

1808

17<sup>th</sup> June 2013

Bay of Plenty

Constitutional Advisory Panel  
c/o Ministry of Justice  
DX SX 10088,  
Wellington.

TO WHOM IT MAY CONCERN

We are writing to strongly oppose that any legislation or reference to the Treaty of Waitangi should be drafted in the future.

We have just travelled overseas and observed that in the countries we visited, people have a sense of identity as to who they are and what they represent.

An example of this was in America where we spoke with a woman who said she was an African American, a democratic one law for all and we know the journey of the past generation to reach American democracy.

In New Zealand, we as European New Zealanders are being made to feel second class citizens. We, Maori and European, are **all** New Zealanders with equal opportunity.

Let us keep it that way and not go further down the apartheid road which we are starting on now.

**We oppose a change in the written constitution.**

John and Adrienne Malcolmson

5056

**From:** <webmaster@ourconstitution.org.nz>  
**To:** <constitutionalreview@justice.govt.nz>  
**Date:** 7/08/2013 3:13 p.m.  
**Attachments:** AJM Constit Arrangements May 2020131.docx

Sent from The Constitution Conversation #link:<http://www.ourconstitution.org.nz/>.

Full Names: Alastair Maling Email: Phone: Postal  
AddressA: Postal AddressB: Postal City: Auckland Postal  
Post Code: Postal Country: New Zealand Submission Upload: P:\My  
Documents\Personal\AJM Constit Arrangements May 2020131.docx

Submitted on the 19 June 2013 at 11:48



# NZ Constitutional Arrangements

## Introduction

1. I believe that we should be very careful in making changes to our constitutional arrangements. The present system has evolved over nearly a thousand years, and is still evolving. Recent changes include the implementation of MMP and that has resulted in far reaching changes to the Select Committee structure to reflect the proportionality of the House. Another significant change is the appointment of Ministers from coalition parties, who remain outside Cabinet.
2. Overall it is essential we retain the supreme law-making power held by elected Members of Parliament. This provides a very strong form of parliamentary democracy and must be maintained. There is no interest or benefit to all New Zealanders to transfer the ultimate law-making power to unelected judges who are not accountable to the public.

## Written Constitution

3. I am strongly opposed to a written constitution. I do not believe it is necessary, and even if well written, it tends to codify the present arrangements and then hinder any further development. I think it is significant that the US Constitution, possibly the best example to date, has had to be amended many times; starting soon after it was completed.
4. Our constitutional arrangements protect our liberties quite successfully. Written constitutions around the world have singularly failed to do so. For example, those in the former Soviet Socialist Republics and that of the present Chinese Communist Party. Even the US Constitution has a clause decreeing that, "Congress shall make no laws concerning commerce", that has failed to keep pace with change.
5. My principal reason for opposing a written constitution is that in our present system, Parliament has "the last word" on the law, being in a position to change the law in response to judicial judgements. A written constitution gives the last word to the Courts, which are able to strike down laws deemed to be inconsistent with the constitution. In my view, the last word should remain with Parliament rather than unelected judges so that voters can express a view through election cycles if they wish, and through the select committee process. It also follows that I do not believe the Treaty of Waitangi needs its current status changed.
6. I would not like to see any reference to the Treaty of Waitangi or its principles in any constitutional document.



### Size of Parliament

7. I believe that the number of Electorate MP's should be greater than the number of List MP's. I suggest that the total number of MPs be 100 (plus whatever is required to accommodate an overhang), made up of 60 Electorate MP's and 40 List MP's.

### List MPs

8. I believe that List MPs are creatures of political parties. Accordingly, if they resign from the party, or are expelled, they should be required to resign from Parliament. I accept that such a measure gives political parties a lot of power over List MPs, but I believe that is acceptable because they only get there at the behest, or whim of the party. If dissent is considered desirable there is still the majority of Electorate MPs to express dissent, without fear of expulsion from Parliament. Electorate MPs may be expelled from their party but could continue as independent members, recognising that voters put them in Parliament.

### Appointment of Judges

9. The independence of the judiciary is one of the single most important elements of our liberty. They should not, however, be appointed by a member of the legislative or the executive. Appointments should be made in a transparent process, by an independent judicial appointments commission, set up by Parliament and its members appointed the same way as Officers of Parliament.

### The Maori Seats

10. As I understand it, the Maori seats were originally established at the time when only property owners had the franchise. Maori, communal owners of property were disenfranchised by that system and the Maori seats were an effective way of ensuring Maori property owners had a voice. The advent of universal suffrage, and MMP, has led to a much more representative Parliament and I doubt if the original justification for the Maori seats still exists. Accordingly, I think they should be disestablished.
11. We are in danger of this country becoming influenced and perhaps governed by the demands of Maori. I see this as discrimination and whether it is correct or not, the impression we are left with from the Maori party is one of greed and wanting everything back. Unfortunately it creates racial distinction and division. Take the sale of Mighty Power as one example.
12. The positioning and ideology of the Maori party is all about ownership and therefore changes the fundamental concept of equality, fairness and being "one". I was born in New Zealand and feel I have as equal right as many Maori. Why is this not being recognised?

13. You ask the question how Maori views should be represented in Parliament. The answer is the same as everyone else.

#### Upper Chamber

14. New Zealand is one of the few parliaments in the world that does not have a second chamber or upper house. An upper house tends to slow the progress of legislation and ensure that there is a further opportunity to scrutinize bills before they become law. New Zealand has a sad history of having to revisit legislation in the year or two after implementation, to correct mistakes and avoid unintended consequences. It is at least arguable that a second chamber would limit this kind of unintended effect.
15. In New Zealand it is difficult to see what the constituency of a second chamber would be. With only a three year term for Parliament there is not the same need to slow down legislation, or provide extra scrutiny, as there would be if the term was extended to four, or even five years. If the term of Parliament were to be extended then consideration would also have to be given to the establishment of a second chamber.





## **NZ Constitutional arrangement.**

### ***Submission by David Maling***

**Introduction:** I believe that it is very important that New Zealand retains a transparently operated parliament that maintains separated sections of control that protect New Zealanders' liberties.

### **Written Constitution:**

***I am strongly opposed to a written constitution for the following reasons:***

1. It is a snap shot in time based on current thinking and in an evolving Society inevitably will demand change
2. It is important that the people have the last word and not the court system.
3. A written constitution will require the Judiciary to decide on law that fits the written constitution, it must be the People.
4. Protection of Peoples' liberty is paramount. Written constitutions around the world have failed to do this.
5. New Zealand has managed extremely well with no written constitution and with the introduction of MMP and greater proportional input in Parliament's select committees we have no need for one.

### **Should the Treaty of Waitangi be included:**

The Constitutional review panel has been considering including the Treaty of Waitangi in a written constitution, this we do not agree with.

The Treaty in 1840 met a need for the day and with all the modern interpretations placed on this document the intent has become distorted.

### **Size and term of parliament:**

***The term of three years is quite sufficient particularly with the advent of MMP.***

1. The introduction of MMP has seen major changes in the select committee make up reflecting the proportionality of Parliament.
2. The protection for New Zealanders is that they can vote out inept Government.
3. There is a tendency to rush unpalatable law through in the first year but the trend is to better disclosure at election time thus making a reasonably savvy Public aware of intended alterations prior to casting their vote.

**Number of Parliamentarians:**

The debate at Te Papa talked of the need to increase the number of Parliamentarians to 150, to handle more legislation. NZ requires less legislation, less members of Parliament.

1. 90 members in total with 60 being elected and 40 list MP's.
2. List MP's are chosen by each political party, absolutely no input by the People of New Zealand, therefore if they resign or are expelled they should leave parliament.
3. Dissent may still be expressed by the elected majority and as they are elected by New Zealanders they should be able to remain in Parliament as independents.

**Maori Seats:**

History has clearly shown why they were introduced, original voting was related to land ownership, and equally clearly shown that successive Governments know that this issue has been remedied but have not had the political will to change an iniquitous situation.

1. MMP has introduced a more representative parliament of the people
2. Any person over the age of 18 may vote, you just need to make the effort to be on the electoral roll and exercise your vote.
3. **In the interests of all New Zealanders' who seek a stable and united future the Maori seats must go.**

**Appointment of Judges:**

**Judges must be independent of any political linkage.**

A separate body set up by Parliament and its members being selected by a cross party input will help to maintain a non political choice of the Judiciary.

**Upper House:**

**I do not support the advent of an Upper House for the following reasons:**

1. The introduction of MMP has allowed greater scrutiny of legislation being introduced through rigorous questioning at select committee stage as these committees can no longer be stacked with Government members. In many cases opposition members chair and dominate these committees.
2. Our three year term is another feature that denies the need for an Upper House.

**That no changes should be made without a nationwide referendum**



5231

05 AUG 2013

Office of the  
Hon. Judith Collins

New Zealand Constitutional Review.

Submission from Joanna Maling.

1. Size and term of Parliament. - The referendum of 1999 was largely ignored . This indicates a lack of respect for the citizens of NZ. regarding the size of Parliament and shows that the citizens are concerned and wish for more say in how legislation affects NZ citizens.
2. I would expect submissions for this idea of a Constitution be thoroughly reviewed in a fair and democratic manner and, that it is aired in a public forum before it becomes law..

A Declaration of equality needs to be enacted by Parliament.

The Government has to accept that New Zealand is peopled by New Zealanders of many different origins.

As a New Zealander they choose to give their allegiance to the laws of the country and expect to be treated equally.

This means one law for all and be governed as one person equally.

To maintain democratic stability one law does not mean one race should be entitled to favours.

For instance, monetary and other support in health, education, universities ,schools ,enterprise ,local body politics, , media, parliamentary seats, etc.

By maintaining the present interpretation of the Treaty of Waitangi the Governments are promoting divisions within the New Zealand society.

The danger is that if a Constitution is enacted the laws of the country can be challenged in a court of law.

Thus Judges will be making laws for our country.

This has to be very undemocratic when people vote politicians - who can be removed at an election - to make laws for all New Zealanders.

I do not support a written Constitution especially if it is based on the modern day interpretation of the Treaty of Waitangi.

A written Constitution will require and allow the Judiciary to decide on law and not the elected Government.

As a new Zealander I have faith in the present process of Government with MMP and Parliament's select committees to maintain stability - New Zealand does not need a written Constitution with the existing system of governing.

I strongly support a Declaration of Equality and changes to any law be thoroughly aired and an opportunity to be consulted via a binding Referendum.

I believe our Government should strive for a stable country that gives one law for all.

JOANNA MALING.

2610

**From:**  
**To:** <constitutionalreview@justice.govt.nz>  
**Date:** 4/07/2013 7:42 p.m.  
**Subject:** CAP Submission

Lets get real, it is time we moved on as one multicultural country. It is time to abolish twin elections, have one election and abolish Maori seats so that best and capable people are elected to represent in local and national government,



689

**From:** "Jean" <  
**To:** <constitutionalreview@justice.govt.nz>  
**Date:** 29/04/2013 5:53 p.m.  
**Subject:** CAP Submission  
**Attachments:** In the information pack.doc

Please find attached my thoughts on the "Constitution Conservation".

Jean Mallinson

Phone:

Mobile:

In the information pack, the NZ Constitution is said to: "belong to everyone". It may well do, but in my view, it doesn't belong to everyone EQUALLY.

We have a very divisive system with considerable emphasis on a culture of guilt and financial compensation for perceived injustices.

Bearing in mind that it is Maori who have called for the "conversation" and also, judging by the blurb behind the chosen 'independent' panel at least HALF have a pro Maori agenda.

It is therefore my very deep suspicion, that the 'conversation' will open more calls for compensations in one form or another (not necessarily monetarily, but legal strengthening and empowering). This will simply create more division, disharmony, and an embedded future of discontent!

UNLESS...it is used as a line in the sand! To say be done with retrospection, historical injustices have been redressed with good will and positive intent from all parties.

Move on from a culture of compensation.

No more guilt.

No assumption that a minority group needs extra just because they were once hard done by.

No more tyranny of a minority over the majority.

It is time for New Zealand to GROW UP!

It is time to stand against a future based on "Apartheid" principles of separatism.

It is time to realise that a healthy future for this country cannot be based in constant reference to a frequently misunderstood, consistently contentious and probably faulty document.

Thanks for the opportunity to have my say.

It is with genuine concern for the future of ALL New Zealand people that I wish to submit these observations.

Jean Mallinson

# Comments on 'adaptation'

March 2010

M. D. Malloy

## Opposition

Bjorn Lomborg. *The Skeptical Environmentalist. Measuring the Real State of the World*. Cambridge, U.K.: Cambridge Univers. Press, 2001.

- A. Lomborg is an Associate Professor of Statistics in the Department of Political Science at the University of Aarhus, Denmark. He has published in international journals in the fields of game theory and computer simulations.
- B. "In Canada, oil has been extracted from tar sands since 1978 and here the costs have dropped from \$28 per barrel to just \$11. For comparison, the price of a barrel of oil was \$27 in 2000. (Around US\$81 in March 2010.)

The US Information Agency estimates that today it will be possible to produce about 550 billion barrels of oil from tar sands and shale oil at a price below \$30, that is, it is possible to increase the present global oil reserves by 50 percent. And it is estimated that within 25 years we can commercially exploit twice as much in oil reserves as the world's present oil reserves. Should the oil price increase to \$40 per barrel we will probably be able to exploit about 5 times the present reserves.

The total size of shale oil resources is quite numbing. It is estimated that globally there is about 242 times more shale than the conventional petroleum resources. There is more than 8 times more energy in shale oil than in all other energy resources combined – oil, gas, coal peat and tar sands. This stunning amount of energy is the equivalent of our present total energy consumption for more than 5000 years.

Consequently, there is no need for any immediate worry about running out of fossil fuels. A proportion of the fossil fuels, however, is probably only accessible at a higher price. Still, there is good reason to believe that the total energy share of our budget – even if we continue to depend solely on fossil fuels – will be dropping. Today the global price for energy constitutes less than 2% of the global GDP, and yet if we assume only a moderate continued growth in GDP this share will in all likelihood continue to drop. Even assuming truly dramatic price increases on energy of 100%, by the year 2030 the share of income spent on energy will have dropped slightly."

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## C. Notes:

1. Lomborg ignores the problem of increasing difficulty in mining "free" petroleum oil as levels drop towards zero.
2. No reference is made to a possible technological shift to fuel cell motors and alternative hydrocarbon fuels able to mediate a shift from





primary reliance on the release of hydrogen rather than carbon in exploiting energy stored in hydrocarbons.

3. Lomborg wrote before the public were aware of:
  - a) The enormous quantities of energy-rich methane stored in oceanic ice clathrates dwarfing in size the stores of fossil fuels,
  - b) The danger to atmospheric makeup posed by oceanic warming with resulting release of methane (some 23 times more powerful than CO<sub>2</sub>) to the atmosphere,
  - c) The effect of carbon release through internal combustion engines on global warming and
  - d) The effect of cheap fuel on global food supplies (the "eating oil" syndrome).

### Scientific History

Jared Diamond. *Collapse. How Societies Choose to Fail or Survive.* Camberwell, Victoria: Penguin Books, 2005.

- A. Diamond is the Professor of Geography and of Environmental Health Sciences at UCLA. His awards include:
  - a) MacArthur Foundation Fellowship (a "genius" award),
  - b) The Pulitzer prize for non-fiction,
  - c) Two-time winner of the Science Book Prize.
- B. Simplistic one-liners; *Just look around you: the grass is still green, there is plenty of food in the supermarkets, clean water still flows from the taps, and there is absolutely no sign of imminent collapse.*

"For affluent First World citizens, conditions have indeed been getting better, and public health measures have on the average lengthened lifespans in the Third World as well. But lifespan alone is not a sufficient indicator: billions of Third World citizens, constituting about 80% of the world's population, still live in poverty, near or below the starvation level. Even in the US, an increasing fraction of the population is at the poverty level and lacks affordable medical care, and all proposals to change this situation (e.g., 'just provide everyone with health insurance paid by the government') have been politically unacceptable.

In addition, all of us know as individuals that we don't measure our economic well-being just by the size of our bank account: we also look at our direction of cash flow. When you look at your bank statement and you see a positive \$5000 balance, you don't smile if you then realise that you have been experiencing a net cash drain of \$200 per month for the last several years, and at that rate you have just 2 years and 1 month before you have to file for bankruptcy. The same principle holds for our national economy, and for environmental and population trends. The prosperity that the First World enjoys at present is based on spending down its environmental capital in the bank (its capital non-renewable energy sources, fish stocks, topsoil, forests etc.). Spending capital should not be misrepresented as making money. It makes no sense to be content with





emissions to be falling by 4% NOW, and you just can't turn the supertanker around that fast. So we are going to need geo-engineering solutions as stop-gaps to hold the temperature down while we work at getting our emissions down, and we should be examining our options in this area now. There is a very broad consensus that we should not even discuss geo-engineering techniques because of the 'moral hazard' they represent – because we might choose geo-engineering methods INSTEAD OF emissions reductions – but we get only 1 shot at solving this problem, and we will probably fail without geo-engineering.

4. For every degree that the average global temperature rises, so do the mass movements of population, the number of failed and failing states, and very probably the incidence of internal and international wars. Which, if they become big and frequent enough, will sabotage the global co-operation that is the only way to stop the temperature from continuing to climb.

Pages xi – xiii

Note. In Dyer's terms, my paper on "Adaptation to the run-down of oil" should be regarded as national geo-engineering with implications for generalisation. (MDM)

### Climate Rule

Brian Fagan. *The Great Warming. Climate Change and the Rise and Fall of Civilizations*. New York: Bloomsbury Press, 2008.

- A. Brian Fagan is an emeritus professor of anthropology at the University of California, Santa Barbara. His professional interest focuses on the Medieval Warming that took place between the 10<sup>th</sup> and 15<sup>th</sup> centuries. Favoured areas such as Europe, the North Atlantic and the South Pacific experienced warming, bountiful harvests and population growth. Other areas such as parts of North America, Central America and South-East Asia experienced drought and famine – the silent elephant of climate warming. Fagan traces the impacts of these factors on the rise and fall of civilisations.
- B. "Our travels have taken us down the highways and seaways of a nascent global economy, through a world where interconnectedness and interdependency were beginning to become sustained political realities. We travelled through a time when, on the whole, people lived conservatively, with a good weather eye for risk. Now we confront a future in which most of us live in large and rapidly growing cities, many of them adjacent to rising oceans and waters where Category 5 hurricanes or massive El Ninos can cause billions of dollars of damage within a few hours. We're now at a point when there are too many of us to evacuate, where the costs of vulnerability are almost beyond the





capacity of the wealthiest governments to handle. The sheer scale of industrialised societies renders them far more vulnerable to such long-term changes as climbing temperatures and rising sea levels.

This is the immediate crisis of global warming in human terms and it requires not a short term response but massive intervention on a truly international, and long-term, scale.

We're not good at planning for our great-grandchildren, yet this is what is required of our generation and of those who follow us. There's a political temptation to announce some short-term palliatives and then to claim that we have made a significant contribution to the battle against global warming. Unfortunately, we are past the moment when we can rely on short-term thinking. Drought and water are probably the overwhelmingly important issues for this and future centuries, times when we will have to become accustomed to making altruistic decisions that will benefit not necessarily ourselves but generations yet unborn. This requires political and social thinking of a kind that barely exists today, where instant gratification and the next election seem more important than acting with a view to the long-term future. And a great deal of long-term thinking will have to involve massive investments in the developing world, for those most at risk.

We can't afford to think in provincial terms, of only the drought problems in our own backyards. The warm centuries of a thousand years ago show us that drought is a global problem. Today, we're all interconnected. The experience of the Medieval Warm Period shows how drought can destabilise a society and lead to its collapse. Today, destabilising forces can jump local boundaries. If we look at how the chance to earn a better living has drawn millions from Latin America across U.S. borders, imagine how many people might uproot themselves if the choice were between famine and food. Many futurists believe the wars of coming centuries will not be fought over petty nationalisms, religion, or democratic principles, but over water, for this most precious of all commodities may become even more valuable than oil. They are probably correct."

