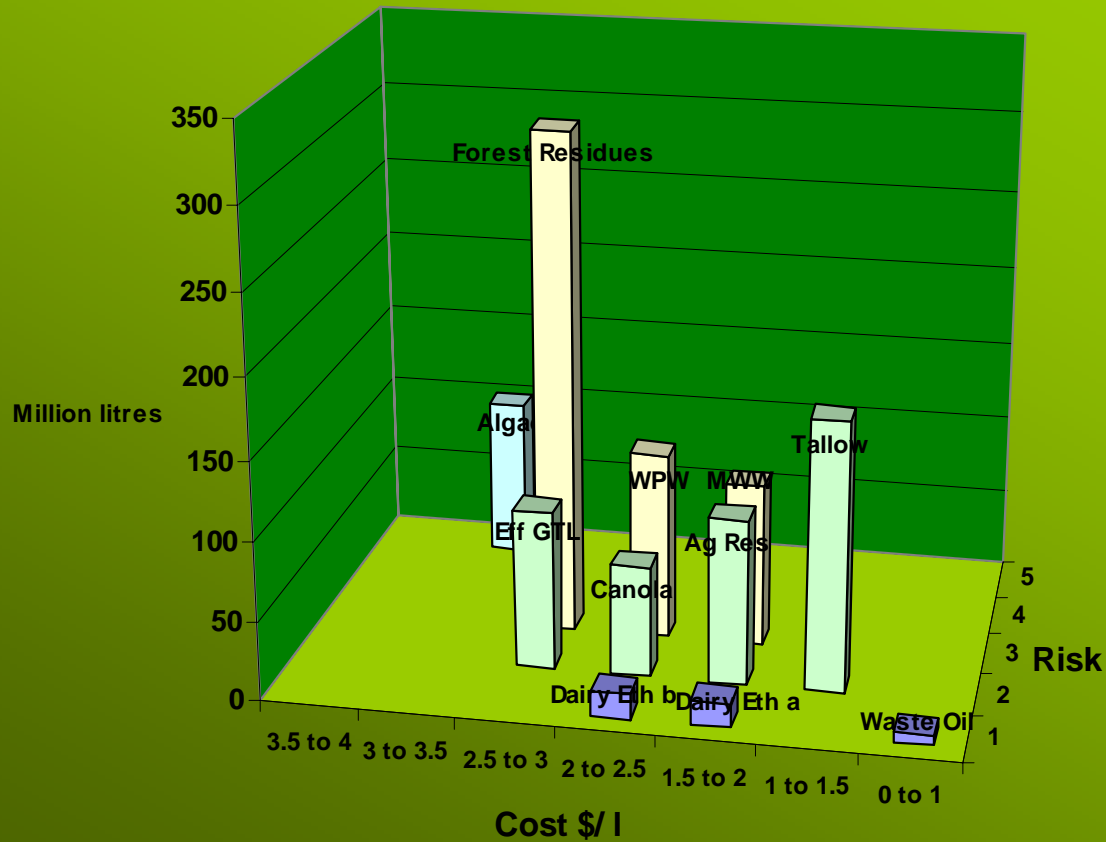
Proportion of Biomass Contribution by residue type



-  MBS 1
-  MSWP 3.1
-  MWW 6.3
-  WPW 6.3
-  Ag Res 5.4
-  Log Res 32.3

82% wood

Residual Biomass to liquid fuels, Cost, risk and volume



Raw Material	Conversion	Energy Product
Wood Residues	Combustion	Heat Combined heat and power
	Enzymes	Ethanol Biobutanol
	Gasification	Combined heat and power
	Gasification + Fischer Tropsch	Biodiesel
	Pyrolysis / Oil	Combined heat and power
Effluents, Industrial, Farm waste effluent Municipal Biosolids	Anaerobic Digestion / Gas	Combined heat and power Gas for transport Liquid Fuels
	+ Algae Anaerobic Digestion / gas	Combined heat and power
	+ Algae Chemical Mechanical	Biodiesel
	+ Algae / supercritical water	Liquid fuels
Agricultural Residues (straws)	Combustion	Heat Combined heat and power
	Gasification + Fischer Tropsch	Biodiesel
Horticulture Residues (fruit wastes)	Anaerobic Digestion / Gas	Combined heat and power
	Enzymes	Ethanol
Agricultural Crops (canola)	Chemical Mechanical	Biodiesel
Waste Oil	Chemical Mechanical	Biodiesel
Landfill Gas	Capture	Heat and Power
Tallow	Chemical Mechanical	Biodiesel

NZ has

- 2.0 million ha of cropping land
- 8.7 million ha of moderate to low productivity grazing land
- Agricultural crops to fuel, off arable land, at large scale is not possible, especially if you want to eat. (4.0 million ha)
- Forests for energy can do all of our heat and liquid fuels off 3.5 million ha of moderate to low productivity grazing land.

