New Zealand's versus United States' organic wastes

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In March 1980 Jim Williams, Deputy Secretary of Agriculture, reported to the US Senate Subcommittee on a survey of biomass research into the availability of woody and agricultural materials (a) to produce alcohol fuels, and (b) for direct combustion and the production of other forms of energy. (Williams, 1980) In the absence of comparable research in New Zealand, his findings are of Full life member, NZIF guideline relevance to this country. Of the agricultural commodities measured, plant wastes such as cereal straw, corn cobs and stalks are not of interest to New Zealand because of different agricultural practices. Neither are wastes from farm animals raised in confinement. The US forests, however, are comparable to those of New Zealand in terms of management.

New Zealand maintains national records on natural and plantation forests, as does the US. We also keep records of primary energy supply and its sources. Because forests produce both material and energy, and New Zealand statistics cover material usage only, the US report provides a tentative view of forest potential to yield transport fuels and electricity either as additions to material use or as a possible alternative use. At a time when the world may have passed its peak of oil production (possibly in 2006), New Zealand is overdue to settle on a plan for the production of alternative fuel. From that perspective, a US - New Zealand comparison of forest energy potential becomes urgent.

Primary energy in New Zealand is recorded in petajoules (PJ). For that reason, the expected energy yield from forests has also been reported in PJ. The detail of the US - New Zealand comparison is given in Appendix A. The comparison suggests that New Zealand may be able to produce some 50.44 million barrels of oil equivalent from the wastes of existing forests.

Recent news reports suggest that erosion-prone hill country in New Zealand, if afforested, should support a national forest increment of some 800,000 hectares. An examination of the detail of such land suggests that the total may be somewhat higher, but with large and small concentrations in different regions. (Ministry for the Environment, 2007) If only large regional concentrations are used (0.25% of gross land area or more), the suggested figure of 800,000 ha. becomes a reasonably attainable target out of a total land area (large concentrations) of 960,000 ha. The most exposed regions are Manawatu (0.83%) and Gisborne (0.59%)

Samples of statistics on primary energy supply up to last year are given in Appendix C. An augmented estimate of forest supply of wood wastes in New Zealand is given in Appendix B. Extrapolations from US data suggest that New Zealand could supply some 320.816 PJ of energy from augmented forest resources and 307.684 PJ from existing forests. Either of these amounts should be sufficient to make New Zealand totally self-sufficient in transport fuels, given that imported oil and oil products for 2007 do not exceed 270.31 PJ. However, forest energy would not of itself enable New Zealand to free itself from using fossil fuels, including coal as the fallback option when oil and gas disappear.

A glance at Appendix C tells the story of renewable sources. Historically, successive New Zealand governments have done well to elevate renewables to around 40% of primary energy supply. Since the eighties, however, enthusiasm has waned. From 1980 to 2004 the proportion dropped from 38.6% to 31% while the quantitative figure grew by 81.16 PJ. During the same period, use of indigenous fossil fuels has risen by 157.86PJ and by 10.5%. The

Appendix A: Energy content of US and NZ forests

Attribute	US	NZ
a) Continental or island land area	904.7 m. ha.	26.9 m. ha.
b) National forests controlled by govt	76.9 m. ha.	6.2 m. ha.
c) Forest proportion of land area	8.5%	23%
d) Plantation forest area	18.4 m. ha.	1.2 m. ha.
e) Proportion of land area	2.03%	4.46%
f) Total forest area	95.3 m. ha.	7.4 m. ha.
g) Total forest and land proportions	10.5%	27.5%
h) Abbreviations:		
odt = oven dried tons		
boe = barrels of oil equivalent		
GJ = gigajoules		
PJ = petajoules		
i) Expected waste wood from forests annually	500 m. odt	38.8 m. odt
i) Btu value of waste wood @ 1.3 boe/odt	650 m. boe	50.44 m. boe

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Appendix B: Possible capacity of NZ to provide energy from forests

Source	Quantity
a) Area of new forests on erosion-prone land	0.8 m. ha.
b) Wood wastes new forests	1.656 m. t
c) Btu value of wood wastes from new forests	2. 1528 m. boe
d) Btu value of wood wastes from total NZ forests (j + m)	52. 5928 m. boe
e) Conversion to joule units	1 boe = 6.1 GJ
f) Conversion of boe value to joules (n....o)	320.816 m. GJ = 320.816 PJ

Appendix C: Primary energy supply, NZ

Year	Imported oil & oil products	Indigenous fossil coal, oil & gas (Petajoules)	Renewables (geothermal hydro etc.)	Total
1980	148.02 (36.6%)	100.08 (24.8%)	156.2 (38.6%)	404.3
2004	257.94 (33.7%)	270.28 (35.3%)	237.36 (31%)	765.58
2007	270.31 (36%)	251.98 (33.5%)	229.71 (30.5%)	752

retrograde trend continued up to 2007. Central governments have failed to maintain the care for the environment displayed by their predecessors up to 1975, while advocating public abstention in the use of carbon.