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# Eight Wonders of the World

August 2011

M. D. Malloy

## Essays

### Question

Have you ever wondered why:

1. Numbers of school leavers are unemployable?
2. Large numbers of folk living in "rural" areas are unemployed?
3. The transport system is at risk of ageing?
4. Cost-challenged transport systems threaten food distribution and famine globally?
5. Governments throughout the world have been accused of criminal negligence in failing to deal with disappearing oil?
6. Democratic regimes can't produce leaders?
7. Leaky roofs still threaten buildings with collapse?
8. Members of Parliament don't subject themselves to the sanctions for irresponsible behaviour imposed on corporate officers, trustees, teachers, lawyers and professional people in general?

Some of these questions can be answered from a base of general knowledge. Others require some specialist knowledge, often stemming from scientific research that has not become part of the educational curriculum. They all involve issues of public interest. They demand public debate. A few essays on the topics may help trigger that debate.

A feature of the essays is the prominence of a single variable: time. Short term thinking cannot deal effectively with long term problems. The term of a given Parliament has a major impact on changes achievable by that Parliament. People not yet born can be severely affected by actions or omissions on the part of their parents or grand-parents over which they have no control. Developing a skill takes time but society can be deficient in patience needed to perfect learning. Releasing a small amount of gas may have no effect on the environment, but releasing large amounts over time can change (and have changed) climate. Democracy needs to learn how to take factors such as time and scale into account in planning constitutions.



## 1. School leavers

There is nothing new about school leavers. The education system has never purported to teach kids how to work in the adult world. Getting a job and holding it have been issues confronting parents, craftsmen, retailers and professionals, not teachers. The City of Exeter and Oxford University provided the culture and the model for organised education in NZ. The first schoolteacher in NZ was the Reverend Frank Gould (born 3<sup>rd</sup> March 1827) whose father and eldest brother (both named George Masters Gould) were both masters of St. John's Hospital School in Exeter. The school was previously known as the Blue Coat School, but given a name change in the 19<sup>th</sup> century. Its original name was the Free English School which it held from its beginnings in the reign of Charles 1 from 1625 to 1649. At all times, the school was for boys only. It was a Free Grammar School established in the nave of the former St. John's Hospital consequent on a bequest of 500 pounds by one Elizabeth Jourdain. Its purpose was to provide education for children of honest parents "born within the said city especially of such as were of the meanest sort, and chargeable or likely to be chargeable to the parishes from whence they came; that no child should be admitted under seven or continued after fourteen years of age..."

The language of the 19<sup>th</sup> century needs interpretation for today. "Children" meant boys, because only boys were then considered worth educating. Class differences were of fundamental and lasting importance. Money consisted of coins of precious metal and was scarce. Taxes necessarily yielded little money and were jealously kept within the prerogative of Parliament. The Anglican Church dominated the educational world of England, Scotland and Ireland and played a major role in the relief of poverty.

Exeter is located in the south-west of England. For tertiary study by residents, Oxford University was by far the closer of the two English universities (roughly 200 kilometres). It was used for tertiary study by Frank Gould, his father and his brother. "Hospital" had a meaning different from that current today. It provided shelter and nourishment for people in need, and especially the elderly.

When Frank Gould arrived in NZ in 1845 as a member of Governor Grey's staff, he settled first in the Bay of Islands and later moved to Otahuhu. Like his relatives, his education focussed mainly on religion and the arts. His mental furniture was heavily influenced by Exeter and Oxford. In Russell, he set up the first school in the colony. Naturally, it was for boys. He used his own home (built for him by his father-in-law, Captain James R. Clendon, in 1854) as the schoolroom and charged 1 shilling per week for board and schooling. (Incidentally, his bungalow at the south end of the beach front is still in existence.) The subjects taught were roughly Exeter recipe. Schoolboy ages were approximately the same.

Attainment was about the same (primary only), as was leaving age. His recipe showed up throughout NZ. My father was born and grew up on the Reefton goldfields. His primary education during the 1890s is clearly recognizable as an Exeter export. The main influence that education authorities have subsequently brought to bear has been to add secondary education to the menu and to extend the compulsory leaving age for education to age 15. In doing so, they have failed to deliver a broad learning pattern to equip pupils for the IT age and NZ conditions. They have thus postponed skill learning until it is dangerously close to the reproductive years and beyond the school curriculum.

IT technology is a natural product of cities. It is another symbol system. Education authorities need to develop learning methods in primary and secondary schools that are compatible with IT practice and engineering and lead naturally to work that is IT qualified.

Through Frank Gould, Exeter has left its imprint on NZ. Blue coats have been taken over by airport guides. Girls have been officially acknowledged as human. They can now be educated as of right. Parishes have morphed into nation states. Reading, writing and arithmetic remain the staples of primary education. Charitable gifts for education have morphed into taxes. Otherwise, Exeter culture is alive and well on the opposite side of the world. So much for geography. But what about time? Are 17<sup>th</sup> century subjects and symbol systems adequate for the purposes of 21<sup>st</sup> century education? For a population density some 4 times what it was at the beginning of the 20<sup>th</sup> century? For a world rapidly running out of cheap liquid fuel? For a global transport system increasingly unable to provide low shipping costs? For a world unable to cope with lack of birth control? For a world threatened with massive deaths by famine? These are fundamental issues deserving of careful study by a group of scientists carefully chosen for the breadth of their disciplines and acting under Parliamentary brief.



## 2. Rural education

What may be necessary and desirable for urban pupils is not necessarily suitable for rural workers. Cities want knowledge and symbol skills transferred to the young. Now that the majority of the global population resides in cities, there may be increasing pressure for education to respond to urban rather than rural needs. Management of forests and farms needs knowledge relevant to city pupils plus information relevant to muscular skills. The strength of this need is likely to increase as cheap oil disappears. The study of erosion-prone land carried out under the auspices of Scion during the previous decade found that the best solution to the problem of disappearing topsoil on high country ridges was to afforest it. Designing such a project can be carried out by urban specialists but its implementation must be in the hands of nurserymen and rural planters. Muscles, and skill in their usage, as well as basic education are needed. The same recipe applies to shearers. It is less relevant to lowland farmers in the age of cheap fuel.

Afforestation is unlikely ever to be carried out for conservation purposes alone. Bulk uses are likely to include durable timber for house framing and bulk wood for energy purposes, but especially for transport. Both short term (say, 6 to 10 years) and long term (say, 30 years) growth periods are likely to be needed. Crop handling will include tasks such as saw felling, drying, milling, wood chipping and transport. The end result will be houses and other buildings that are stable and durable under any weather conditions, and national production of mobile energy. The most obvious results are predictably:

- a) The ability for NZ to produce all its own energy, free from the influence of the big oil companies,
- b) A substantial rise in employment opportunities to all parts of the academic spectrum.

Young people need to feel that they have a future in NZ and in other parts of the world. A comprehensive scheme for the growth of biofuel and naturally durable timber not requiring treatment of any kind will give them the reinforcement that they need: money, self-respect, social status and pride in personal achievement. Compared with money spent on a holiday highway in Northland, youth reinforcement wins hands down in long term popular esteem.

The suggested difference in rural and urban secondary education should be viewed as a difference in emphasis only. If implemented, it should be accompanied by a transfer scheme enabling students who are incompatible with a given school bias to move to a compatible environment better suited to their educational needs.



### 3. NZ transport system

The national transport system has air, sea and land components. What powers them is cheap liquid fuels. Cheap fuels come from cheap petroleum oil. What happens when cheap oil runs out? Currently, cheap oil is mined in a series of relatively small regions. It is distributed (refined or in crude form) by ships, road tankers and pipelines. It is expected to lose its current form and supply in about 19 years. At that time, reserves are expected to diminish to the last 10% of recoverable oil. This fraction will be the most difficult to recover and the most expensive. Political and media predictions of all types carefully ignore the effects of run-down, especially as they impact on national economies. Run-down with escalating fuel costs bode ill for national economies, economic growth, large scale food distribution and the survival of the poor. The global population is expected to commence an irreversible decline as famine affects impoverished nations.

We can expect global energy costs to rise markedly after 2030. This will happen whether or not we leave energy production to the big oil companies (who will shift extraction of raw, bound material to bound oil such as tar sands and oil shales regardless of environmental damage and treatment costs), or to nationally self-sufficient biofuels. Their retail costs must reflect processing charges. Because energy props up national economies, rising costs impact on all their parts. They must also affect consumption. Poverty is likely to become more than an inconvenience. It is likely to become a global condition signifying impending death by starvation. The magnitude of famine-related deaths could be related to national decisions on post-oil energy supply. Will nations prefer to trust the oil companies or the "unproved" biofuels? The market or science? The benevolence of locals or of shareholders of overseas corporations? In which direction will the media jump? How will people rate the expected performance of their leaders? Will there be a cutting line between democracies and autocratic rulers? Between industrial and agricultural societies?

At this stage, we can be certain of one thing: the issues have yet to be decided. Twenty-first century history cannot be guessed at, let alone written. Having said that, 2030 increasingly looms as a turning point year. The Government has just (30 August 2011) released its energy policy. For static energy, the aim is increased sustainability. For mobile energy, offshore drilling for cheap oil is to be expanded. It is hoped to lead to substantial domestic production of conventional fuels by 2030. Nobody should complain at that. What is questionable is the lack of any non-petroleum vision. At the very time when the world is expected to reach the decline of petroleum oil (i.e. the last 10% of reserves) NZ is expected to reach a belated peak, but has no policy to produce a substitutionary, sustainable supply of raw material able to provide liquid fuel for fuel cell (FC) vehicles.

The omission of planning for dedicated energy forests looks like a reincarnation of Nelson – famous for putting a telescope to his blind eye. NZ needs any cheap oil that can be extracted off-shore. The world needs energy from sustainable, dedicated forests. The two courses are not competitive with one another. The production of methanol from plantation forests, natural gas and methane hydrates could supply FC vehicles with accessible hydrogen for direct use in FC motors and significantly lower motoring risks because of its reduced probability of vehicle fires. (Olah et al., "Beyond Oil & Gas", 2006, p.204)

Coupling energy plantation development with oil exploration would create a fail-safe strategy for mobile energy. If drilling fails, trees on steep land will not. Their combination puts NZ firmly in the global energy driving seat with a firm handle of the export of liquid fuel.

Throughout the developed world, the distribution of food and domestic supplies is effected by truck to supermarkets. Fuel is distributed by road tanker and service stations. All transport is reliant upon cheap fuel. When fuel prices rise significantly, they impact on the whole economy. How they impact will be largely determined by the national choice of substitutionary fuel: bound oil or processed biomass. If the national choice favours bound oil, mining of crude will remain in the hands of the big oil companies. They will be responsible for the mining of sands or shale, the separation of oil and binding agent, and the global distribution of crude oil.

If biomass is the national choice, high country farmers will be responsible for the growth of biomass, its harvesting and (possibly) its conversion, along with natural gas and methane, into the conventional transport fuels. Long distance transport of raw material by mining companies will not be necessary. At this time, the costs of global versus national supply are unknown. There may be no significant difference.

Where differences will arise is in the area of control. Global supply by oil companies puts recipients into a colonial-style relationship with the companies. National production of biofuels avoids the threat or promise of neo-colonialism. For NZ the choice is stark. Who do we want to manage fuel production? Overseas oil companies or a domestic Parliament? Who do we trust to set fuel prices fairly? Domestic Parliamentarians responsible to the electorate, or the directors of oil companies responsible to corporate shareholders for the size of company profits? The decision must be made very soon to be effective. A do-nothing policy in NZ will leave the field to the oil companies because planning, designing and growing biomass and processing it into fuel takes time, and time is running down now – rapidly.



#### 4. Food and Famine

From 1600 to 1870 D.D. world population increased from about half a billion humans to about 1.3 billion – say, 800 thousand. The increase amounted to about 300 thousand per century. That rate is believed to be somewhat higher than that for the earlier part of the Christian era. From 1870 to about 2000, it grew to about 6.5 billion by about 1.3 billion per century – about 4 times the average rate of the preceding 2.7 centuries. The growth occurred in spite of 2 world wars and a number of smaller conflicts. How did this happen? The obvious answer is to examine the economic driver, i.e. statistics for world oil production.

Prior to the age of oil, fossil fuels had made their mark throughout the western world via coal. Its use gradually lifted productivity of labour and showed its economic influence especially in ship (steamer) and rail (steam engine) transport. Humans have always increased their progeny up to the limits imposed by available food. Famines represent errors in estimates of future food availability. Shifting from forest wood to coal meant a move from low (horse) to medium (steam driven) energy supplements to human work. Shifting from coal to oil meant a shift from a medium to a high energy supplement. These shifts enabled food produced in high yielding land areas to become available in more distant regions and so make population growth possible. It is no surprise to find that statistics for population growth mirror statistics for coal and oil production. Richard Heinberg comments on the result;

*"If we were to add together the power of all the fuel-fed machines that we rely on to light and heat our homes, transport us, and otherwise keep us in the style to which we have become accustomed, and then compare that total with the amount of power that can be generated by the human body, we would find that each American has the equivalent of over 150 "energy slaves" working for us 24 hours each day. In energy terms, each middle class American is living a lifestyle so lavish as to make nearly any sultan or potentate in history swoon with envy."*

To the statistician, the presenting problem with oil is that what cheap oil made possible, its absence may (and probably will) take away. The significance of "peak oil" is that its peak is likely to mark the peak of population growth as well as the commencement of population decline. When graphed, the decline may not be as sharp or as extensive as it was during the growth phase but it will be extremely painful as images of starving infants become increasingly commonplace.

What cheap oil has done for humans in propping up economic welfare is unlikely to cause a return to pre-oil days. The world has grown accustomed to relying on energy slaves. It is unlikely to accept a simple return to pre-oil economic conditions if it has other options. Transport systems will be affected by their own fuel costs and by the impact of increases on economic levels of productivity elsewhere. Such systems must adjust to a different world. It may well have population levels different from those of both the 19<sup>th</sup> and late 20<sup>th</sup> centuries. Work may well take a different form. Intelligence will be of major importance but muscle power and skills may assume different roles, both physically and economically. The key to survival later this century will not be economic power measured by survey methods familiar to accountants and economists. Those methods are irrelevant to prediction in a world not propped up by cheap oil. The new criterion will be biological adaptation, applied especially to working with high cost energy.

The concept of growing-your-own raw material for energy purposes has huge implications for survival adaptation. Important national factors are likely to include:

- a) The availability of suitable land for energy cropping;
- b) The population density;
- c) The availability of suitable labour;
- d) The willingness of land owners to change crop habits (e.g. the shift from grass to trees);
- e) The capacity of states to provide crop land for energy without severely damaging the national capacity to grow food
- f) The willingness of investors to provide capital for processing raw material (e.g. wood) into liquid fuel.

The concept of producing your own transport fuel has an ancient cultural background. Slavery seems to have a history stretching back to the time when we changed from food gatherers to food producers. Slavery became the first work supplement, probably before horses. Its abolition owes nothing to ethics and conscience. The most obvious influence was the growth of fossil fuel supplements. Their appeal sprang from the fact that they didn't need feeding, clothing, sheltering and doctoring. Apart from savings in expensive care, slaves required management. Liquid fuels provided another advantage. They opened the door to unlimited opportunities for technical innovation. The people of the 19<sup>th</sup> century could not resist the pressures to get rid of the old burden of slavery and to take up the promise of a cheap, unlimited work supplement. A glimpse of an attractive alternative to slavery arose in 1859. Edwin L. Drake struck oil by drilling 69 feet down in Pennsylvania. It became the first commercially successful oil well and marked the beginning of the age of oil that we still enjoy. The American Civil War ran from 1861 to 1865. It was popularly believed to represent a conflict over slavery. The widespread use of coal and steel, coupled with the discovery of oil in Pennsylvania, may have contributed to a general feeling in the U.S. that slavery and the Confederacy, like wooden warships, were out-dated.



NZ is unlikely to experience first-hand the coming growth in death rates. We grow food well and enjoy a substantial trade in food surpluses. That trade is likely to be affected by global famine as fuel costs rise dramatically. Movement of expensive foodstuffs by airfreight followed by long distance sea freight are likely to show an early decline. Unemployment rates will reflect the wisdom and speed of government action in shifting from oil to biomass sources of mobile energy. Government decisions, domestic population density, and employment rates seem to be the keys to economic survival and magnitude; the shape and cost of mobile fuels; and political stability or lack of it. The recent episode of opening up oil drilling suggests that gambling by Government on an unknown outcome is OK while investing in energy forests is not. It remains to be seen how the NZ public rates the relative methods of gambling and investment.

The NZ government has demonstrated that it can't handle threats to long term economic stability. Both the major parties are equally blind to energy threats and needs. Both parties are uninterested in the development of a forest policy to supply the raw material for mobile energy when petroleum oil runs out (say, 2050) or noticeably runs down (say, 2030). Their abandonment of responsibility to younger electors threatens future citizens with a neo-colonial dependency on big oil companies, massive unemployment and the likelihood of an increased suicide rate. And its avoidable!

## 5. Government negligence

Commentators on global warming and oil rundown have been especially hard on Governments. They have good grounds for criticism. Throughout the world, Governments have exhibited behaviour on all fours with that of women during the French revolution who are popularly supposed to have killed while watching aristocratic heads roll. NZ has been no different. I have written to Helen Clark on the subject of oil run-down when she was Prime Minister. I received no reply. I wrote twice to John Key – once when he was Leader of the Opposition and once when he became Prime Minister. No replies were forthcoming. I suspect that both ministers have no idea how to handle an unprecedented environmental change. Silence may have been their only option. The same explanation may apply in other states to attempts to signal a forthcoming emergency.

Governments throughout the world have difficulty in obtaining a realistic appraisal of their own role. They wield considerable power. How should they use it? For short term benefits only? What happens if short term benefits conflict with long term benefits? If the interests of the elderly conflict with those of youth? If population density rules out a shift to land production of work supplements?

NZ provides a classic example of long and short term thinking. Thousands of buildings, most of them houses, display rot in their framework. If not remedied at the material source, this could lead to structural collapse. Increasing framework danger is the practice of concealing it behind partitions. Government has chosen to look at monetary cost only. It has offered to stump up 50% of repair costs, leaving the remainder of the burden to be borne by owners and local bodies. What alternatives existed? An examination of leaky houses would reveal that the framework timber used (mostly *Pinus radiata*) is the common plantation softwood, planted originally for pulp and paper uses and as a relief for unemployment. Its timber is basically sapwood, with an air dry density of some 480-500 kg/m<sup>3</sup> – a low figure by any standards. Human intervention plays a critical role in the basic work of constructing a building. Each form of intervention provides an opportunity for mistakes. In summary, the forms are:

- a) Choice of tree species in forest management;
- b) Choice of material used in framework;
- c) Preparation of timber if chosen for framework building;
- d) Appropriate treatment of non-durable timber against rot and insect attack;
- e) Care in constructing leak-proof roofs;
- f) Building design for detection of framework damage.



Remedial action could have started with a programme of afforestation of steep land of little value for farming – some 3400 hectares according to a report from one of their own agencies. In the event, Government walked away from long term remedies and dealt only with superficialities – in this case, money. The nation will regret this decision. It puts a little plaster over the wound but does nothing to cure the illness. The result: remedial work will show the same form of degeneration in the future and probably demand demolition of the building because of age. Moreover, the cost of remedying the problem the second time around will increase substantially because of a steep rise in the cost of timber treatment in pressure cylinders attributable to diminishing reserves of oil, rendering an aging building prematurely obsolete. The nation's housing stock is thus exposed to premature destruction directly attributable to Government ineptitude.

Wood is a natural building material. It has a long history of service to humans. In the course of that service, skills in handling wood have been developed to a high degree – and sometimes lost. Take the stave churches of Norway. These elegant structures delight the eyes of tourists. What is not obvious to casual inspection is their age. Many of them have stood for more than a millennium. Their roofs are high pitched and show a highly developed awareness of what is needed to prevent snow damage. What seems to be their most impressive feature is their durability. Preservative salts did not exist in 1000 AD. Skilled craftsmen did all the work needed to convert trees into timber and to handle the timber for indefinite, stable use in buildings. We do not know precisely how they made timber durable for an indefinite time – but they did. The one clue we have to medieval success in handling wood is patience – a commodity not familiar to people of the 21<sup>st</sup> century.

Government ineptitude in dealing with leaking buildings is not confined to a single party. Judging from Parliamentary behaviour, all parties are equally blameworthy. None seems interested in developing a forest policy suited to the needs of the electorate. None seems interested in learning something about a major national asset: our plantation trees and the capacities of our land to grow virtually anything. A preference for selective ignorance seems to have become a Parliamentary cult.