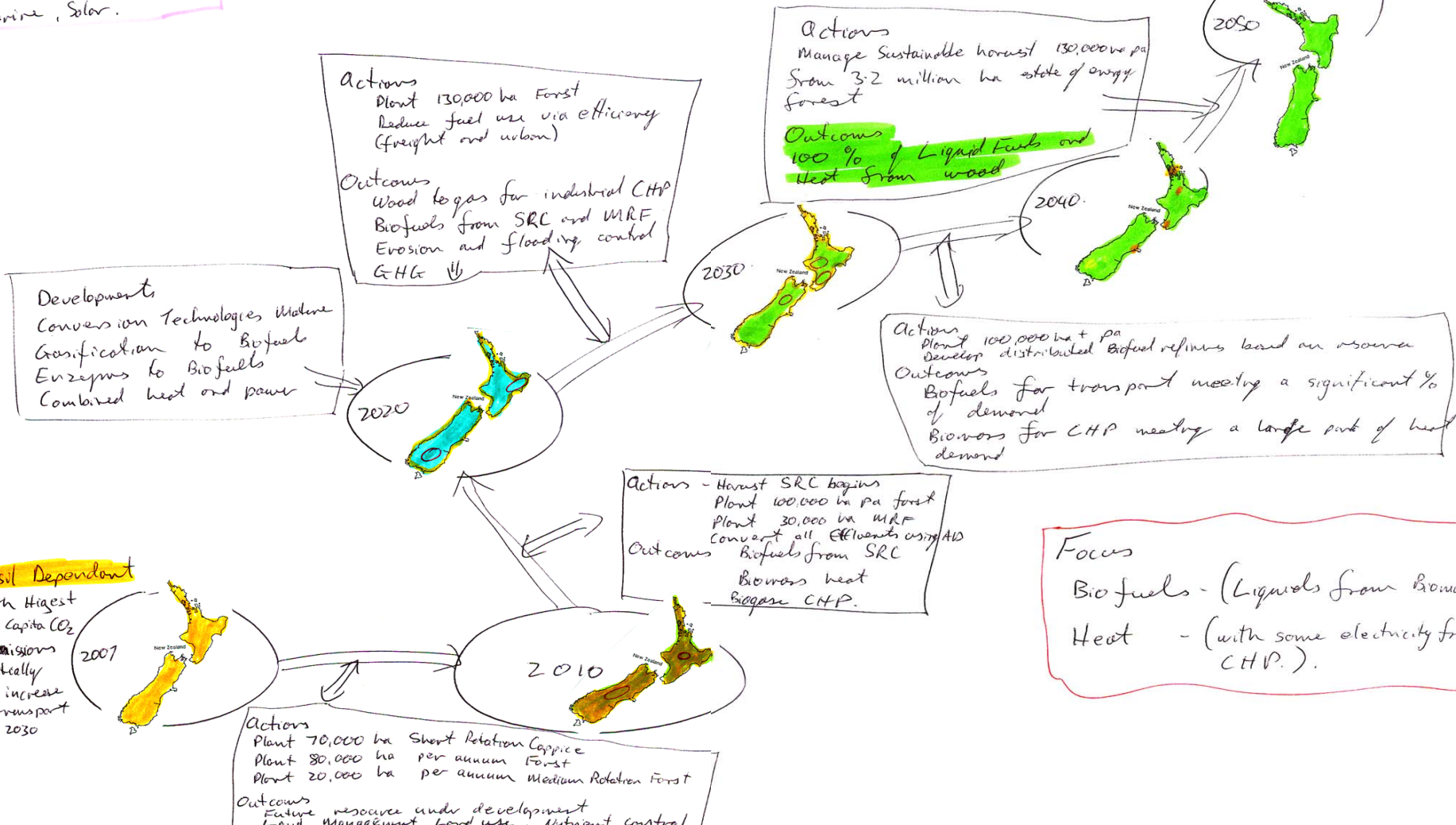
Plant SRF, MRF, Traditional forest for Energy and other products and values

Concept strategy for sustainable energy

Goals

NZ sustainable in heat and transport fuels - biomass derived
Carbon Neutral Energy
Land use optimised
Water Quality and use sustainable

Note
Electricity provided by renewables from Hydro, Geothermal, Wind, Marine, Solar.



1. Develop a resource (stored solar energy) and convert to;
 - Heat (scale, logistics)
 - Biofuels (technology, scale, logistics, crops)
 - Solid wood
 - Chemicals
2. Leverage off biofuels driver (not captured by it)

Step in right direction

Linked to Forestry and ETS policy

Encourages renewable electricity, needs a focus on waste streams

Will drive renewable investment

Will impact on GHG emissions, nil effect on Climate change (NZ = 0.3% of global GHG?)