Because inanimate energy supplies the drive for the working part of the national economy and its carriers, and the material for major parts of industrial and agricultural production, forests in New Zealand represent the key to successful adaptation this century. In proportion to those of the US, New Zealand is nearly 3 times as well supported in natural and created wealth.

A major economic issue arises from the report of Jim Williams. He demonstrated the value of forest wastes. Because cheap (i.e. accessible) oil has created the world economy with which we are familiar, its replacement should replicate its basic characteristics, of which liquidity and cheapness stand out. Wood wastes mark the pathway to cheap substitutes. Dedicated plantations do not.

The fundamental issue for forest-based wastes or dedicated energy crops is land value. So far, research into transport fuel use in New Zealand has ignored the practicality of land values when decisions on substitutionary feedstocks are contemplated. The failure has serious economic implications. A glance at statistics on rural land values given in Appendix D will show that average sales figures for horticultural farmland are more than 20 times those for grazing land. Clearly, cheap energy crops must be grown on cheap land, because land values must be factored into any calculation of crop returns. In turn, this factor must influence the kind of crop that can be grown. In this area, economics comes before fuel research.

Appendix D: Farms sold in NZ 2007

Land class	Number sold	Average area (ha.)	Average price/ha. ($)
Grazing	249	262	4658
Fattening	1308	143	11,458
Arable	94	95	23,150
Specialist livestock	178	53	27,840
Dairy	699	91	28,035
Horticultural Farmland	386	12	100,734
Total Farmland	2914	116	15,188

A recent BBC World News item discussed cars of the future. It predicted that they would be powered by electricity, hydrogen and biofuel. This seems to be a common European theme, not popularly replicated in the US. Their practicality needs updating:

a) Electricity makes an efficient substitute for oil-based fuels in battery cars because, when compared with the rating of the internal combustion engine energy efficiency rises from some 17% to something over 80%. Per se, it does nothing for long term primary energy unless that energy derives from renewables.
b) Hydrogen is not regarded as a practical source of energy for transport purposes. Using a volatile gas is impractical. George Olah has provided a valuable alternative by

demonstrating that the hydrogen-rich methanol can do everything that neat hydrogen can do without any of the problems and dangers associated with its gas form.

c) To New Zealanders, biofuels are acceptable provided they are drawn from multi-use forests rather than from land otherwise capable of producing food efficiently. While forests can satisfy human needs for energy and materials, their flexibility as to proportions enables needs to determine proportions of each over time via markets.

Electricity from the grid and fuel cells, the methanol and carbo-v (when proved) used in internal combustion engines, and wood feedstocks set the scene for transport post oil. Jim Williams has done a favour to New Zealand by providing prima facie data suggesting that the nation can become self-sufficient in transport fuels. However, the supply is limited. At this point, scientific evidence suggests that reliance on fossil fuels will be impossible in the long term. Oil and natural gas will run out this century, perhaps by mid-point. Coal will run out a few centuries later. The land area capable of sustaining forests is finite and subject to demand pressure for other uses as the global population climbs to around 12 billion by the end of this century.

The inference is clear: forests alone will not suffice to satisfy New Zealand's energy needs. Finite coal and land will not suffice to satisfy New Zealand's energy needs indefinitely at the present rate of consumption. Their limited scale points to the need for much greater efficiency in all aspects of energy use, planning and supply. Overall, the data on supply from 1980 to 2007 show a strong upward trend. Pressure on emerging energy policy will come from land usage, population growth and efficiency demands. It is safe to assume that competing pressures will result in the dynamics of change - a kind of tsunami following flat surf.

This issue has been addressed by an Australian academic (Newman, 2006) He examines how Australian cities can adapt to the threat of urban and regional collapse discussed by Diamond (2005). Newman suggests that adaptation to the problems of peak oil should include the following components:

1. Take it seriously - education, crash demonstrations, research.
2. Build cities with reduced car dependence.
3. Build regions with reduced oil dependence.
4. Rebuild agriculture.
5. Facilitate localism.
6. Regulate for the post-oil transition.
7. Prepare risk management scenarios for the future.

Newman sees the future design of Australia's coastal cities as one of increased localism, reduced car dependence, the creation of horticultural precincts, frozen suburbs, centres well served by public transport, and expanded agriculture in regions adjoining cities. According to data released by the United Nations, 3/4ths of the global population in 2050 could face scarcities of freshwater (Rogers, 2008). The kind of effort needed to cope with peak oil is matched by the need to satisfy increasing demand for freshwater. Both demand new planning, new infrastructure, new thinking and new ways of living. When applied to New Zealand, they highlight the need for change, especially in Auckland and Christchurch.

Major physical change of the kind demanded by peak oil and the scarcity of freshwater must be preceded by study, research, planning, financial deployment and social reform if the nation is to achieve a successful transition. New leaders must be found and groomed for new tasks. New skills must be developed and new staff recruited and trained. To cope with predictable crises of the 21st century, we need to start immediately. The alternative is a decline into poverty, malnutrition, ill-health and shortened life expectancy at an ever-increasing rate and severity.

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