We all believe that power corrupts. The most difficult challenge for Government members is to retain an appropriate self-image. A novel problem created by humans such as the exhaustion of oil resources confronts Government with issues never previously encountered. Governmental self-image says that officers must be able to handle the problem. Self-examination says that individual members of Government haven't a clue. The only acceptable stance by Government seems to be one of presenting the problem in a way that avoids Government action. One such stratagem is to pretend that the problem does not exist. Another is to pretend that new technology driven by market forces will automatically take care of it if the need ever becomes manifest. (Scientists do not subscribe to this belief.) Both of these reactions should lead electors to reject any Government adopting either of them at the earliest opportunity.



Americans have a fondness for litigation and may seek a legal remedy for negligence. Given unlimited funds, this may be an excuse for such game-playing but shows little practical remedy in most countries. Both Americans and Australians share a mining culture: the belief in their own natural right to take whatever they want from their environment regardless of the issue of descendant interest in repeating such behaviour. Another stratagem may be to seek problem-based leadership wherever it may be found and then attempt to develop and sell it to Government, dressed up to appear as a Government initiative.

Within the world of science, the twin issues of global warming and replacement of petroleum oil receive increasing publicity. Global warming embraces issues such as mass migration; greenhouse gases; research methodology; gasoline alternatives, soil fertility; methane hydrate release; tilling method; carbon release; and upset of weather patterns, sea levels, agriculture and disease dispersal. The run-down of petroleum oil covers issues such as carbon tax method; sustainable grassoline (derived from methane extracted from leaves and grass) and other substitutes; steam injection to extend extraction limits; the release of bound oil; techniques for producing alternatives such as ethanol and methanol for use in internal combustion and fuel cell motors; and techniques for running vehicles on hydrogen from a variety of sources. From a regulatory perspective, the critical issues appear to be:

- a) At what point in time should substitutionary fuels be used to replace oil (the takeover date);
- b) The takeover date should be fixed at a point when the consumer price for oil fuel derivatives is roughly equal to the expected price for substitutes such as methanol, known to be high in hydrogen content and therefore valuable as a replacement fuel choice whatever the preferred motor driver;
- c) Methanol can be produced from plantation wood and methane gas wherever it may be found;
- d) An important issue in favour of methanol is its processing methodology: the first stage involves gasification, which can generalise to embrace a number of different solid raw materials such as coal; the second stage involves catalytic conversion of gas, which opens the door to acceptance of natural gas and methane from hydrates as raw materials for fuel processing;
- e) A second issue favouring methanol is its high hydrogen content – ideal liquid input for direct fuel cell propulsion;
- f) If plantation methods are wanted to yield short rotation harvesting, coppicing species should be used as much as practicable to avoid replanting at harvest and to retain carbon stored in tree roots;
- g) If dedicated tree crops on erosion-prone land are expected to provide the raw material for substitutionary fuels, time for design of woodlots, nursery growth, planting, tree growth, harvesting and processing should be assessed so that wholesale distribution of new fuels occurs on the takeover date;

- h) Because motive fuels have arisen through the slow processes of market testing, selective preferment and establishment of retail distribution methods, the takeover should use as much oil era technology as is practical;
- i) The takeover date should be fixed and incorporate an allowance for testing of substitutionary fuels in a pilot plant in order to iron out problems caused by the global exhaustion of market-tested raw material supply;
- j) As much as possible, scientific data should be used to assist in planning the takeover detail and scheme.



## 6. Democratic leaders?

Talking or writing about negligence, criminal or otherwise, solves no problems. Tackling the issue of leadership may yield some joy. Whether government anywhere in the world is democratic or authoritarian seems to be irrelevant to the issue of leadership. The real test arises only when Government is faced with a novel problem. How does it tackle it? Ideology provides no answer. Science provides a lot of data but no simple answer. Specialists may not be able to help. Government needs to take a back seat and look for people with leadership potential.

In NZ, forestry may provide the environment from which ideas on substitutionary fuels may emerge. Wood is the oldest known fuel for emerging forest dwellers and can now be converted into convenient liquid form for cartage, storage and delivery to customers. Following George Bush's disastrous foray into transforming subsidised corn into ethanol, forestry consultants have a good idea of what not to do, especially when the raw material is food. From the Scion report on erosion-prone land, NZ consultants have already been alerted to the potential availability of some 3.4 million hectares of high country land needing soil support. Its trees could yield hydrogen-rich methanol in quantity. The good news is that this land has little value for food production.

Democratic systems of governance suffer from a built-in handicap in selecting leaders. Most people have a very short time span in thinking about future conditions and events. They are vulnerable to easy conviction come polling time. Candidates need only paint a rosy picture to capture voting attention. In part, this becomes easy because poor capacity to project into the future is a basic human characteristic. Short term thinkers understand each other well. Long term thinkers and planners leave electors very cold (and bored) for the most part. Thus, global Parliaments and General Assemblies tend to be populated by a wide variety of representatives sharing a single characteristic: limited time perspectives.

Humans have created a looming disaster for themselves. By developing first a taste and later a dependence on petroleum oil as a prop for transport and food production, they have put human life on a path initially to vast wealth but eventually to vast losses. The reality is that they cannot look to nanny state for a remedy. Nanny state is run like themselves. For the developing crisis, the state is clueless, feckless and helpless. It is pointless talking about criminal negligence. Adaptive behaviour is, for the most part, beyond the comprehension of world governments. To survive, humans must look to non-governmental parties for leadership guidance and then exert pressure on governments to take survival measures. Happy days!

On cue, NZ provides a wonderful example of how popular thinking works out to yield the worst possible outcome. Existing Government plans include the design of a Puhoi to Wellsford "Holiday Highway", meaning a minor extension of the existing Auckland-North motorway. The logical time to dust it off for public appraisal is just before the coming election in November. Assuming that the National Party wins the election and carries out its election promises, it would take perhaps 7 years to complete and the highway should be ready for use around 2018 – about 10 years before the world hits the terminal decline of cheap oil. Oil prices are then expected to hit an all-time high. Car traffic will be dramatically reduced as drivers find fuel costs unaffordable. Freight costs will rise to levels unaffordable by huge numbers of people as shipping and trucking charges rise and bite. Shopping in centres remote from trading ports will decline because of removal of custom from the poor. Economists will be forced to come to terms with the physical world rather than confine professional attention to short term surveys of past commercial behaviour. The only good news will be that vastly diminished traffic flows will cause public maintenance bills for the Holiday Highway to drop slightly.

The existing beliefs of the National Party put popularity way ahead of leadership in the political value stakes. The Holiday Highway and transport fuels offer a contrast in values. The Holiday Highway proposal, if implemented, shaves a few minutes off travel time between Puhoi and Wellsford. Providing a sustainable alternative to disappearing oil could,-

- a) Give our progeny a smooth transition to national production of raw material, national processing of that material to transport fuels, self-sufficiency in mobile energy and the possibility of exporting energy-carrying liquids;
- b) Provide young people with rewarding, physical employment;
- c) Offer a permanent solution to the problem of erosion-prone land;
- d) Create demand for new opportunities for innovation;
- e) Establish conditions rendering youth suicide less likely;
- f) Bring hill country farmers into the self-sufficiency limelight;
- g) Place basic adaptation ahead of economic gains;
- h) Put adaptation into a key role in economic welfare;
- i) Assign new comparative values to trees and grass.
- j) Introduce a new and powerful addition to state revenue.

Long term and in the mid-short term, effective leadership wins over immediate popularity by a country mile.



## 7. Leaky roofs

NZ has failed to take remedial action when confronted with the fundamental problem of leaky buildings (rotting framing timber). It addressed the issue by laying down a settlement formula and by ignoring the fundamental question of wood quality in building framework. The great bulk of framing timber comes from plantation trees comprising a single species yielding wood inappropriate for building support. *Pinus radiata* is basically sapwood, grown to large dimension, and vulnerable to rot when in contact with water. It is also vulnerable to borer insect attack. What to do with it? It never occurred to Government to replace it with strong, durable timber drawn from plantation trees developed for the purpose. The nearest Government got to a remedy was to order timber treatment for rot regardless of its cost when oil ran down. (Its most effective treatment is with CCA preservative of timber, impregnated in pressure tanks by compression force, a method likely to become prohibitively expensive when oil needs replacement.)

Mainly, Government dealt with money. It could have investigated exotic trees already growing in NZ to find out whether they could fill the bill and what growth rates were like. Had they done so, they would have been pleasantly surprised to discover in NZ a small number of Australian species that could supply the needed qualities at a reasonable growth rate and without treatment.

My family farm grows such trees. The early plantings went in the ground between 1976 and 1980. They included species such as *Eucalyptus pilularis*, *E. muellerana* and *E. microcorys*. A couple of *E. microcorys* were cut in 2009 and found to possess the same air dry density, quoted by K. R. Boodle (around 990 kg/m<sup>3</sup>), as characteristic of trees grown in Australia. Moreover, the growth rates of eucalypts are comparable with those of pines. Growth periods of 25 to 35 years are sufficient to yield commercial timber and would benefit by being lengthened if wood volume per tree becomes commercially desirable.

In locally grown, exotic hardwoods we have the long term solution to New Zealand's problem of rotting framework in leaky buildings. In a small variety of exotic species (*Pinus radiata*, *Eucalyptus fastigata* and *Sequoia sempervirens*) we have established species that, in the south eastern North Island hill country at least, and based on established properties of health and productivity, are most suitable for use in producing mass wood for timber (and therefore energy) purposes. By combining energy and durability uses, we can design a combined short term and long term recipe for survival of the coming oil crisis. That can only be maximally effective if decisions to proceed are made to fit into the takeover schedule. From 2011 on, every year of delay in commencing plantation development of erosion-prone land increases the damage that will be sustained by the NZ economy when oil run-down

becomes apparent. At that point we can forget about economic growth. The world will then be concerned about survival. The critical issues will be population numbers, food supply and transport costs. In the case of NZ, we will also be concerned to protect our borders against forceful invasion by starving refugees from the third world.

Historically, scientists have been interested in both human-induced climate change and the extraction and use of petroleum oil. That interest can be tracked in articles by scientists published in *Scientific American* subject, of course, to all the biases peculiar to American culture. Four periods were chosen for examination:

1. The decades 1980-89, 1990-99, and 2000-09;
2. The broken period 2010 and 2011 to September of that year.

Numbers of published articles were as follows:

Period	Human-wrought climate change	Extraction, uses & misuses of oil
1980 to 1989	11	7
1990 to 1999	21	11
2000 to 2009	41	10
B.P. 2010 & 2011 to September	8	4

During the first 3 decades, the relative interest in oil search, extraction and use declined markedly. It may have reflected habituation of the parent population to oil and its derivatives. They seem to have merged into the American environment as something to be taken for granted.

Such beliefs fit American culture with its stereotype of a God-give right of Americans to take whatever they find in their environment for their immediate use, regardless of the needs of following generations. The belief seems to flow from the American past: an era when the West allegedly screamed out for courageous, armed settlers; an era when resources seemed boundless, when the population was small, when needs were limitless, and when God was always on the side of the man of vision and boldness. Like oil, such beliefs seemed part of nature and built into mind-set as an aspect of the natural order of citizens of the United States. The beliefs are unlikely to be held strongly, if at all, by minority groups such as Spanish speaking immigrants and the remnants of the indigenous population. They are totally inimical to ethical concepts such as land trust: the concept that land is trust property; that its occupants are its trustees for their own and future generations; and that no single generation has rights to its enjoyment ahead of the rights of succeeding generations. Deep-seated differences of this kind make it difficult for citizens of countries other than the US to comprehend the majority mind-set (including that of American scientists) on ethical issues touching the physical environment. They constitute a gulf commonly too deep to cross.



## 8. Constitution

Like its fellow bodies found elsewhere around the globe, the NZ Parliament is very good at regulating the behaviour of citizens in a host of situations. Its enthusiasm for regulation shows minor changes over time, thus reflecting ideology for the time being most popular. However, on one issue all political parties are agreed: their responsibility to the voting public. They owe nothing to their voters. There is no obligation to tell the truth when electioneering. There is no established obligation to act in the best interests of voters when confronted with issues such as immigration, gifts to foreign powers, handling "refugees", loss or wasting of resources, setting priorities for resource use, protecting children against abuse, protecting people against motivation to commit suicide, providing education for occupational facilitation, etc. In their communication with voters, democratic politicians feel under no obligation to rely on objective evidence in support of their proposals. Eloquence is given a higher mark than accuracy.

In restricting the duty of MPs to giving an oath of allegiance to the Crown, Parliament is looking after its own privileges regardless of the interests of the people who vote them into office. Codes of conduct apply to a host of professional, state, working, sporting and common interest organisations. They contain provision for punishment and expulsion for breaches. They apply to every major organisation with a single exception: members of Parliament. Why the exception?

Parliament is the seat of power in democratic states. There is nothing new in this observation. Its antecedents go back to the expulsion of the kingly Tarquins and the establishment of the Roman republic in 510 B.C. Administrative powers, large but not unlimited, were then vested in two patrician Consuls, appointed to serve for a year. The changes left the plebeians out in the cold. They demanded representation in the corridors of power. They succeeded. Tribunes of the plebs were appointed to oversee the acts of magistrates when dealing with plebeians and to veto decisions with which they disagreed. The Tribunes for their part adopted the practice of summoning assemblies of the plebs, out of which grew the first attempt to codify the law; the XII Tables.

These tables, mainly Latin custom with an infusion of Greek law, became and long remained the basis of the law. They existed in modified form until the reign of the Emperor Justinian (483 – 565 AD). He codified Roman law in a form known as the Justinian Code or Institutes, which became the basis of modern civil law. State power in Rome in the form of civil and criminal law thus became structured and enforced in varying mixtures of popular and autocratic exercise over a period exceeding a millennium. The making of the law (but not its substance) passed in this form into western culture and survives today, both in national and state organizations and in the international sphere. Reformers have not always been



welcomed. Gibbon remarks: "A Locrian who proposed any new law, stood forth in the assembly of the people with a cord round his neck, and if the law was rejected, the innovator was instantly strangled." (Decline and Fall of the Roman Empire, Vol. 2, p. 107.)

New Zealand's Constitution Act of 1986 states; "A member of Parliament shall not be permitted to sit or vote in the House of Representatives until that member has taken the Oath of Allegiance in the form prescribed in section 17 of the Oaths and Declarations Act 1957." That is all. No duties or obligations are prescribed. Parliament is defined as the House of Representatives plus the Sovereign in right of New Zealand. (Sec. 14[1]) The so-called constitution is simply another Act of Parliament. It can be repealed at any time. The public was not consulted. As expected, members of Parliament were very good judges in their own cause. No duties were prescribed. Members were not burdened by obligations to their electors of any kind. In the absence of duties and obligations, no penalties for breach were prescribed. House rules gave the Speaker some control of procedure, but this was for the benefit of members only.

Any attempt to draft a constitution giving electors some protection against inappropriate behaviour come up against the issue of unambiguous definition. For example, rules aimed at "protection of the interests of citizens" leave open the issue of religious and ideological differences in the meaning of 'interests'. External threats to the lives, property and bodies of residents of NZ can be handled with ease. They come within the domain of the Ministry of Defence in any case. An area of behaviour that has not been touched is environmental change.

Change comes in various forms and with varying speeds. When instigated by nature, its speeds are very slow and enable protective measures to be conceived and enacted in good time. When instigated by man, change can be relatively rapid and thus difficult to handle. Take climate warmth, created by humans. Ice near the poles is already melting dramatically. Its rate could go up several notches at any time. When it does,

- a) Sea levels could increase, thus rendering port facilities, beach protection, low-lying land and ice-encrusted marine gases likely to be endangered. (Only 2 degrees C currently protect methane hydrates in the Hikurangi margin and Puysegur Point areas of NZ against melting and release to the atmosphere, according to current thinking.)
- b) The production of food by existing methods could be threatened.
- c) Some icebergs could be found in waters remote from the poles.
- d) Living in equatorial regions could become insupportable and intolerable.
- e) Desertification, already large, could increase.
- f) Attempts at forceful migration could increase.
- g) The melting of permafrost might release some land in Canada, Greenland, Scandinavia and Russia for food production.

Electors would expect MPs to take action when effective, collective measures are needed to protect citizens against harm. But would they? Parliamentary inaction on the timely replacement of oil and the supply of durable timber to prevent framing rot suggest that any action taken would be too little, too late. Electors would be wise to demand some kind of reassurance from their representatives that environmental changes threatening the quality of life in NZ must be met with appropriate defence. The disgraceful record of legislators in the past suggests that a constitutional remedy against inaction should be devised and should contain remedies against breach. Such remedies should be capable of initiation by organised, non-profit groups in NZ and should be within the jurisdiction of the Supreme Court for enforcement. An Act of Parliament recording such duties and rights could be set up so that executives of groups given initiation rights, and members of the Supreme Court, could be sworn to uphold the interests of the electorate endangered by environmental change and Parliamentary inaction; if necessary, by removal of membership rights conferred by the Electoral Act, 1993.

A major difficulty with establishing a written constitution is the ability of Parliament to pass and repeal legislation. This is not a necessary bar to a constitutional attempt. If a strong national consensus were to develop, Parliament is unlikely to consider repeal because media and public outrage is likely to constitute a threat too much. Few Parliamentarians are likely to take on an outraged Fourth Estate if public approval has been given to the creation of a constitution by statute.

# Food, Fuel and Famine

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Mike Malloy

## In memoriam

This essay is dedicated to the memory of the late Professor John Tong, clinical psychologist, university teacher and infantryman in the British Army during World War ii, who respected and enjoyed trees and who believed that quality tree farming was possible in New Zealand

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Auckland , New Zealand.





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## Introductory

Alongside all the research and rhetoric about the increasing levels of carbon in the atmosphere, a quiet revolution has been going on in the world of transport. Powering cars and trucks up to the present has been the explosive burning of fuels drawn from cheap petroleum oil. Coming into view is a quiet new form of power – electricity. Not the kind we see every day on power poles. It's a new kind, based on within-vehicle generation by fuel cells. And its preferred fuel is a liquid, portable and safer than gasoline: the hydrogen-rich methanol. Its most effective vehicle host is the fuel cell vehicle (FCV). In internal combustion vehicles (ICEs), the exhaust systems of explosive power emit carbon in the form of CO<sub>2</sub> and expel it into the atmosphere. That's how climate warming develops. Similar systems within FCVs emit hydrogen in the form of dribbles of water – the stuff that leaves, grasses and animals need to survive – and no carbon. There's only one major snag. At present, FCVs run on methanol, and methanol from sustainable biomass is, and is likely to remain, more expensive than gasoline. (In contrast, methanol from natural gas, another fossil fuel, is comparable with gasoline for cost.) There is one possible advantage accruing to New Zealand. It has an opportunity to take a leading role in the revolution. Current evidence suggests that NZ may have a global advantage in the conditions attaching to its rural land and its capacity to yield the raw material needed for methanol production. Two of these conditions are hillslope and erosion. A study by Deroose et al. found:

- a) Annual herbage accumulation decreases with increasing slope angle from the bottom to the top of hillslopes.
- b) Pasture recovery is slow on landslide scars, taking 40 years to reach about 74% of uneroded levels. Herbage accumulation is permanently reduced on soils with low soil water-holding capacity.
- c) Declines in mean annual herbage accumulation are greatest on slopes steeper than 28 degrees (28°). These declines amount to between 1 and 3% per decade for the first 100 years after forest clearance, but are expected to decrease over longer time periods.

(5)

The inference is clear: steep land is more stable and productive in forest than it is in pasture. As a nation, we ignored selective clearing to our cost. The scientific evidence is indicative: when fossil fuels no longer supply a reliable and cheap fuel for transport purposes, farmers can step into the breach for raw material by converting their steep, relatively unproductive grassland into energy tree plantations, assuming, of course, that the market place provides an adequate return for wood. The world is running out of cheap oil. NZ is not (yet) running out of cheap land. People like living on flats, just as they like working land that is flat or gently sloping. They mostly by-pass steep land: just the kind that suits trees, their leaves and repetitive harvesting. The human dislike of steep country has been highlighted by the wholesale destruction of native forests that have in the past protected soils on steep country. The result: the steady erosion of valuable topsoil, often resting unsteadily on rock. By reversing forest removal, we can exploit the extraordinary capacity of leaves to absorb solar energy and convert it into portable, energy-rich hydrogen via methanol. If needed, the carbon content of wood and leaves can be handled conveniently at the processing plant and then sequestered. The same processes enable us to use tree roots on steep land as stable stores of carbon outside the atmosphere.



Cheap oil has made the modern world, and its people, what they are. Its problem is that, like natural gas, it is a wasting asset, used by a global population that is growing at a geometric progression. The gravy train must run out of steam soon – certainly before this century reaches the 50 year mark. Well before that happens, we need a replacement to take over the role of cheap oil. We can do the replacement act of oil, but we can't replicate its cheap aspect. Cheap oil is free oil. It merely needs extraction to enable it to be refined into fuel. Bound oil is quite different. It is found in sands and shale. To use it, we must extract it from its embedding material. It is much more expensive to convert into a fuel, but favoured by the oil companies as the replacement for free oil.

Plantation forests yielding methanol can stabilise our hill country, yield wood and leaves that are energy-rich, and support repetitive cropping of successive generations of tree growth through coppicing. The processing of wood, leaves, natural methane hydrates and water weeds into methanol is an immature technology, ripe for extensive development through research. So is plantation management on steep country. Such research normally leads to decreasing the price of the finished product.

Methanol is a basic product of trees or natural gas. Trees can be cropped. Natural gas can't. Methanol can be used as a laboratory solvent, as a component in a process yielding biodiesel, and, directly and indirectly, in the production of:

A. Chemicals – Formaldehyde

- Methyl-tert-butyl ether
- Acetic acid
- Chloromethanes
- Methylamines
- Methylamines
- Methyl methacrylate
- Dimethyl terephthalate
- Butanediol
- Ethanol
- Hydrogen
- Carbon monoxide
- Biochemicals

B. Products - Adhesives for particle boards, plywood & wood panels

- Paints
- Resins
- Silicones
- Antifreeze
- Plastics
- Foam as insulation in refrigerators, doors, dashboards & fenders
- Gasoline
- Gasoline additives
- Explosives
- Textiles
- Windshield washer fluid

Aerosol spray propellant  
Polymers  
Direct methanol fuel cells

(26)

Globally, methanol is produced at the annual rate of about 40.6 million tonnes. Between 2008 and 2013, demand is expected to grow at the rate of some 7.8% per annum. Methanol can be blended with LPG for home heating and cooking, and as a diesel replacement. It can be used directly as a fuel in ICEs and in FCVs, thus displaying remarkable versatility. It can also be used as an ICE fuel in blends with gasoline. In ICEs, it has only half the energy content of gasoline. In FCVs, it has about the same energy power. When produced from sustainable biomass, it is the key to an evolving economy. The revolution opens up a vista of fame and fortune for the entrepreneur, the inventor, the bold and the ingenious. It also gives Parliament the opportunity to lay claim to a leadership role in economics – something in which it is markedly deficient at present.

## Problem

On any map of the world, New Zealand sits alone – remote, small and sparsely peopled. When oil runs down to the point of its disappearance being measurable, where can New Zealanders look for a replacement fuel? To the oil companies? Their ability to find and exploit a sustainable replacement feedstock is highly unlikely. Compared with the wealth, population, land mass and pulling power of countries in the northern hemisphere, we will not rate a glance as consumers of a diminishing resource or any other resource that can be exploited as easily. What, then, should we be doing about it? How large groups of people react to stress suggests that nationalism will get a rebirth. Every state is likely to seek its own favoured solution based on resource and population statistics. Long term rather than short term solutions are likely to acquire popularity. “Sustainable feedstock” is likely to be judged an important attribute of any alternative fuel. New Zealand’s national interest points to a secure “do it yourself” (DIY) solution based on close cooperation between people and government as the preferred scenario, especially during the transition period.

Petroleum oil is both a lubricant and a source of energy. Wood is also a source of energy, as it has been since man abandoned forest life. An FAO prediction of total world wood consumption for 2010 forecast 5069 million m<sup>3</sup>, of which some 47%, or 2395 million m<sup>3</sup> would comprise fuelwood. Among developing countries (where most people live) fuelwood makes up 20-40% of total energy consumption and up to 90% of domestic energy supplies. A different picture emerges for developed countries. Fuelwood supplies some 1 to 15 % of total energy requirements and is far more likely to end up as waste in rubbish dumps. As a corollary, natural forests have a much better chance of survival in developed countries (where plantation wood is vastly more productive than native forest wood could ever be) than they do in developing countries.

From 1975 to 1995, wood provided about 5% of New Zealand’s energy needs. (18) Thus, developed countries are far more vulnerable to economic collapse through oil depletion than are developing countries. However, developing countries are more vulnerable to famine than are developed countries when transport and food supplies suffer significant cost increases.

What is the government position? Like most other governments throughout the world, it does nothing. This is not because it knows nothing about the coming crisis. Its own SOE, Scion, has published a full report on the adoption of a New Zealand strategy for handling the crisis. (13) Moreover, the NZ government maintains a close working relationship with the governing bodies of its nearest neighbour, Australia. The Department of Primary Industries for the State of Victoria has issued a paper on “Plantations for Energy”. On transport fuels the paper says:

*Currently, the biomass-based transport fuels most commonly used are bio-diesel and ethanol. These fuels are mainly sourced from plants with a suitable starch and sugar*



*content, such as sugarcane, potato, corn and grains. These are commonly known as "first generation" biofuels. "Second generation" biofuels promise a more advanced and efficient production of liquid biofuels and include the extraction of energy-producing sugars from cellulose. Cellulose is found in high concentrations in woody tissue, which includes forestry and agricultural residues. Current research aims to make this form of biofuel available for use in the community and has significant potential to address climate change issues, declining oil supplies and a solution to the current concerns regarding the use of food crops as energy.*

NZ is well placed to adopt and manage second generation biofuels. Where will we get our replacement feedstock? The primary answer has to be the surface of our land. Our history, culture and population numbers support a strategy based on land and biomass. What kind of fuel? A study of options suggests some principles that should be used to guide the new fuels of choice. To educated inhabitants of the South Pacific, the principles will look like simple common sense. To most inhabitants of the Northern Hemisphere they may look like a mixture of common sense and heresy. (The culture of most such inhabitants is heavily impregnated with a belief in mining, regardless of whether or not it is sustainable.) Given world beliefs, the proposed Fundamental Principles of Adaptation (FPA) to oil depletion in NZ are proposed as follows:

- a) Biomass fits NZ skills and population numbers and distribution;
- b) Plantation forests are part of NZ national experience;
- c) Recent overseas research (particularly on the high methane content of grass and leaves) points to full tree conversion into energy as the preferred management tool (20);
- d) Economic efficiency points to multi-goal plantations (such as the short term growth of trees for large scale woody production and, long term, of trees for naturally strong, durable, and cheap timber for house framing) as the strategy of choice;
- e) Plantation methods should target soils vulnerable to degradation and well designed tree mixtures, able to provide their own shelter against strong winds in high country, as the preferred plantation pattern;
- f) Plantation design should include provision for easy logging and permanent conservation of ridge soil, possibly by native tree species (e.g. beech), thus constituting a reserve dedicated to permanent ridge soil protection;
- g) Land dedicated to energy use must not diminish food production (13) subject to export demand not dropping severely;
- h) The technology used for biomass conversion should be capable of processing a wide range of raw materials possessing a strong hydrogen component;
- i) The base goal of a biomass takeover of petroleum oil (now, or near completion of the mining process) should be to produce the greatest possible amount of energy for transport purposes from land displaying the least possible disturbance of food production, thus maintaining export trade;



- j) Automotive manufacturers should be informed as soon as practicable of New Zealand's policy on the production of substitutionary transport fuels and the implications of new fuels for vehicle power systems;
- k) New Zealand's preferred fuel should be based on established technology at the time of initial transition.
- l) Fast growing, water-based plants offer attractive sources of biomass, particularly when growth rates can be stimulated by urban sewage, but because of limited wetland areas available for the purpose, their contribution to energy must be supplementary to that of plantation forests on erosion prone (EP) land.

Evidence supporting HPA points to the selection of methanol rather than the government-touted ethanol as a preferred, basic fuel for transport purposes. Its second stage process (catalytic conversion of gas to liquid fuel) enables the collateral input of both wood gas and methane from hydrates for liquefaction processing. This is important to a country with large, dangerous marine deposits of methane hydrates, vulnerable to atmospheric discharge through global warming. In NZ, they currently have only 2°C of oceanic security. Some weather forecasts indicate a rise of 3°C this century. The use of methane hydrates for energy production, although not sustainable, is warranted because of the vulnerability of hydrates to melting and release of methane (about 17 times as powerful as CO<sub>2</sub> as a greenhouse gas) as global warming continues with the use of oil-based fuels. This point constitutes a strong argument in favour of a rapid rather than a delayed shift to biomass energy.

Large scale woody production suggests a careful look at pines, poplars, redwoods, eucalypts and cypress trees for the short rotation production of wood and leaves as raw material for conversion into liquid fuel. (A recent paper [20] reports an experiment showing that leaves and grasses are rich in methane, thus for the first time opening the door to 100% use of tree material as input for liquid fuel production.) The choice of species should make use of natural coppice growth to speed regrowth following felling, in order to maintain and extend the existing store of carbon in roots, and to fit climate and site soil conditions. The Scion report on bioenergy options for plantation trees (3.4 million hectares of steep EP country) gives site locations and a pointer to a possible mode of organisation. (13)

For long rotation timber purposes, different selection criteria should apply. Such trees could be planted with short rotation trees in something like a chequer-board pattern to create a growing environment conducive to the provision of shelter in young trees and of logging methods appropriate to varying periods of growth. (It was mainly the omission to supply shelter that brought about the failure of the tung oil plantations near Kaikohe during the 1930s. Strong winds on ridges can constitute a growth problem on steep country.) Possible candidates for long term use include:

- a) tallowwood (*Eucalyptus microcorys* – air dry density [ADD] about 990 kg/m<sup>3</sup>),

- b) blackbutt (*E. pilularis* – ADD about 900 kg/m<sup>3</sup>) and
- c) yellow stringybark (*E. muellerana* – ADD about 870 kg/m<sup>3</sup>) . (2)

The evidence for NZ grown tallowwood will be given later. All three species have been tried for plantation growth on the writer's farm in Lower North Auckland and found satisfactory for growth and form.

NZ houses present a special long term problem. At present, their framing is (or ought to be) treated *Pinus radiata*. Its ADD ranges from 450 to 580 kg/m<sup>3</sup> (2). Pine is now the dominant plantation species. Its wood (nearly all sapwood) is subject to water-based rot and needs treatment to prevent the onset of premature decay. (Treatment can only penetrate the sapwood.) Large pressure cylinders are used for treatment and require significant amounts of energy for impregnation. Post oil, the cost of energy for treatment and transportation of timber will be greater than is possible for fuels drawn from cheap oil because of the need for intervening, expensive processing of the raw material. If framing is produced from plantation-grown eucalypts of relatively high density, thus not leaving their dwellings vulnerable to framing decay, two advantages will accrue:

- a) Absence of treatment will lower cost;
- b) The greater strength of high density timber gives builders the option of using smaller timber sizes or wider spaces or both.

Something like a 30 year term should be used for the growth of framing timber and a 3 to 10 year term for energy. The raw material for energy could include urban waste wood (e.g., Christchurch earthquake waste), dedicated plantation wood, mill residues, old tyres, urban tree droppings and prunings, and long grass clippings. Sewage disposal systems could provide extremely rapid growth sites for fast growing water plants. Biomass of different types could supply a source of income for local bodies. Off-site production of designed nail-free framing could be used to avoid the need for difficult on-site nailing of framework.

Of the three eucalypt species suggested for house framing purposes, only two are needed for plantation growth. The preferred species are tallowwood and blackbutt for long term plantation growth. The reason for two species is to build in plantation insurance against unknown risk. If only one species is grown, it is relatively vulnerable to unpredictable hazards. Two species halves the risk while still retaining major economic advantages associated with scale. By this stratagem, some of the disadvantages associated with the choice of a single species (*Pinus radiata* – notable for the scale of growth of sapwood) in New Zealand's forest monoculture can be avoided.



## Technical

A biomass scenario for the production of transport fuels is essentially sustainable because its growth processes absorb carbon from the atmosphere while its processing stage will either return it or enable convenient sequestration. The longer the period of storage and the greater the volume extracted, the more atmospheric carbon is reduced. This point has implications for plantation management. Short rotation plantations leave stumps at harvest. If cropping for follow-on crops can be done via coppice regrowth, the root system for the preceding crop maintains its growth and its store of carbon. If practicable, we should ensure that the store of carbon grows continuously as successive energy crops are harvested. Globally, a shift to biomass fuels enables man to manipulate the amount of carbon in the atmosphere and so influence temperature and climate, not to mention political debate.

The processing of wood to yield alcohol goes back to 1648. It became the mainstay of Hitler's armed forces in World War II. According to a report of the Methanol Institute (Washington, D.C.) published in 2006, methanol's commercial use "has focused primarily on its value as a building block for thousands of consumer products from plastics and paints to construction materials and windshield washer fluid." (26) When used in internal combustion engines it carries half the energy supplied by gasoline. When used in FCVs, it matches gasoline for energy because of the greater energy efficiency of FCVs. (Only 17 to 20 % of the energy in gasoline is used to move a vehicle, whereas 75 to 86% of the electricity delivered to an electric vehicle goes into motion. {21}) The Institute reports that a 50 kw.fuel system for a vehicle will cost about US\$2500, thus being comparable to the cost of internal combustion engines (ICEs).

Currently, the main operational advantage of methanol over gasoline is its safety record. The Institute writes: "Methanol is one of the safest and most environmentally sound fuels available. In the United States there are over 180,000 vehicle fires each year in which gasoline is the first material to ignite. According to the Environmental Protection Agency, a switch to methanol could reduce the incidence of these fires by 90%, saving 720 lives, preventing nearly 3900 serious injuries, and reducing property losses by millions of dollars." (26) Any NZ government interested in the health and employment of its citizens would accord top priority to switching from gasoline in ICE vehicles to methanol in FCVs by regulating imports and domestic economics to render a full DIY system sustainable, efficient and obligatory. The result (if achieved in the near future) would be a marked improvement in our trade balance, improved adaptation to our environment, a significant improvement to life and health, a significant reduction in unemployment and smooth passage to an oil-free world.

In the German city of Freiberg, Saxony, Choren Industries has established an operational plant designed to convert waste wood into liquid fuel. It has established a marketing



arrangement with a firm in Beijing. Its basic technology involves the gasification of solid matter and the conversion of the resultant gas into liquid fuel. The company appears to be interested in licensing its technological knowhow. At this time, any dealings with the firm would first require an assessment of the nature and quality of its fuel products. As this is the first firm to attempt the large scale commercial adoption of gasification and liquefaction technology, a study of its operations could be of assistance for engineering purposes.

Elsewhere in the world, methanol is processed from natural gas. This technology is used in NZ. Methanex New Zealand Ltd., a Canadian-owned company, has its executive office in Auckland and its processing plants in Taranaki. Its products are largely exported. At present, it is not interested in expanding its raw material input to include biomass.

In the course of converting petroleum oil into petrol fuel, refineries have been established world-wide, including NZ. They do a lot more than simply refine the raw material. They also add further components to aid the efficiency of the combustion process. Whether additives may be needed to convert factory methanol into something the motorist will need remains to be fully tested.

A considerable amount of work has gone into experimentations with blends of petrol using the alcohols as additives. Volkswagen (VW) began a series of tests of 45 vehicles in 1975 using gasoline and 15% methanol. Olah et al. (26) report that minimal modifications were made to existing engines. VW found that the blend worked efficiently with minor problems. The methanol acted as an octane booster enabling the blend to deliver more power than could pure gasoline. VW also tested 5 vehicles running on pure methanol. They found that the lower volatility of methanol led to cold start problems but that problem could be solved by adding small quantities of butane or pentane. All in all, comparatively minor experimental work in NZ, coupled with minor vehicle adjustments made by manufacturers, would see biomass-based fuels (methanol and diesel) provide sustainable replacement fuels that would not damage world climate and would assist in stabilising high country soils – without significant loss of food! Olah et al. discuss a decision by Bank of America to convert most of its vehicle fleet to methanol fuel in 1980. More than 200 vehicles so fuelled accumulated over 30 million km. on the roads. The Bank concluded that, compared with gasoline powered cars, the use of neat methanol was cheaper, increased the engine's lifespan, and greatly decreased exhaust pollutants.

A voluntary shift to methanol before the run-down of oil compels such a step enables ICE vehicles to use methanol immediately, enables trees to grow in timely fashion, stimulates research and brings up the issue of tree species. Wood quality for short term (e.g. 3 to 10 years) energy production does not impact on the selection of tree species. Long term growth for timber framing does. The writer's family company has



a farm west of Warkworth. A trial was undertaken in 1980. The forest literature accorded high marks for strength and durability to *Eucalyptus microcorys*, yielding tallowwood. Would the same properties be found in material grown in NZ? The climate and soils were obviously different. To find out, one tree planted in 1980 near the railway line was felled in May, 2009 and milled on site. The resultant timber was stored in an air drying unit for over a year. A tested sample revealed a density of 889.55 at a moisture content of 12.4%. Bootle (2) quotes an ADD of about 900 for Australian grown tallowwood. A New Zealand density figure of 890 for a plantation tree only 29 years in the ground strongly supports the conclusion that there is no significant density difference between NZ and Australian grown trees of the *E. microcorys* species.

What is tallowwood? New Zealanders do not know it, but they are familiar with its uses. Walk down any street in any town in NZ and look upward. The poles you will see are there to support cross-arms, which support wires. Wires are heavy and must withstand strong winds from time to time. Their supporting cross-arms must be very strong. Chances are high that the cross-arm you see will be made from tallowwood.

For short term species, growth rate seems the obvious determinate for selection. For the lower North Island, three species have been found to be suitable: *Pinus radiata*, *Eucalyptus fastigata* and *Sequoia sempervirens*. (25) Selection criteria were health, siting and productivity. They did not include reproduction by coppice. That might exclude *P. radiata* for short term use. Some research may be needed to refine preferences for liquid energy. For other parts of NZ, other species should be added to the list for short term selection. One genus that may require exclusion is *Syncarpia* (Turpentine). Current evidence suggests that it is fire retardant and will not burn except in hot fires in mixture with more flammable woods. (30) Another genus requiring care in selection is *Salix*. It may not adjust well to EP sites.

The energy content of wood has not been adequately tested in relation to species. Among people interested in farming trees for energy, the common view is that species differences do not matter. This seems contrary to common sense. Hardwoods may contain double the number of cells in equivalent volumes of material. Cellulose is a carbohydrate forming the main constituent of plant cell walls. It seems to be the key to the organic production of methane, or CH<sub>4</sub>. This suggests that, by doubling wood density, nature has doubled the quantity of wood gas produced. Morgan (18) holds a similar view. He writes: "While on a mass basis, wood energy content is not affected by density, density does matter when comparisons are made on a volume basis. Basic densities of commonly encountered NZ tree species can vary almost twofold from little more than 300 kg/m<sup>3</sup> to over 600 kg/m<sup>3</sup>. The heat content/volume will also vary similarly." The issue needs careful testing for the purposes of fuel energy derived from the gasification and liquefaction of wood.



Of critical importance to management is the lack of research. All commentators are at one on this issue. At this time, one problem remains unsolved ahead of all others. For a forest resource to base transport fuels, what is the best possible use of scarce land? At the beginning of a programme to build up a sustainable, biomass resource we need to know which species produce the most energy when converted into liquid fuel. As a bonus, we want to know which species can do the job in the shortest time. Alternative technologies (with particular reference to Ghana and the Third World) were discussed in a report to the American Society of Agricultural Engineers. The officer responsible for the report discussed good practice in evaluating options. They were:

- a) Search for tree, bush or plant species that might be higher energy collectors than the common lumber and pulp wood varieties;
  - b) Follow a new strategy in the breeding and development of conventional field crops in order to maximise energy production;
  - c) Manage mixed farming methods to yield (in Ghana) food, fodder, energy, fibre and lumber production.
- (1)

In many ways, NZ is strongly resistant to change. So far, it has not experienced the kind of bully-boy tactics that have damaged Australia and the US in adapting to oil run-down. Inertia has been the enemy of adaptation. Inertia has characterised the attitude of the Labour and National parties to the development of new fuels. Not, however, the Maori party. Mrs. Tureana Turia, one of its leaders, has displayed a keen interest in, and an extensive knowledge of, renewable fuels. Among the population at large, indifference is the keynote attitude. Oil has become a part of the common culture – a bit like the stone culture of Gothic cathedrals in the 12<sup>th</sup> century – just part of the scenery. Oil and its derivatives have crept into our language unnoticed. Words and expressions like car, automobile, lorry, tin lizzy, gin palace, beach bomb, petrol head and gas guzzler all owe their adoption to oil and its derivatives. They are part of our common mental furniture.

When oil companies plan counter-attacks on renewable fuels, they start with a huge cultural advantage. They can simply use common mental furniture to distract attention away from uncomfortable adaptation to environmental change and towards comfortable reliance on the status quo. An example of this phenomenon recently emerged in Auckland. Mayor Len Brown has suggested a railway train link through the CBD, including a subterranean line through lower Queen Street – just a few feet above the high water mark of the adjoining Waitemata Harbour. He has totally ignored the possibility of rising sea levels drowning the tunnel. Such a rise has been predicted for low lying land this century. Climate warming melts Antarctic ice and lifts ocean levels. And no one has noticed! Fortunately for Aucklanders, the Government vetoed the project for financial reasons. Thus, Auckland commuters will not

have to swim out of the Britomart Place tunnel at high tide later this century, thanks to an accident of Government penny pinching.

For many years the NZ economy has stuttered along, displaying minor annual gains. Its prop, oil, has been the focus of attention by oil-wealthy and large industrial states. NZ has watched management of oil from the sidelines. If biofuels dominate the economic skyline, NZ could be in a very different position. It has certain natural advantages in an energy world dominated by biofuels. It has a large area of land suitable for biomass growth, a population accustomed to an agricultural base for the economy, lots of expertise in food production, distribution and sales, plenty of marine expertise, an adequate base for research, development and sales of biofuels, and a well-tuned social conscience, all critical to leadership of a world needing a new deal in mobile energy.

For the individual, the introduction of a new fuel has some exciting possibilities. It opens the door to innovation, new knowledge and new enterprise. Such opportunities do not open up in a vacuum. They are tender flowers, nurtured in quantity only in broadly favourable environments. This is where forest biomass comes into its own. As a novel feedstock for an essential commodity, its potential demand (when translated into transport fuel) is on the global scale. For the individual aspiring to fame and fortune, the opportunity for innovation is opened up by a new fuel. For him (or her), knowledge is power, innovation is its key, and global interest in relevant technology represents potential reinforcement on a huge scale. For the politician, new energy also opens up the need and the opportunity to introduce protective measures for intellectual property and trading rights.



## Political

Digging up petroleum oil and refining it is one approach to the supply of transport fuels.

Growing biomass and converting solid raw material into liquids is another. The two techniques are like chalk and cheese. A world-wide shift from one to another necessarily requires a culture shift of epic proportions. Who wants it? Answer, almost nobody. Who needs it? Answer, we all do. Why? The answer has several parts:

1. Nothing on earth will stop humans from extracting oil to feed their insatiable demand for mobility and industrial products until oil supplies are exhausted.
2. Oil has developed into a fundamental prop for transport, food production, its distribution, the world economy and as a component of a huge variety of manufactured products.
3. Without oil, the world population could not reach the predicted 9 billion this century. (16)
4. Without oil, famine (actual or threatened) would have prevented population growth, mainly during the 20th century, of at least 3.6 billion people.
5. Oil represents the sun's historic contribution to life by the storage of solar energy in organic matter under the surface of planet earth for millions of years.
6. Solar storage of energy in organic matter is currently effected by leaves at low temperatures but nobody has worked out how leaves do it.
7. Man's only long-term hope of reducing the role of famine in controlling its population overhang of some 4 billion (based on existing knowledge) is to manage the solar role in developing organic matter to supply the energy needs of humans in a new way.
8. Current knowledge indicates that famine control is mainly limited to land management.
9. Land management of energy crops and their processing will inevitably increase the cost of mobile energy.
10. The longer land management of mobile energy is delayed, the greater will be the role of famine in controlling population.

Politicians have known these simple facts for decades. Herein lies the critical problem. Its indicative solution runs counter to everything they stand for. They are short term people. By unspoken consensus, leaders of all stripes and systems throughout the great part of the world's land area have side-stepped the issue. One stratagem has been to cloud the problem by masking its language. It sounds less ominous to talk about the feedback to humans from the disappearance of mining mobile energy rather than to examine mining



itself. The term "climate change" does not sound threatening. When it comes to mining, New Zealand is part of an informal, international political club. I wrote to two NZ leaders about oil depletion. One recipient of a letter was the Labour PM at the time, Helen Clark. Another recipient was the National leader, John Key. He received two letters – one as Leader of the Opposition and the other as PM. The letters did not result in a single reply. There can be only two possible interpretations of Ministerial silence. They either cannot produce a solution of the problem or they believe that the electorate will not swallow the needed medicine. Presumably their Parliamentary colleagues feel the same way, judging from their silence on the issue.

The story of petroleum oil illustrates an aspect of human behaviour that receives little publicity. Man is clever at interacting with his environment to satisfy appetitive and mobility drives where his actions produce immediate and positive results. He is not clever at, and probably not interested in, protecting the ability of his descendants to do the same thing. The NZ Herald of the 5<sup>th</sup> May 2011 reports a decision of the federal and South Australian governments to release the Woomera Rocket Range for mining. The area contains vast storehouses of gold, copper, iron ore and uranium. It is bigger than England. According to State premier, Mike Rann, "we are talking about thousands of jobs for more than 100 years, and it is a resource that is valued at more than A \$1.4 trillion." With the demise of the Cold War, who could resist such a move? The Herald couldn't. Clearly, the immediacy and magnitude of the rewards make Rann's move a predictable election winner. How will the mining be powered? By fossil fuels as usual, stupid!

Mike Rann is playing to Australian strength by pitching his political appeal to mining. John Key could do the same in NZ by leading a move to plant 3.4 million hectares of EP country in sustainable energy crops. He does not. Clearly, Australia and NZ are very different countries, of different areas and composition, and of very different geological ages. Their environments offer different economic opportunities. History suggests that, in the modern world and in the light of mining culture still playing a dominant role in Australian and American politics, the political influence of the miner exceeds that of the forester. But where does the scientist stand in the influence stakes? And what should be the role of politicians?

Since man emerged from the forest, sex drives and food needs have been in chronic conflict. Peter Goodchild ( 11) describes the issue thus: "At some point in the early years of the 21<sup>st</sup> century, there will be a clash of two giant forces: overpopulation and oil depletion." The world will look to its leaders to guide nations in their approach to this conflict. There is nothing new about the fundamentals of the conflict. Man has always attempted to lift population numbers beyond the limits imposed by food availability. In good years, the war appeared to have been won. In bad years, food crops failed and famine ruled. Its victories showed up in death statistics. Commonly, famines lasted for 6 to 10 years. Some were accompanied by pestilence of varying types. Some triggered war. Some degenerated into



cannibalism. Available records cover the Eurasian land mass, stretch to the west of England and Ireland and date back to some 1000 years B.C. The most severe famine in England occurred in the reign of Ethelred the Unready and lasted from 1005 to 1016. According to contemporary chronicles, half the population perished. Some 3 years after the Conquest, in 1069, northern peasants, being no longer able to secure dogs and horses to appease hunger, sold themselves into slavery in order to be fed by masters.

In 1314, heavy rain spoiled the harvest. Edward ii was scarcely able to feed his household. The dead lined the roadsides. Dogs, horses, cats and even babies were eaten. When a new criminal was thrown into gaol, he was torn to pieces by other starving inmates and eaten. In France, between 987 and 1059, 48 famines devastated the peasantry, all triggered by climatic disasters. In Ireland, due to potato crop failures, famine struck between 1844 and 1850 and caused the population to drop from 8.3 million to 6.6 million through death and emigration. Russian famines occurred in 1891, 1906 and 1911. That of 1911 affected over 1/3<sup>rd</sup> of the Empire in Europe (30 million people) and reduced some 8 million to starvation. In China, famine broke out in 1846 – 1849 and accounted for 45 million deaths. A later one in 1906 – 1910 accounted for 10 million deaths.

Historically, famine deaths represent nature's way of maintaining a tolerable balance between the forces of procreation and environmental support. They reveal no results of varying leadership skills. Their place in history is no longer regarded as of practical importance, due to the long economic rein of petroleum oil. In most of the world, decisions are taken in reliance on the opinions of economic "experts". If this attitude continues, the world faces a monumental disaster. Leaders and led, politicians and electors, will all be on the endangered list when oil runs out. M. K. Hubbert's (19) predicted date for the complete extinction of oil deposits was 2075. Church (4) predicts a crunch date of 2040. Oil's lifetime seems to be contracting. The contraction is probably related to unpredicted demand associated with population growth. Church wrote:

*"Eating Oil" was the title of a book which was published in 1978 following the first oil crisis in 1973. The aim of the book was to investigate the extent to which food supply in industrialised countries relied upon fossil fuels. In the summer of 2000 the degree of dependence on oil in the UK food system was demonstrated once again when protestors blockaded oil refineries and fuel distribution depots. The fuel crises disrupted the distribution of food and industry leaders warned that their stores would be out of food within days. The lessons of 1973 have not been heeded. Today the food system is even more reliant on cheap, crude oil. Virtually all of the processes in the modern food system are now dependent upon this finite resource, which is nearing its depletion phase. Moreover,..... the food system is lengthening its supply chains and increasing emissions to the point where it is a significant contributor to global warming.*

The danger inherent in using oil-based fuel to subsidise food supply and distribution is developed further by Jay Tomcz. Writing in the Energy Bulletin of December 2005 he says:



*Our current industrialized food system is not sustainable due to its over dependence on non-renewable fossil fuel energy and its degradation of the natural systems on which it depends for its existence. If action to change these aspects of the food system is not taken, convening resource depletion and degradation will cause the food system to collapse. Our food system is the result of the "green revolution" which created greatly increased crop yields by using large amounts of fossil fuel energy in the form of synthetic nitrogen fertilizers, petroleum based agrochemicals, diesel powered machinery, refrigeration, irrigation and an oil dependent distribution system. This system destroys biodiversity, contributes to global climate change, and degrades soil and water quality."* (33)

In this picture, the role of national leaders (autocratic or democratic) changes dramatically. Up to this point, they have had no responsibility for maintaining stability between the population and crop forces. Oil depletion changes all that. Such depletion constitutes a change in the global environment that has been brought about by humans. It arose from the use of petroleum oil on a scale comparable to the global conversion of natural forests into pasture land. Its exhaustion can be partially made good by the afforestation of EP land in NZ at least, and by the installation there of a processing plant or plants. If action is taken rapidly, there will be a short period of competition between biomass- and oil-based fuels. Government can regulate such competition during the takeover phase to ensure survival of a NZ growing and processing enterprise essential for food protection, both for domestic consumption and in our global trade. It can do more. It can and should stimulate investment in farm woodlots and processing plant(s) and participate in their financing.

The opportunity and responsibility facing the NZ government are without world precedence. They are based on the work of scientists and not upon precedent relied on by lawyers, civil servants and politicians. It is evidence based rather than judiciary based. The need to act on changing the resource base of transport fuels has both its negative and its positive aspects. Action is relatively simple. It involves an extension of plantation forest methods well bedded down in NZ, the implementation, extension and refinement of the Sustainable Land Management Hill Country Erosion Programme already adopted by Government to improve water and soil management, the use of distribution methods established for oil-based fuels, and the construction of a processing plant or plants along lines familiar to engineers. This amounts to a commercial programme, needed to work large scale, from a standing start. State initiative and protection of a novel kind will thus constitute an essential component. Political ideology will be irrelevant. Multi-disciplinary expertise will be essential. While population and economic pressures have shortened the expected time period for the needed change-over from a terminal date of 2075 to 2040, the effective date of commercial crisis is still about 2030, thus leaving a very short but (possibly) achievable period of adaptation, given immediate and urgent action.

In contrast, government inaction will leave NZ at the mercy of oil companies' trading policy driven by a declining resource base. Current evidence points to transport fuels being



supplied by the companies for as long as possible from their present resource base – extended if possible by the mining of bound oil. The same attitude seems to apply to the manufacture of methanol from natural gas. If the oil and methanol companies seem intent, long term, on commercial suicide, that is their prerogative. It is not, however, a recipe for responsible government because it will lead, inevitably, to famine deaths this century of unprecedented proportions. Of the two contrasting courses of action open to the NZ government, never in history have the issues been so stark. They boil down to a choice between courageous action leading to long term economic survival, compared with self-serving inaction, so allowing famine on a global scale to reinstate its rule.

As a nation, NZ faces a situation where prompt, broad-based action can be expected to lead to world rewards in terms of employment, capital returns, government initiative and world status. On the other hand, failure to act will leave the country facing fierce pressure to admit starving migrants while dealing with a moribund economy and a horrific public debt. It is no consolation to learn that the US, parts of the EU and the UK may be in an even worse position.

A theoretical issue confronting the world is caught up in the expression "climate change". Concern about the aetiology of climate change has obscured the practical issue of oil replacement. Chemists have not been routinely consulted on climate matters. If they had been, someone is likely to have pointed out a simple remedy. If the burning of oil-derivatives stores climate-changing carbon in the atmosphere, why not burn hydrogen and pour water into the ocean? After all, hydrogen is as plentiful as carbon on planet earth, burns readily and converts into harmless water. It makes up a major part of the greenhouse gas methane (CH<sub>4</sub>) but in the liquid methanol becomes a harmless fuel which, when burnt, yields potentially valuable water. Automobile emissions could then change role from enemy to helper.

While New Zealand's politicians remain in the "do nothing" camp, this is not entirely true in historic and administrative terms. Scion reports on "Bioenergy options for New Zealand" were published in 2007 and 2008. The 2007 report related to planting medium- to long-rotation forests on marginal land. It predicted that "to meet the country's total heat demand, an estate of 700,000 hectares would be required. To meet the liquid fuels demand a further 2.5 to 2.8 million ha. would be needed." It is expected that the report was written about 2005 because the first year's plantings in 2007 were expected to comprise:

- a) 70,000 ha of short rotation forests;
- b) 20,000 ha/year of medium rotation forests;
- c) 80,000 ha/year of pine forest or equivalent.

In 2010, plantings were expected to comprise:

- a) 30,000 ha/year in medium rotation forest;



b) 100,000 ha/year in pine forest or equivalent.

In 2020, forest plantings were expected to amount to 130,000 ha. The annual area was expected to reduce to 100,000 in 2030. Production from biofuels was expected from short rotation forests in 2010 and from short and medium rotation forests in 2020. By 2030, biofuels were expected to meet a significant proportion of demand. By 2040, domestic supply was expected to meet 100% of demand for liquid fuels and heat. (13)

Scion is a state-owned enterprise. Its signposts for successful adaptation to a new, DIY energy world were well displayed. Successive governments have simply ignored the signals. Through its East Coast Forestry Project Grant scheme of June, 2007, the Ministry of Agriculture and Forestry makes cash grants to farmers who address erosion on steep land by planting radiata pine, Douglas fir or poplars but the scheme has a 50 year tree life. Through its SLM Hill Country Erosion Programme of October 2010, MAF targets erosion-prone land especially in Northland, Gisborne, Hawkes bay, Greater Wellington, Manawatu-Wanganui and Taranaki but has no implications of wood being used for energy purposes and excludes planting before 2012. Its focus is entirely on soil erosion and flooding. The failure of successive governments to act on energy leaves NZ exposed to an energy poor, declining economy – at the least. The deadline for NZ to achieve a workable, JIT, takeover of King Oil's dominion is when oil is no longer affordable for essential transport and agricultural productive purposes. With a herculean effort, it may be possible for NZ to meet the deadline, subject only to updating of the tree species and the quantitative annual planting components of the Scion programme, to a survivable extent. The Parliamentary elections in 2011 give electors and candidates the opportunity to take a fresh look at Scion's DIY signposts. It will be interesting to see how the energy/economic penny lands.

Where NZ politicians fail badly is in assessing their own self-interest. They concentrate on money when examining indifferent economic performance. Money does not prop up economic activity. Energy does. By boldly addressing the real-life oil issue, politicians would achieve an important place in history for imaginative steps taken akin to the mana now attaching to the name Winston Churchill – an erstwhile news reporter, who made a nuisance of himself during the Boer War and who accurately predicted the menace of Nazi ideology and the steps needed by Britain to protect itself against invasion.

In the section on "Globalization" below, reference is made to the transitional period between the run-down of oil and the commencement of a sustainable replacement. One conclusion is that the role of the nation state will, if anything, become more important globally. In NZ, this will be of critical importance during the transitional phase. Shifting rapidly from an oil-dependent regime to a biomass-dependent regime will be conditional upon fuel prices being comparable with each other. This issue will inevitably require state intervention – hopefully, for a brief period. Long term, there is no reason to expect that normal market forces will prevail and enable farm-produced transport fuels to achieve the same status in public estimation as does milk. Managing such a takeover is without

precedent in world history. To succeed, politicians would be wise to locate expertise wherever it may be found and to follow expert advice carefully. In NZ we are fortunate in having Fonterra's experience to draw on. A collateral issue that should be addressed is that of the need for strong, durable and cheap framing timber for houses in the post-oil world.



## American influence

Two nation states are of particular interest to New Zealanders – the U.S.A. and Australia. Like them, we have coastlines to the Pacific Ocean and speak English – more or less. The US is ranked 6<sup>th</sup> in the world for GDP per capita in 2010 (US\$47,016) and 10<sup>th</sup> for public debt as a proportion of GDP (58.9%). Wikipedia records total public debt (including intragovernmental holdings) in March 2011 at US\$14.26 trillion or 96.3% of GDP, ranked 12<sup>th</sup> highest against other nations. In 1980 a committee of the National Academy of Sciences chaired by economist Thomas Schelling wrote to its parent body on the social and political consequences of global warming. He focused on physical and social scientific uncertainties on what warming would mean. In particular, he emphasized the huge scale of those uncertainties as regards both their physical dimensions and their cost. Unsurprisingly, he strongly recommended more research. He thought that we had time to deal with the problem, which boiled down to a change in the distribution of climate zones on Earth. The time period for appropriate research was supposedly sufficient for adequate research. It would probably lead to a rise in the cost of fossil fuel and a decrease in usage. In this, Schelling was mostly wrong. Over the next 3 decades, fuel price increased but fossil fuel use rose dramatically, and global warming accelerated.

Within the US, a war of words erupted from about 1980 until the mid-nineties. In the one corner were the physicists, solidly behind human responsibility for global warming. In the other were a number of doubt merchants, mostly economists with a strong American belief in the power and the right of private interests to extract oil and supply energy to the world. Respected Academy members like Jastrow, Seitz, Singer, Nierenberg and (later) Michaels made up a denial group that set to work to create something like a new Cold War aimed at bringing about a do-nothing Congress. Battle took place within the Academy, at public meetings and in leading American newspapers. It was summed up in an American publication as follows:

*This divergence between the state of the science and how it was presented in the major media helped make it easy for our government to do nothing about global warming. Gus Speth had thought in 1988 that there was real momentum toward taking action. By the mid-1990s, that policy momentum had not just fizzled out; it had evaporated. In July 1997, three months before the Kyoto Protocol was finalized, U.S. senators Robert Byrd and Charles Hagel introduced a resolution blocking its adoption. Byrd-Hagel passed the Senate by a vote of 97-0. Scientifically, global warming was an established fact. Politically, global warming was dead.* (27)

The significance of this outcome of an American cold war over science was not confined to America. In 1994, IPCC began to put together a position paper on climate change. Benjamin Santer of the Lawrence Livermore National Laboratory undertook to find a group of lead authors. Their task would be to complete an agreed version of Chapter 8 of a publication devoted to the detection of climate changes and the attribution of causes. Santer put

forward a draft of Chapter 8 to a meeting organized by IPCC in November 1995. Among those present were representatives from Saudi Arabia and Kuwait. According to a New York Times reporter, the oil-rich states made common cause with American industry lobbyists to try to weaken the conclusions of the draft. That meant a diminution in the human capacity to adapt to change. Among those present at the meeting was a representative of NZ and a lone Kenyan who suggested that there was no need for a Chapter 8. Presumably, the NZ government was fully briefed on the IPCC meeting in 1995. Presumably, it knew all about representations made by the chairman of a fossil fuel industry group, the Global Climate Coalition, and by automobile industry representatives. Why were the public not informed of the outcome of the meeting and of the pressure exerted by commercial lobbyists? Why were special interest organisations such as Federated Farmers and the NZ Institute of Forestry not brought into discussion?

The role of oil in supplying the essential base energy for 20<sup>th</sup> century economies is well known. Its role in enabling the greatest population increase of any century over the last 8000 years (3.6 billion people) is less well known. So are predictions of the deaths of equivalent numbers of people when oil disappears. It appears that government inaction in NZ has been influenced by inaction of the US government justified by propaganda on the part of American lobbyists acting for interested industrial groups, including oil companies.

On the basis of American experience, allegations of democratic strength do not stand up. Against the power of the dollar and the human weakness for short term reinforcement, US legislators had no defence. So what about Australia?



### Australian influence

Australian politics is supposedly based on democratic principles. On climate change, however, let's examine the record of Senator Warwick Parer from Queensland. Democratic government principles flew out the door when he was appointed by John Howard to act as Minister for Resources and Energy in 1996. At the time, he was chairman of Queensland Coal Mine Management, a position from which he then resigned. Parer has been described as "an untiring defender of the fossil-fuel industries and the coal industry in particular." In the 1970s he became CEO of Utah Mining, one of the largest coal producers in Australia. In 1978 he was appointed chair of the Australian Coal Exporters industry body. Until 1997 he gave speeches lauding coal as "the corner-stone of economic growth in the Asian region well into the next century" and praising "clean coal". He abolished the Energy Research and Development Corporation and made it clear that Government would refuse to take any measures to reduce emissions that would, in his view, affect economic growth and employment. (15)

It has been suggested that the fact that Howard appointed as Minister of Resources and Energy a man who rejected greenhouse science, defended coal interests and had a large investment in the coal industry, was symbolic of his approach to climate change. In the nineties the government asked ABARE (Australian Bureau of Agricultural and Resource Economics) to provide an estimate of the costs of cutting emissions. The Bureau's results were captured in a number of publications, two of which were carried around the world in the briefcases of Ministers and public servants. In 1997 131 professional economists, including 16 professors of economics, issued a statement declaring that the Bureau's conclusions overstated the costs of abatement measures and underestimated benefits. Critics pointed out that the Bureau model failed to allow for technological change, overstated the likelihood of jobs going offshore, and presented estimates in a grossly misleading way. (15)

In 1997, Parer revealed details of the funding of the Bureau's research to the Senate. A number of organisations each paid A\$50,000 per annum for the privilege of sitting on the steering committee. They included:

1. Australian Coal Association
2. Australian Aluminium Council
3. BHP
4. CRA
5. Business Council of Australia
6. Electricity Supply Association of Australia
7. Exxon
8. Mobil
9. Texaco



All these organisations had strong interests in oil-based energy and in the business status quo. Three of them (Exxon, Mobil and Texaco) are transnational oil companies. Two of them (Exxon and Mobil) are among the world's biggest industrial corporations. (8) By their constitutions, all three must act in the interests of their shareholders rather than in the interests of Australia. Ethical and inter-disciplinary conflict became apparent to Professor Alan Powell of Monash University, who had been asked by the Bureau to provide independent advice. On 16 July 1997 he resigned from his advisory position, citing private sector funding as posing major risks for the integrity and efficacy with which modelling work can be done. He wrote that the problem was made severe when "government seeks to use results from a semi-secret proprietary model as a basis for justifying its policy position." The funding arrangements of the steering committee were investigated by the Australian Ombudsman late in 1997. He found that by limiting membership of the committee to organisations willing to pay A\$50,000 for the privilege, the Bureau had failed to protect itself from allegations of undue influence by vested interests. (15)

Overall, the handling of climate change issues in both the US and Australia has been a disaster. Governments of two of the world's leading democracies have made a similar mistake. They have sought to mix specialists in physics and economics together and produce a cake by "agreement". They failed, as they were bound to do. Oil and water really don't mix. Apart from that issue, there is another and more fundamental problem.

Climate change is only one side of an intellectual coin. The other side is the run-down of oil, a far more practical issue, and one which might have helped to solve the physicist-economist dilemma. The academic squabbles given media and commercial publicity do not open up alternatives for examination. If oil disappears, human ingenuity may well find another way of solving the energy problem, and even a sustainable one. Biomass is one option not handled by the physicist/economist wrangle. It has many aspects not even touched on in the political arenas to date. The version tried out by George Bush (using food to yield liquid energy) is about as stupid as it is possible to imagine. Biomass, however, has a vast number of possible applications to the energy problem. Only some of them have negative consequences such as the diminution of the global food supply.

## Globalisation

The tragedy of the American and Australian events is that they tend to put an end to the exploration and exploitation of well-founded biomass sources of raw material for the production of sustainable liquid fuel. They have done more to enterprise and exploration. They may be responsible for a failure to carry out critical research and investment and cost the human species some billions of famine deaths. The people responsible for such a disaster must go down in history as the most prominent examples of the failure of leadership in the 21<sup>st</sup> century.

Within the universe of discourse that is climate change, NZ is not a player. If anything, it is an observer from the sidelines. Politically, it is merely an ill-informed observer. As a sovereign state, with a low population density and large areas of both fertile hill country and low country that are suitable and effective for food production, NZ could contribute substantially to the cause and effect side of adaptation to climate change. It knows where to look for land that sits neatly within the basic FPA principles. It knows that the critical area is some 3.4 million hectares. That has already been identified. It has legislators possessing some familiarity with the principles (if not the practice) of sustainable resources. Its forestry consultants know a great deal about forest management as a tool to assist in the creation and management of forest biomass as a source of energy for transport purposes. It has a reasonable supply of competent forest scientists. Given this head start, the inability of government to try for world leadership in the adaptation and new economic stakes looks like inexcusable negligence. The interest of forestry consultants in the Emissions Trading Scheme does nothing for any professional claims to respect for professional integrity that their Institute may seek. All told, advocates of democracy (other than those in Germany (of all places!)) have nothing to boast about when the oil saga becomes history.

The mining industry started well in its claim to respectability. It did relatively little damage in its extraction processes. By confining attention to cheap oil, it built up a huge clientele and a huge population of dependent users. Now it faces oblivion as it advances towards extinction of the resource. That it resolutely refuses to bow to its own extinction can mean only one thing. The industry is determined to continue with oil until it has exhausted the global resource of bound oil. Free oil has traditionally been the only mined source of feedstock for mobile fuels. It has been accessible on land and beneath seas. It has been simple to mine.

Bound oil has been found in Canada (the Athabasca tar sands), the US (the Colorado oil shales), Venezuela and elsewhere. Bound oil necessarily involves environmental damage in extraction and industrial work in freeing oil from its earthen containers. Additional mining, environmental and processing costs mean that it can only be sold at a relatively high price. It can no longer be regarded as "cheap".

The same comments apply to methane hydrates. They will be difficult to mine and unsustainable. The only excuse for their extraction is the danger posed by non-extraction. Given steady global warming brought about by the use of petroleum oil, the 2°C of safety left for oceanic stability, when coupled with the large scientific ignorance of hydrates, looks



like a highly dangerous margin of security for human survival. The spontaneous release of methane to the atmosphere is likely to increase global warming at a much higher rate and commence feedback warming at a catastrophic and irreversible level. The threat is such that it compels attention being given to the early mining of hydrates and their liquefaction for fuel as a preventative measure. Here, however, we meet a snag.

Methane hydrates constitute a gas (methane) trapped in ice water. The ice may exist beneath land or beneath lake, river or sea. At this time, nobody has succeeded in mining the hydrates commercially. In NZ, a very large deposit of hydrates exists along the Hikurangi margin, stretching from Gisborne down the eastern flank of the North Island to the vicinity of Cook Strait. If a method of extracting the hydrates could be devised, they could be brought ashore and then melted to yield natural gas, or methane, needing only catalytic liquefaction to produce methanol. The legal problem is that the Crown, by law, owns all hydrocarbons found in land, whether or not the land is covered by water. Further, "all petroleum, gold, silver, and uranium existing in its natural condition in land....shall be the property of the Crown". (Crown Minerals Act 1991, sec. 10.) Under the same Act, "petroleum" means any natural occurring hydrocarbon (other than coal) whether in a gaseous, liquid or solid state or any natural occurring mixture of one or more hydrocarbons (other than coal) whether in a gaseous, liquid or solid state." (Section 2) The Minister of Energy has power to issue Minerals Programmes "to establish policies, procedures and provisions to be applied in respect of the management of any Crown owned mineral that is likely to be the subject of an application for a permit ... and in particular, policies, procedures and provisions which provide for –

- (a) The efficient allocation of rights in respect of Crown owned minerals; and
- (b) The obtaining by the Crown of a fair financial return from its minerals."

(Section 12)

In the light of these provisions, the Minister has a duty to exercise his powers to protect the interests of the people of NZ. Those same people are vitally interested in securing access to cheap energy. Methane hydrates are potentially a major source of energy. The higher the Minister raises the financial return bar, the greater will be the cost of energy to the same population, including in particular the cost of transport fuel. In effect, the Minister of Energy has the power to increase taxation at any time and at his whim. The absurdity of this situation has not yet dawned on Government.

The ability of Parliament to tie Government in knots is seen in the Climate Change Response Act, 2002. The purpose of that Act is to enable NZ to meet its international obligations under the UN Framework Convention on Climate Change made at New York on the 9<sup>th</sup> May 1992 and the Kyoto Protocol thereto made on the 11<sup>th</sup> December 1997. The ultimate objective of the Convention was to achieve "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." (Article 2). The authors were referring to burning petrol in ICE vehicles,



with consequential release of CO<sub>2</sub>. The reverse side of the burning coin is the fact that deposits of petroleum oil in or on planet Earth are finite in amount. The available scientific evidence suggests that depletion is expected by mid-century, but run-down to the point of unaffordable prices will occur by 2028-2030. It never occurred to the UN negotiators to fund research to pinpoint substitutes and to find a way to establish programmes for replacement. They simply turned to the one symbol system they understood (regulations) and drafted a wish list. It constituted a fundamental error. Substitutes like biomass do exist. They take time to sort out and to implement. The UN could not stomach this effort, and chose to attempt their tried and tested tool - regulation. A pity. At issue were the lives of some 3.6 billion people - the population bulge brought about by global efforts to climb aboard the petrol gravy train. Finding a recipe for hydrogen and fuel cells to replace carbon and ICEs would not have been difficult when brooding about hydrocarbons and their use in new and less harmful recipes.

For its part, NZ has not succumbed to the blandishments of oil companies with bottomless purses. It simply turned to the "wisdom" of the UN and adopted a one-sided view of the energy coin. It ignored the practical side of the coin: the issue of sustainable energy. It followed the UN's trip into fantasy. Its Government ignored the reality that trucks cart food. They need fuel to make that happen. Fuel is the central issue of the NZ economy, because that is where we are vulnerable to the ploys of the oil companies. The irrelevance of words in place of knowhow will come to attention when the insupportable global population starts to die off in large numbers in about 20 years' time. The lunacy of a UN rump and of the NZ Parliament will then become apparent.

What started the UN slide into irrelevance was the UN Framework Convention on Climate Change adopted in New York on the 9<sup>th</sup> May 1992. It was accepted by 40 nation states plus the European Economic Community. Using 2008 statistics, the combined population of the states amounted to a mere 9.7% of the global population. The geographic areas not represented by signatories comprised the islands of the Caribbean, Central America, South America, Africa, the oil-producing countries of the Middle East, and the whole of Asia except Eastern Russia and Japan. Their lack of interest in the convention had no influence on New Zealand legislators. The fact that oil-based energy propped up the global economy, and its implications for survival, by-passed their deliberations. Bluntly, we in NZ get the legislators we deserve. We are uninterested in what props up our economy, nor in its disappearance. The result is that we inhabit a country with a vulnerable economy, a proneness to natural disasters, and huge economic potential in the post-oil era which we ignore. It is not pleasant to reflect that we get the legislators we deserve.

Where should we be going? We have seen that the oil to transport fuels scenario (A) will simply die from over use. It does have an obvious alternative: wood to fuel cells (B). Scenario A has market support. Scenario (B) does not - yet. Scenario A is the fossil fuel way, unsustainable and powered by explosion. Scenario B is quiet, sustainable and powered by



leaf capture of solar energy and electricity. Vehicles using it do not send carbon into the atmosphere. Unwanted carbon during processing can be absorbed by existing and newly planted forests or sequestered into earth storage from the processing plant. Obviously, scenario B is the pathway of choice, but when should it be adopted? The do-nothing politicians would opt for scenario A. Before we enthuse at their wisdom, some recent research deserves mention. A team of American researchers, all geologists or climate scientists, visited Spitsbergen, a large island in Norway's Svalbard archipelago, Arctic Ocean, in 2007. There they were joined by other scientists from England, Norway and the Netherlands. They were interested in the Paleocene Eocene Thermal Maximum (PETM) period, which lasted as a unique period for a few thousand years some 56 million years ago, and was accompanied by planetary fever. Over its existence, temperatures rose some 5°C, forcing plants and animals to migrate, adapt or die. What caused PETM was a massive injection of heat-trapping greenhouse gases akin to the emissions from vehicles today. The scientists intended to drill through rock beneath an eroded plateau for samples of sediment lifted from beneath the sea by tectonic forces. They struck it lucky. They ran across a geologist employed by a mining company who, years previously, had kept earth samples of drilled material removed from the target area and stored in 1.5 metre boxes. It was exactly what the researchers needed.

From traces of organic material they were able to build up a picture of global warming during what had traditionally been regarded as the most significant period of warming in the earth's "history". In comparing 3 separate samples of temperature warming from the Cretaceous, PETM and modern periods, they found that rates of warming varied markedly. (See Table 1.)

Table 1

Warm Climate Periods

Period	Cretaceous	PETM	
Modern			
Duration	145.5 to 65.5 million years before present (myBP)	56 my BP	18 <sup>th</sup> to 21 <sup>st</sup> centuries
Warming period	145.5 to 140.2 myBP = 5.3 my	20,000 y	1750 onwards
Warming rate	0.000025°C/100 y	0.025°C/100 y	1 to 4°C/100 y
(Key: *C = degrees Celsius)			(23 and others)

From Table 1 it is clear that, as the warming periods decrease over time from millions to thousands to hundreds of years, the warming rates increase. This has a significant effect on adaptation of life forms: the more rapid the rate, the more dangerous it is to successful adaptation. The Cretaceous was a period when the seas were populated with marine reptiles, ammonites and rudists. The land was populated by dinosaurs. During the same period, new groups of mammals and birds as well as flowering plants appeared. Wikipedia reports: "The Cretaceous ended with one of the largest mass extinctions in Earth history, the K-T extinction, when many species, including non-avian dinosaurs, pterosaurs, and large marine reptiles, disappeared." PETM was harsh on life forms. Some perished; others, by genetic modification, became smaller. The speed of change was significant for adaptation: the faster, the harder. While the Cretaceous changes took place over millions of years, PETM lasted for thousands of years and modern is expected to last for decades, possibly rising to hundreds of years. Surviving living creatures adapted easily to Cretaceous warming, but had difficulty during PETM. Some seafloor life became extinct but most life on land either adapted or migrated. The expected life responses to the relatively rapid modern warming are the poleward movement of many species; habitat loss; coral bleaching; and extinctions. Overall, it appears that differences in capacity to adapt among species, including learning capacity, play an important role in determining which species survive and which species do not in any period of warming, whether induced by nature or by man. (23)

Modern threats associated with warming are clearly more serious than those associated with earlier climatic changes. The inference is that persistence with fossil fuels for motive power may be a form of suicide for the human species. Changing from oil-to-ICE power to wood-to-fuel cell power becomes not just something forced on us by mobility; it becomes an issue of human survival. The keynote to survival has just changed. The sooner we start producing sustainable fuel, the sooner we provide an impetus and the environment needed to improve its technology and to address the thorny issue of rising transport and food costs. This issue may well become the key to famine's success in reducing human numbers to a very few billions, starting this century.

An immediate switch to scenario B above has 2 key problems:

- a) It involves a switch to high cost rather than low cost fuel;
- b) It allows no time for the creation of dedicated tree crops for feedstock.

Both problems could be handled in NZ by government subsidy and immediate small scale production based on a) waste wood, old tyres, and water weeds as feedstocks, and b) a pilot plant for processing, possibly at Auckland.

Any broad-based switch to high cost fuels must be accompanied by basic economic changes and by a host of other changes that cannot be accurately predicted. There is a price demanded by the environment for shifting primary allegiance from unsustainable economics to sustainable survival: the deaths of impoverished oil-to-food consumers.



Among the obvious mechanisms must be the direct costs of travel and transport. They must rise. Of the indirect costs, the most certain increase attaches to food prices throughout the world. This could well have a negative effect on NZ exports. On the other hand, NZ may be able to develop an export business in energy. Countries such as Indonesia, committed to deforestation, may continue to treat forests as mining areas and drift into extreme poverty. Others, able and willing to convert to plantation forests dedicated to energy, are likely to prosper. In any case, voluntary, large scale movements of people are likely to diminish, with consequential damage to tourism and conventions. Effective gatherings of people for political purposes are likely to decrease in number. Famine will reappear, but on an unknown scale, depending on how effectively the world handles depletion of oil. On the global political scene, globalization is likely to decline in importance and national political issues to rise. The UN may develop a role similar to that of the pre-war League of Nations. Its handling of the ETS issue, including its logic on distinguishing between developed and developing states, is unlikely to assist in the development of international mana.

All in all, until nation states develop their own positions on sustainable energy in an oil-free world, globalisation must take a back seat in economics.

## Organisation

NZ is a country with a relatively small population – comparable with the population of Sydney (4 million odd). As a nation, it can act with reasonable competence but requires care in handling tasks needing scale for effectiveness. In tackling the transition from dependence on a single mineral (oil) to dependence of various forms of biomass, its first priority must be the public welfare. In this area, we have some historical experience to guide us – most of it negative.

New Zealand's record of preserving the national interest in corporate affairs is appalling. Domestic companies have fallen like dominoes to takeover raids. Our shareholders are suckers for any offer that looks good in purely dollar terms. On the other hand, our record with co-operatives is fairly good. Dairy farmers have shown that in Fonterra they possess a powerful, reliable tool in handling sales in an international context. If farmers on EP country elect to establish energy and quality timber plantations on that land, they would make up a common interest group that could form an effective co-operative. Appropriate regulatory legislation already exists in the form of the Co-operative Forestry Companies Act 1978. Enabling legislation that can be adapted for the partial use of farm land for woodlots exists in the form of the Forestry Rights Registration Act 1983.

One of the activities of an endangered soil co-operative is likely to be the establishment of a company to process biomass into liquid fuel. A descriptive name for such a company is Forest Fuels Limited. That name is available for such a project. Foundation shareholders could include investment funds held by special interest groups such as that formed to handle government compensation for the loss of West Coast forests and some Maori trusts. Government should be included to ensure that the public interest is represented. Given a strong foundation of funds committed to national interests, public participation in a minority position (including, in particular, fuel distributors) should be encouraged. The primary group of shareholders, however, must be the grower co-operative.

In essence, the energy problem confronting NZ involves the whole population. We are all dependent for survival on food and shelter, and both are dependent upon an efficient transport service. With a shift of the source of transport fuel from mining to growing, we confront a vitally important change in the conditions of supply of raw material. From a world-wide, heterogeneous collection of unknown miners, we move to a well-known group of local landowners. This shift demands a carefully negotiated arrangement between the people's representatives (government) and landowners' representatives (initially, Federated Farmers). The first and most difficult part of the fuel transition is to put up the money to get tree crops established on the target land. Only the Government can do that - quickly. Initial funding should be regarded as a bridging loan. Eventually, returns from the sale of fuel should be used to repay the loan, and only then should net returns be used for shareholder dividends.



Loan conditions are a matter of careful negotiation in a setting of emergency lacking precedent. From the perspective of taxpayers, they are all vitally interested in the takeover. There is no reason, however, why they should lose money put up for vital bridging. Money repaid could be calculated on its value at the time of repayment by the use of the Consumers' Price Index and the loan reduced in magnitude accordingly. Thus, the taxpayer gets two returns: his capital in full and access to fuel, transport and commerce without break. In due course, the same kind of arrangement could be used to get Forest Fuels Limited under way.

An implication of producing high quality specialty wood for house framing is that nailing will not be easy. It would be advantageous if it were not required. Attention is therefore drawn to nail-free construction methods. Houses in Auckland have been constructed in this way. So have the stave churches of Norway that have stood for a millennium. The practice of off-site fabrication of dwelling components lends itself to the engineering of framework members as building components needing only placement and glue for construction purposes.

The directorate of the company will need to be multi-skilled. It will need to establish company policy on a number of different issues, all of critical importance to the company and NZ. Some of these issues will be of importance to both the co-operative and the company. Others will be of importance mainly to the company. Some critical issues appear to be:

- a) The delivery, timing and condition of raw material for processing;
- b) The makeup of raw materials;
- c) Research into, and the identification and procurement, of raw materials;
- d) The drying of raw materials;
- e) The scope of processing for energy use;
- f) The refining of processed fuels;
- g) The distribution of fuels in NZ;
- h) The export of fuels surplus to New Zealand's requirements;
- i) The relationship of the company to the government of the day;
- j) Lobbying government on regulatory assistance;
- k) Public relations.

Another activity of an endangered soil co-operative will be the sale of high quality, untreated lumber from long term woodlots. For this purpose, it seems unnecessary to establish a special purpose organisation unless merchants prove resistant to the use of high quality lumber. It is expected that the issue will not arise until some 30 years after planting. However, the scale of production of such lumber and its impact on the quality of buildings in NZ are expected to be such that the co-operative should be in a position to compete successfully in the market place with merchants favouring low grade lumber to their own commercial detriment.

In dealing with lumber, the co-operative will need to take careful note of government policy. At present, government is unwilling to protect specialty lumber against overseas competition, regardless of whether the competition emanates from legal or illegal logging of natural forests. That policy puts an intolerable handicap in the way of farm production, and reduces the capacity of farmers to make sensible and profitable use of their land. It thus acts against soil conservation in high country – an inconsistent and surprising policy for NZ governments.

The logical administrative and research centre for the proposed co-operative and processing company is at Auckland. The University of Auckland has the qualified staff to handle a variety of research needs. It makes sense to site a pilot plant in that city. A centre there is well placed to make use of freight movements by air, land and sea. The city has the resources to handle a variety of meetings and conferences in a variety of settings. A pilot plant there could serve as a test of efficient manufacturing and as an auxiliary plant when methods have been checked and perfected. Gisborne is the obvious site for a major production facility. It could be readily reached by land transport of raw forest material harvested from 40% of EP land in NZ. It is adjacent to the northern reaches of methane hydrates in the Hikurangi margin. If they can be mined economically for methane, it would be convenient to land the gas close to the plant and feed it directly into its liquefaction section.



## Summation

For thousands of years, humans have dreamed of finding a way to escape the Rule of Famine. In the second half of the 20<sup>th</sup> century, they thought that they had found the secret. Stored solar energy in the form of petroleum oil was the elixir. For a few generations, the dream seemed to have come true. Population numbers climbed as never before. Invention blossomed as humans played with the new toy. The shape of civilisation and everyday technology changed. Famine seemed to have lost its grip. However, the real cost of fuel climbed steadily and remorselessly as population numbers bloomed and oil supplies remained steady. Predictions of oil depletion increased in volume and number. The predicted date for final exhaustion dropped from the 2070s to the 2040s. The Age of Oil seemed destined to last less than a century and to terminate in a painful, monster famine, wiping out billions of people. A defence screen could be attempted, but success is not assured. To their lasting shame, politicians simply looked the other way, and continue to do so. Even basic research has been by-passed.

We now live in the 21<sup>st</sup> century – crunch time. Generations have now grown up in a world where powered vehicles are just part of the environment. The gasoline and diesel that power them are of interest only when the tank runs down and demands replenishment. Vehicles are of passing interest, but only as units in traffic congestion and as parts of a brand and age class. Habituation has consigned both vehicles and fuel to the back room of consciousness and left no room for the handling of the run-down and disappearance of oil. That is not perceived as a disaster. Natural disasters are something to which humans must adapt. However, they relate to incidents such as plagues, fires, earthquakes, volcanic eruptions, tidal waves and floods. They do not cover man-made disasters. In other words, perception acts against survival in a world bereft of one of life's props.

A critical factor in addressing the problem of supplying a substitute for disappearing oil supplies is scale. NZ uses about 6750 million litres of petroleum products per annum. That requires a great deal of replacement. It wipes out most "good ideas" for substitutes. To be useful, any substitute must fit two limiting factors: available land and existing knowhow. Of these issues, the most difficult to deal with is land use.

A first class SOE report on a strategy to introduce a national programme of high country afforestation for energy purposes in 2007 has been ignored. Time has gone by with virtually nothing to show for it. We now have a mere 19 years within which to carry out basic research and to implement something like the Scion programme. What is now needed is a crash course of planting trees on a best guess basis to the maximum extent possible and amend it as research findings come to hand. Parallel to these steps will be the raising of capital, the design and location of a processing plant or plants, and the construction of the plant or plants. When coupled with the need to convince Parliament of the need and urgency of the work, NZ faces a seemingly impossible task.



The conclusion is stark. No matter how effective intervention may be, it can only mitigate the disastrous effects of losing cheap oil as the mainstay of the economies of nation-states. Famine on an unprecedented scale will return. It will garner an enormous death toll. Its victims will, as always, be the world's poor. Where will famine reign supreme? There are a number of answers. The sizes of domestic food production and domestic population density will be the first determinants. Also relevant will be the capacity of leadership to handle public debt. Its magnitude will attract public scrutiny. Leaders who cannot display competence in its management under stress will fail to attract new loans. The cheapness of petroleum oil as a prop for national economies will never return because energy comes only from the sun, and its earth store can only be replenished through a very limited number of resources, including the management of forest leaves. Transport will necessarily be expensive because fuel will become a capital-intensive commodity. Only those states displaying marked efficiency will survive, let alone dominate world affairs.

To have any hope of surviving the run-down of oil unscathed, NZ should be in a position to process significant volumes of biomass fuels by 2030. If Hubbert's (19) prediction of oil run-down are not borne out by 2030, that year still retains its importance. The more NZ is able to produce DIY fuels by that time, the sooner it will be able to reduce carbon emissions from oil feedstocks. Nineteen years remains a fixed time constraint under any scenario. Within that period, an action plan for a New Zealand DIY scheme to yield transport fuels will need to be operating. Some of its critical components must be:

- Discussions between the Government and Federated Farmers will be needed to ensure that landowners are willing to plant EP land in short term and long term tree species and that Government is willing to fund such plantings at an agreed level;
- Government should establish a pilot plant capable of processing wood waste, used tyres and water weed sustainably into methanol for research and use;
- Nurseries and forestry consultants will need to be briefed and be able to handle biomass planting at updated Scion levels;
- A co-operative planters' company needs to be put in place;
- Loggers will require to be briefed in order to be able to handle harvesting in time;
- Water-based and land-based transport firms need to be briefed in advance of decisions on processing;
- The economics of land- versus water- based transport for processing and distribution need to be worked out;
- A site at Gisborne should be designated as the primary site for a production processing plant capable of converting wood and wastes into methanol;
- Local bodies will need to be briefed on the location of woodlot establishments, processing plants and transport traffic;
- Research into the engineering of mining methane hydrates in the Hikurangi margin for on-shore liquid fuel processing should be carried out;



- The design of processing plant(s) should be completed and approved by concerned local bodies;
- A processing company needs to be incorporated (say, Forest Fuels Limited, or FFL);
- FFL should be structured so that the majority of voting shares are held by the Grower Co-operative and processing plant(s) are owned by FFL;
- Extraneous capital for FFL will need to be found and under its Articles of Association attract dividends at the rate enjoyed by the holder of voting shares;
- The dominant position of the Grower Co-operative in FFL and the dividend rights attaching to extraneous shares should be entrenched by Act of Parliament;
- Processing plant(s) will need to be constructed in time for the initial takeover of biomass fuels;
- A public relations plan must be implemented to inform the public of relevant information on changing patterns of transport.

Explosive power represented man's habit of taking whatever he needed from his environment. If it was environment friendly, that happened solely by accident. Electric power from methanol is essentially environment friendly but capital intensive. Its corollary that the end price of motive power must increase has its counterpart – increased wealth in a changed economic structure. The increased costs of planting trees, managing steep sites, transporting raw materials, processing raw material and distributing and selling finished methanol represent:

- a) Income in the hands of recipients,
- b) New products in the market place,
- c) New opportunities to develop the production of methanol-base products, including new products,
- d) Safer motor vehicles through reduced risk of fire;
- e) An expanded industrial base for NZ;
- f) Potential for new industries in NZ;
- g) A sustainable base for the creation of wealth;
- h) An expanded tax base for Government.

Methanol is an alcohol. It is poisonous and can lead to blindness and death if ingested in quantity. For this reason, it is not a drug of potential addiction. It is worth noting that working with, rather than against, the environment can lead to increased wealth and no clear risk of death arising from alcoholic excess.

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1. Financial break-down.

Following the collapse of Lehman Bros. in New York, finance companies around the world struck difficult and sometimes fatal trading conditions. A number went into liquidation or receivership. Why?

Money-lending is an ancient commercial practice. Over the centuries, the business has built up a great deal of knowhow on how to cope with the risks of recovering money lent and correlative interest. Since the beginning of the Industrial Age, the ability of large scale business to make use of borrowed money has become a key factor in development. Scale of borrowing has increased enormously. Take the United States, popularly regarded as the world's wealthiest nation. Its public debt as at the 25<sup>th</sup> March 2011 was US\$14.26 trillion. It has increased by over US\$500 billion each year since fiscal year (FY) 2003. It rose by US\$1 trillion in FY 2008, US\$1.9 trillion in FY 2009 and US\$1.7 trillion in FY 2010. Its ability to service loans is now of increasing concern. Standard and Poors have downgraded the state's credit outlook to "negative", with consequences we are yet to see.

Historically, techniques were developed to minimise the risk of default in payment. The history of the borrower, his or her earning capacity and stability, and the nature of any security offered as collateral to assure payment, all come into the picture. One form of collateral, the value of land and buildings offered, has increasingly dominated borrowing for housing. Lawyers have traditionally been involved in securing real estate as security for low-interest loans. A few principles for risk-takers have been developed:

- a) The financial history of the would-be borrower must be "good".
- b) His or her income and its stability must be established.
- c) The value of real estate offered as security must be established.
- d) Only first mortgages should be considered as security. (Subsequent charges get to be written off when a mortgagee's sale takes place.)
- e) The stability of the would-be borrower's character needs to be established.
- f) The real estate equity of the borrower needs to be at least one-third of market value.

Traditionally, loans were personal and criteria were human. Lenders in NZ included companies whose primary purposes had lost their bases, such as commercial dependence on kauri timber. Second and subsequent mortgages were a no-no.

So much for the traditional theory and practice of low interest lending as it existed in the middle of the 20<sup>th</sup> century. Their validity got a thorough work out during the Great Depression, 1929-35. Large numbers of borrowers lost their jobs and abandoned their houses. Mortgagees took possession and put in tenants. Such tenancies ran until well after World War II. During the fifties and sometimes later, mortgagees in possession sold their secured properties when tenancies came to an end. After taking account of rentals and sales, mortgagees typically recovered the whole of their loan investment plus interest and found themselves in possession of surplus funds which they were obliged to return to the original borrower.

The record of security realisations clearly validated the wisdom of traditional mortgage practice. However, as the 20<sup>th</sup> century ran on, the traditional practices were watered down. Banks entered the housing business by lending on first mortgage securities. The demand for funds was scaled up as industry morphed into large units. Finance companies accepted second mortgage securities. Accountants, economists and loan clerks gradually replaced personal and corporate lenders and their lawyers. Statisticians and securitisation entered the picture. It all led to the 1988 financial melt-down triggered by the Lehman collapse. The crucial lesson: traditional experience and knowledge of borrowers' behaviour were ignored at the cost of severe, world-wide economic damage. In New Zealand the dream of economic growth managed by political know-how took a hammering. Between 2005 and 2010, annual GDP figures showed a drop of some \$15 billion. This was most unusual. It pulled the rug from the base of the economic growth mirage loved and misused by politicians.

## 2. Leaky buildings.

The core problem of leaky buildings in New Zealand is not that they leak – all buildings can do that – but in many cases their basic structure is threatened by rot and structural collapse. How has this arisen?

Only some buildings are at risk. Those with framing of steel or durable wood such as kauri are not similarly threatened. Those with framing of untreated *Pinus radiata* are threatened. Some have already failed.

The history of the milling of *Pinus radiata* in NZ goes back to 1905. In that year, the sawn timber output of kauri reached its peak, some 133 years after its first felling by Europeans. In that same year, a number of large pines were blown down in Canterbury and sawn. They yielded a few thousand feet of sawn timber used by Duncan Rutherford in his own sheds. This small beginning was followed by pine planting, logging and milling in the North Island, where the species was known through experimental plantings in the Okahukura peninsula of the Kaipara district during the 1860s. During the 20<sup>th</sup> century, pine displayed dramatic commercial growth in a number of uses ranging from plywood to sash and door production, joinery, wallboard, Kraft pulp, paper, paper



bags, turpentine and tall oil. (T. E. Simpson, "Kauri to Radiata", 1973, ch. 7.) The expansion of radiata growth and usage continued despite a warning by Henry J. Matthews (chief forester of the Lands Department) at the Timber Conference of 1896 convened by the Seddon Government that radiata pine was fit for nothing but firewood.

Its growth also continued, regardless of scientific knowledge of its wood properties. K. R. Bootle ("Wood in Australia", 1983), in dealing with pine heartwood, says: "Heartwood (is) not sufficiently durable for external use in exposed situations; it is resistant to impregnation with preservatives."

On sapwood he comments: "The wide, readily impregnated sapwood enables a substantial cylinder of preservatised wood to be provided in round timber." In other words, the bulk of pine sawn timber is sap, and is not naturally durable. Bootle writes (p.192): "All sapwood has poor resistance to decay. Resistance is determined largely by the extractives formed when sapwood changes into heartwood.... The sapwood of all species is non-durable because of its life-supporting starches and sugars...."

The expansion of treated radiata as a framework timber was essential to remedy the inherent lack of natural durability of radiata pine. Treatment meant the forced injection of water-borne preservative salts into timber. What, then, about energy use post oil? A critical factor in the success of the oil economy was its cheapness. The continued use of energy post oil means that, because of the capital required for processing new forms of raw material, cheapness cannot be its bedfellow.

Pressure treatment becomes expensive treatment, whether used for boric acid, borax, sodium fluoride, or copper-chrome-arsenic salts for fungal or borer protection. There is a simple way of avoiding expensive treatment: grow framework timber that is naturally durable. When grown on erosion-prone land, the capital investment is not great.

If trees are grown as a dedicated energy crop for transport fuel, they can contain species chosen for strength and durability, as well as trees chosen for wood bulk, thus enabling treatment of wood for framing timber to be avoided and providing an additive energy crop through their leaf, bark and wood residues. Their growth rate may be slightly behind that of *Pinus radiata*, but their timber costs should be lower because of the greater relative volume of heartwood and inherent heartwood density. Long term planning may well open the door to frame affordability in the post oil era. Examples of this type of wood include *Eucalyptus microcorys* (tallowwood) and *Syncarpia laurifolia* (turpentine), both natives of Australia. Given 100% wood usage post oil, the growth of such trees must become economic.

### 3. The gasification route to liquid fuels.

Exploratory work by Choren Industries in Freiberg, Saxony, seems to have established an economic technology for the production of wood-based fuels. The most impressive feature of the technology



is its capacity to process a variety of materials. Waste wood, used tyres, lignite, bituminous coal, clathrate hydrates etc. are all welcome. In this way, the use of gasification-liquefaction technology lends itself to mass production in a way that the chemical removal of a normal wood component (lignin) for the production of ethanol does not.

The Pike river experience may arouse a cautious or even a negative approach to such a course. However, there are other aspects which may push for more science. A fuel such as methanol attracts an energy rating comparable with petrol if used in a fuel cell vehicle. This is because it is hydrogen rich and can be used directly in a fuel cell motor. (Olah, Goeppert and Prakash, "E<sub>2</sub> and Oil and Gas", 2006.) If the feedstock is a fossil fuel, CO<sub>2</sub> is extracted during the gasification process. But what should happen to that gas when it emerges in quantity as a by-product of yielding a hydrogen-rich fuel? Sequestration is the answer and for this purpose the hills of the West Coast provide a natural solution. This is not the answer apparently preferred in the US. There, natural land fissures seem to be envisaged. However, in NZ disused mines seem to provide a possible option for sequestration that may have economic advantages. The issue needs testing. However, the sequestration issue must not cloud the wisdom of using plantation wood as a feedstock for methanol. When carbon is taken out of the atmosphere by leaves, its storage in trees diminishes its contribution to the quantity in the atmosphere. Its loss of CO<sub>2</sub> during wood processing and its emission from fuel cell vehicles or internal combustion vehicles as waste cannot exceed its original atmospheric quantity.

The mining of clathrate hydrates from the ocean floor is not yet an established technology. The problem is not insuperable. Their release through man-made temperature rise becomes a form of mass suicide, albeit one not contemplated by oil miners. If such hydrates can be mined in ice form, their conveyance to a processing plant should be technically simple. Their melting would enable methane to be introduced directly into the liquefaction stage of processing and so lead to economically acceptable transport fuel.

#### 4. The Achilles heel of democracy.

The 3 forms of human behaviour discussed (large scale money lending, use of untreated sapwood as framing timber and sustained burning of oil derivatives as fuel) are all problems which should engage the attention of world leaders. They have not. Given a positive attitude to environmental change and science, all are solvable. This is the weakness of democracy. People in general are short term thinkers. They can understand and identify with short term thinking in would-be leaders. Short term thinking is characteristic of business. It works well when the relationship between man and his environment is a constant. When that changes significantly, a different form of thinking is needed. Long term planning becomes an essential ingredient of the thinking that must precede adaptation to change. The issue then becomes how to find and use such planning.



Each problem could have been avoided by decision-makers drawing on established knowledge when making go – no go decisions. Money-lending knowhow was well worked out through commercial history. House framing had both an historical and a scientific background warning of the tendency of sapwood to succumb to rot in moist conditions. In the late 1970s, cheap oil was scientifically predicted to drop to its last 10% of reserves by 2030, when its commercial use on anything like the present scale would be impossible. The issue of oil's replacement has been studiously avoided by world politicians. Their failure to act has been estimated to put some 4 billion lives at risk simply because of time wasted in finding substitutes. In the case of NZ, failure to act is simply madness in the light of a Scion finding that some 3.4 million hectares of steep land was available and should be afforested to prevent topsoil loss. Forest design could see that land supporting trees able to provide growth shelter on ridges, strong and naturally durable timber for housing and commercial building as well as bulk wood and foliage for liquid mobile energy.

In NZ the failure of successive governments has not simply reflected indifference to the future. An inspection of merchandise imports since 1960 reveals that mineral fuels have been imported in significant quantities that have placed a high and avoidable burden on our trading health. In 1961 mineral fuels accounted for some 7.04% of our import bill. By 1981 the percentage had risen to 22.33. The world financial problems showed up in NZ in 1989 when the percentage dropped to a low of 5.22%. Since then, the percentage has gradually increased to 15.91% in 2008 and 15.73% in 2009. In spite of this clearly visible burden on New Zealand's export dollars, government inaction has continued and Parliament has blessed the inaction by its silence.

All 3 failures are referable to a fundamental weakness in democracy. If political leaders are selected by popular vote, voter popularity is of crucial importance. Short term behaviour by candidates matches short term thinking of the man in the street. Popularity, however, is not a recipe for problem solving. Acute intelligence is. Problems arise from a multitude of causative factors. One of these is conflict within humans. Given supporting conditions, humans can populate their planet very rapidly. Supporting conditions, however, can only improve in arithmetic progressions. Populations lacking birth control increase in a geometric progression. Here's the rub. The slowest geometric progression will overtake the fastest arithmetic progression. Human numbers are thus constantly at war with food supply and like supports. Throughout history, famine has been the effective controller of population numbers. From this perspective, warfare is merely a minor contraceptive, used occasionally to defer the impact of famine.

There is another aspect to this conflict. Human appetitive drives (sex, food, shelter etc.) exert constant pressure for one generation to consume, regardless of whether or not it is at the expense of another generation. In this way, nothing has changed since hunter-gatherer days. The most obvious resource at risk of excessive generational demand is food. Current food production is massively supported by oil. Remove oil without providing a substitute and food supply decreases. People then die of malnutrition unless a form of support energy equivalent to that provided by oil can be found and put in place at the critical time: the actual run down of oil. Unless the gradual run



down can be matched by a gradual substitutionary supply, dependent humans will die. Famine then again becomes the effective controller of the human population.

Where does all this leave us in a quest for substitutionary transport fuels? A few fundamental issues must be addressed:

- A. Plant scale. Engineers are well acquainted with efficiencies of scale. To obtain the greatest benefit from this kind of planning, a single processing plant for NZ should be established for transport fuels derived primarily from forest wood – probably methanol and a form of diesel.
  - B. Feedstocks. The fewer the processing plants in NZ, the greater the distance that feedstocks will need to move to reach them. The more plants that are established, the lower will be the gross transport costs but the higher will be the cost of feedstock per tonne/kilometre brought about by the greater capital cost of multiple plants.
  - C. Transport modes. In theory, feedstocks can be moved by land, sea or air. The air option is not realistic for low cost raw material. Land transport causes road damage by trucks and leads to substantial road maintenance bills. Water transport does not. For an island nation like NZ, water becomes the preferred transport mode, but is itself subject to efficiencies of scale: the longer the trip, the lower the cost per tonne/ kilometre.
  - D. Ship size. The experimental tests of transport efficiency carried out in the early 20<sup>th</sup> century gave top marks to large ships. Why? The answer seems to be the ratio of manpower to ship tonnage. Given that, within limits, a given crew size can move either a large ship or a small ship, crew overheads will obviously be lower per tonne/kilometre in large ships
  - E. Geography. From a forestry and clathrate hydrate perspective, the most obvious site for a single processing plant will be Gisborne because:
    - a) It has useful road access from about 40% of the woodlot sites identified by Scion for planting;
    - b) It immediately adjoins the largest marine clathrate hydrate deposits in NZ sitting on the Hikurangi margin stretching from Gisborne to Cook Strait
  - F. Solution. A single processing plant (gasification and liquefaction to liquid fuels) should be sited at Gisborne. The design of its plant, mining and transport equipment needs to be established. Assistance is available from Choren Industries at Freiberg. A pilot plant for experimental development could be established either at Gisborne or elsewhere in NZ.
- Wood wastes from the wreckage of buildings torn down in earthquake-ravaged Christchurch might be an important resource but the question of contamination by preservatised salts would need careful study. Feedstocks would be mainly dry wood chips, old tyres and hydrates, but fossil fuels could be added if needed . Hydrates would require melting and capture of methane for direct access to liquefaction. Dry wood chips could be moved to Gisborne from distant parts of the North Island and the whole of the South Island. Marine movement should be by large motorised barges to allow for maximum penetration of



shallow coastal inlets. Assuming that the existing refinery at Whangarei and existing distribution outlets remain in use, liquefied fuels will require transport to Whangarei for refining and distribution. Barges capable of handling feedstocks should also be capable of handling liquid fuels.

### Consequences.

Shifting from oil-based to tree-based fuels must involve an increase in the retail price of food. For consumers on limited budgets, rising food prices must require a reduction in non-food expenditure. A recent TV programme dealt with impulse buying. Using its figures, it appears that the purchase of non-essentials could account for about 5% of GDP. The elimination of non-essentials could act as a cushion (at least in part) against the loss of more vital consumer goods and so affect the makeup of the business community.

Another loss is likely to follow the substitution of trees for oil. It is the contribution of commuters to the Auckland economy. They make up a small but significant portion of the work force (3.7%). They work within the Auckland metropolitan area but reside in all parts of the North Island, from the Far North to Wellington. To sustain their work habits (including commuting), their productivity is likely to be above average. Their numbers could be severely threatened by a significant rise in transport costs. At present, the 17,500 Auckland commuters make a contribution to New Zealand's GDP of at least 1.6 billion international dollars. A significant rise in transport costs could put this contribution at jeopardy.

In summary, democratic "leadership" has failed to address 3 important issues:

- a) The world is still floundering in the wake of its abandonment of established, prudent moneylending practices. In this area, our ancestors appear to have had a better understanding of the variation and predictability of human behaviour than we have today. Governments have not bothered to study the issue. Markets can't.
- b) Leaking buildings plague a number of countries, including Canada and the US. Wood is an important contributor to framing because humans have a tendency to attach hangings to framed walls – something they can't do with steel frames. Durable wood can be grown. This would provide a long term and durable solution to the problem. Such a step is anathema to democratic (i.e. short term) politicians, whose main life interest is the outcome of the next election.
- c) Forest woodlots and a wood processing infrastructure provide a long term, sustainable solution to the predicted run down of oil. They are beyond the ken of democratic politicians and most oil companies. Through their deliberate avoidance of the oil problem, national politicians in NZ have reduced the country to the status of a commercial colony of the oil companies.

Political theory needs to address the problem of leadership in a democracy with urgency. It remains trite but important to remember that, if we base today's predictions of Government behaviour on recorded Governmental behaviour in the 3 areas discussed, today's long term view will morph from our trading impoverishment to our grandchildren's nightmare. A part of our current problem is political culture. Almost any problem can, by convention, be solved by "growing" the economy. The most convincing politicians are those who can sell their capacity to manage "growth" most convincingly. However, they are all flogging a dead horse. "Growth" is merely a mirage. What provides economic grunt is energy. The cheapest and most abundant form of mobile energy we have stumbled on to date is petroleum oil, a liquid. All we have to do is dig up the oil and refine it. With other energy carriers (possibly in gas or solid form), we must invest, and invest heavily, in processing plants and transport vehicles. This involves capital and new forms of labour. If we seek to replicate the comfort of the oil age, we must find ways of increasing efficiency in the ways we convert energy carriers into energy products in liquid form with (hopefully) greater safety margins than those accepted by gasoline users. The task is the basic one of adaptation to our environment. Success or failure in this task will be measured by the numbers of humans that survive the disappearance of the oil prop to our economic comfort.

The nightmare of our grandchildren will commence when cheap oil shows clear signs of running down. At that time, its role as a carrier of mobile energy and as a prop for food supply will start to show evidence of frailty. The brutal reality of expensive energy will start to dawn on people everywhere. The early victims of run down will be poor people in Third World countries who cannot feed themselves and their children. Famine will show up and will progressively get worse. The expected loss to famine deaths has been assessed at 4 billion.

The assessment gives us a convenient standard by which to assess the quality of leadership displayed by world politicians. During the second half of this century, the number of famine deaths may fall below or exceed 4 billion. The actual number will become a useful measure of the success or failure of world political leadership in handling a basic problem of adaptation. Here we stumble across a fresh insight. The world-wide failure of politicians of all stripes to tackle the oil problem threatens life on a vast scale. How can we understand the failure? Conspiracy theories will not wash. Oil dependency may. One particular form of oil dependency is air mile addiction. It afflicts the world's politicians severely, regardless of their country's political structure. They need popular support to survive. Some of that support can be engineered. A skilled politician can influence support by photo opportunities – the more the better. Hence, their air-mile addiction and their use of oil-based fuel in quantity. This common form of dependency could explain their silence on measures to deal with biofuels and other alternative forms of energy without any base of overt conspiracy.









## A methanol economy for New Zealand

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*"The Methanol Economy" encompasses:*

- *New and more efficient ways of producing methanol (and/or derived dimethyl ether) from still-existing natural gas sources, without prior production of syn-gas.*
- *Utilisation of the hydrogenative recycling of CO<sub>2</sub> to methanol from industrial exhausts but eventually from the air itself as the inexhaustible carbon source.*
- *The use of methanol and derived dimethyl ether as a convenient transportation fuel for both ICEs\* as well as the new generation of fuel cells, including DMFC\*\*.*
- *The use of methanol as the raw material for producing ethylene and/or propylene to also provide the basis of for synthetic hydrocarbons and their products.*

*The "methanol economy" offers a feasible means by which to liberate mankind from its dependence on diminishing oil and gas resources, while simultaneously utilising and storing all sources of alternative energies (renewable and atomic).*

*\* internal combustion engines*

*\*\* direct methanol fuel cell*

(Olah, Goeppert and Prakesh, "Beyond oil and gas: the methanol economy," Weinheim, Germany: Wiley-VCH, 2006.)

### Problem

Global civilisation owes its form and substance to the exploitation of cheap, accessible, petroleum oil. Around the world, a number of proposals (other than forest-based methanol) have been put forward to provide a replacement for oil-based energy when the resource runs out later this century. None has been designed specifically for NZ. They include a hydrogen economy, a plug-in electricity economy, and an ethanol economy. None fits New Zealand's needs. The choice of a suitable base fuel for NZ and its timely implementation are of fundamental importance to this nation's survival, economy and environmental quality. For the record, reasons for rejecting the non-methanol proposals are as follows:

#### A. Hydrogen

Like all gases, hydrogen is difficult to handle and store, and dangerous. Environmentally, it is a winner. It is a clean and environmentally acceptable transport fuel because it avoids the emission of CO<sub>2</sub> from tailpipes. As an initial compromise suggestion, the on-board reformation of hydrogen-rich methanol to hydrogen for the vehicular generation of electric power is feasible but inefficient compared with the use of methanol directly

in mobile generation of power. Adoption of hydrogen would necessitate a completely new infrastructure for distribution purposes.

#### B. Electricity

Improvements to battery performance have rendered overnight vehicle plug-in to mains power a possible alternative to gasoline. The main drawback is the scale of energy required. In 2005 over 3 million vehicles used our roads and of these, almost 70% were cars. If the bulk of road users drew on mains power to stock up their batteries their demand could stress power supply and create demand for new sources of energy for transport use. The practice could drive NZ into a technological backwater requiring an expensive rescue.

#### C. Ethanol

This form of alcohol is favoured by some continental states such as the USA and Brazil who appear to be indifferent to primary forest loss and to the associated reduction in the global food supply. The principal food crops displaced for energy consumption are corn and sugar. (It is hard for New Zealanders to understand how the US federal government could agree to switch subsidised corn from food to energy use at the behest of its domestic farm lobby.) Ethanol can be made from wood but only if some 25% of its wood content (lignin) is withdrawn from the processing stream, possibly by the use of enzymes. The main disadvantages of this option are:

- The high input of energy required to produce it (some studies suggest a negative energy balance),
- The potential to reduce food supply (corn is subsidised in the US by US\$1.9 billion in 1996 rising to \$9.4 b. in 2005), in a world whose human population has already passed the natural capacity of planet Earth to feed it ,
- Its inability to match methanol in fuelling the next generation of automobiles (fuel cell),
- The use of agricultural ethanol on a global scale needed to replace oil (yielding transport fuels in excess of 6 million tonnes per day) is impractical.

In effect, how many lives will it cost?

The Ministry of Economic Development has supplied data on the consumption of transport fuels in 2008. Based on those figures the replacement target when oil runs out will represent an update of the 2008 consumption as follows:

Fuel	Year to end June 2008		
	Barrels of oil equivalent (millions – GJ/6.1)	GJ (millions)	PJ
Petrol	18,665.573	113,860	113.86
Diesel	24,727.868	150,840	150.84
Aircraft fuel	2400	14,640	14.64
Transport energy	45,793.441	279,340	279.34

The ups and downs of the global economy make it impossible to quantify an estimate of future consumption. However, the available data on population



trends, and on the peak of consumption of cheap oil, suggest that any movement long term is bound to be upward. Meantime, the data give us a tool with which to make some comparisons of hypothetical alternatives to oil consumption. It is noteworthy that new dedicated forest production of alternate fuels in 2030 conservatively estimated from crash course planting is 20.94 PJ – only 7.5% of the 2008 figure. (See Appendix C.) Clearly, existing forests must bear the brunt of the replacement burden.

### Implications

New Zealand's refinery at Marsden Point imports relatively heavy crude oil from the Far East, Australia and Indonesia and uses some oil produced domestically. Its refining processes yield the following products:

- \*Petrol
- \*Jet fuel
- \*Diesel
- \*Fuel oil
- \*Bitumen

When cheap oil runs out later this century, its disappearance will not affect bitumen. In part, its source is the Athabasca Oil Sands in Canada located beneath sparsely populated boreal forest and peat bogs. They contain about 1.7 trillion barrels of oil, thus being comparable to the world's proven reserves of petroleum oil. Market demand for this product shows a continuing upward trend. The high cost of extraction means that Canadian bitumen will always be more expensive than the refinery product.

Crude petroleum represents about 50% of all mineral fuel imports, the remaining 50% being largely refined petroleum. Overall, the domestic sector is the largest consumer (41%) of energy. New Zealand's bill for mineral fuel imports in 2005 (crude and processed) exceeded \$4 billion. Fuel oil is a minor fraction of crude oil that, together with bitumen, represents the residue of the distillery's feedstock after petrol, jet fuel and diesel have been removed by the distillation processes. While fuel oil could not be directly replaced by forest-based fuels, its contribution to energy usage in NZ is minor and could be replaced by the use of other fuels that are forest based.

The attitude of NZ state departments to alternative fuels over time is extraordinary. In 1978, the then Department of Scientific and Industrial Research published the findings of a DSIR working party on "Transport Fuels for New Zealand". Table 42 of that paper dealt with estimates of cost of transport fuels from non-petroleum sources. It is reproduced in Appendix D. Estimates of cost for methanol drawn from natural gas, coal and wood are given separately. Estimates for ethanol drawn from wood and crops are also shown. In 2006 the Ministry of Economic Development issued a report designed as a "starting point for anyone wanting to become more informed about the energy choices New Zealand faces. Its comments on "The Renewables Scenario" are reproduced in Appendix E. In discussing biofuels, the report does not even mention the existence of methanol, without explanation of any kind. The Ministry seems to believe it can define methanol out of existence. Its views may be influenced by the upshot of the American



farm lobby in introducing ethanol in the USA but, in any case, have become mere propaganda. The report lacks a scientific basis. This downgrades it to a new form of political correctness and destroys any informational value.

### Solution

NZ is a relatively young country in geological and human settlement terms. One of the impacts of human settlement has been an acceleration of erosion in steep country. Nevertheless, erosion has not proceeded to the stage of widespread prairie development seen in major continental regions. It is not desirable that it should. The nutrients of topsoils are important for any form of sustainable land use. Stable river-beds, clean waters and silt-free harbours are also important.

An assessment of land areas whose use for pastoral grazing threatens severe erosion has recently been completed by Scion researchers Hall and Jack ("Bioenergy options for New Zealand", 2008). They assess the area of erosion-prone (EP) land in the North Island at 1.949 million hectares and that in the South Island at 1.423 million ha – a total of some 3.4 million ha. In their view, the gross area has the potential to grow trees for biofuel yielding 700.1 petajoules of energy annually, or 8.751 billion litres of fuel at the pump. This can be compared with a current liquid fuel demand of 8.1 billion litres. This is a purely arithmetical assessment but gives no idea of what area of EP land could in reality be set aside by their owners for forests, nor what allowance for tracks, landings, preserved ridges etc. should be made.

Unfortunately for NZ, EP land has owners – ordinary human beings, with all the foibles of our species. No matter how compelling the arguments, no group of land owners, selected purely by the characteristics of their land, will ever see eye to eye on management. Irrelevant factors such as grandfather's will, a marital breakdown, financial problems, neighbour problems, ignorance and sheer bloody-mindedness will obtrude. If owners of 3 million hectares took up the Scion suggestion, New Zealanders would be very lucky.

There is another problem with the Scion proposals. The planting rate suggested as being within capacity is 100,000 ha. per annum. This goal is more than twice the target goal suggested by the 1981 conference on the Forestry Encouragement Act 1962 when continuation of the grant scheme to 1990 was discussed. (43,800 ha./annum.) At the Scion rate it would take some 30 years to plant 3 million hectares. This would bring us to the year 2040 before planting is completed. That is 10 years after the date when Hubbert predicted that the globe's supply of oil would reach the 90% depletion point. If Hubbert is correct, then by 2040 extractable oil will be down to a trickle, petrol prices will have gone through the roof, the global vehicle fleet is still likely to be largely ICE vehicles and the plantable land target will only be three-fourths attained. The wood harvest target would be even more under-achieved. Realistically, the planting target should be increased to 150,000 ha./annum. The global population by 2040 is predicted to exceed 8 billion,



thus creating a predictable increase in demand. The Scion timetable, on the basis of current evidence, is likely to be too little, too late.

The idea of a methanol economy will tend to be judged on its capacity to replace gasoline as a transport fuel. However, it is also a starting point for chemicals such as formaldehyde, acetic acid, polymers and products such as paints, adhesives, construction materials, synthetic chemicals, gasoline and pharmaceuticals. Its high octane rating and low energy content suggest that it is best used in ICEs in the form of blends with gasoline. Its high hydrogen content gives it a leading role in the fuel cell stakes. Olah et al. (2006) summarise its contribution to transport as follows; "Methanol is a most convenient way in which to store and distribute energy, a suitable fuel in its own right, and a raw material in the production of synthetic hydrocarbons and their related products." Its convenience includes a favourable safety record.

Methanol feedstocks are essentially dry organic materials capable of gasification in quantity. Dry wood chips meet this specification. So do dry herbivore faeces, and dry sawdust converted into pellets. So do old rubber tyres, the wastes from native forests, residues from exotic forests not channelled into panel-board, and urban waste wood. The gasification process can be avoided if methane ( $\text{CH}_4$ ) is used for second stage (catalytic) conversion. Methane can be produced by the anaerobic digestion of organic matter.

Energy supplies the drive in the national economy. For this purpose, the source of raw materials is immaterial. What matters is the availability of energy in quantity and its price. For environmental purposes, in contrast, source, and especially sustainability, are all-important.

The number and location of processing plants are issues of major importance. Because transport fuels supply the energising function for internal and external goods trade, their cost is vital for the state of the economy. The critical factors are as follows:

- a) Plant size. Engineers tell us that size is highly significant – the larger the plant, the greater the throughput and the lower the processing cost per unit of output.
- b) Transport distances. Moving wood chips by truck or liquid fuel by tanker is costly but works against economies from scale of plant. (The less the distance, the more plants required to service the country.)
- c) Forest productivity. Native forests show up markedly in the west of the Southern Alps while exotic plantations (existing or planned) show up more in the North Island. Wastes, residues and crops will eventually be large from exotic plantations but will always be low from native forests.
- d) Transport modality. In the 19<sup>th</sup> and early 20<sup>th</sup> centuries transport costs were significantly lower for water-borne traffic (and, therefore, long distance movements) than they were for land movements. However, with the invention of containerisation, inter-modal transport has become possible and the traditional differences have become blurred. Today, engineers aim at using trucks for "short" hauls and sea for longer hauls with seamless handling between modalities.



- e) Processing method. All plants should have the capacity to produce methanol but one or two should have the capacity to handle specialty products such as gasoline-methanol blends, jet fuel and dimethyl ether.

Any selection of plant sites must become a balancing act. To start the debate, plants in the following towns might satisfy the nation's needs for basic fuels:

North Island  
Whangarei  
Gisborne  
Wanganui

South Island  
Nelson  
Timaru  
Bluff

### Adaptation

What will happen to the global economy when oil runs out? How will humans react to the need for substitutes? Does existing knowledge help or hinder adaptation to a changed environment? How do we draw the line between knowledge that assists, and beliefs that hinder, effective adaptation to change? Do our political institutions help or hinder? Why is it that world-wide reaction to the certainty of oil disappearance pays attention to the effects of oil use on environment (e.g. emissions trading schemes) but ignores moves towards adaptation? Answers to these questions define some of the rocks and shoals that need to be navigated by humans in the course of survival and adaptation to oil loss.

Recent events and world history over the last few millennia give a vague outline of some rocks and shoals. Human intelligence functions well when has to solve immediate problems of survival, exploration and appetitive gratification. Habits develop around such needs, and institutions have been developed to assist the satisfaction of needs such as skill specialisation, long distance trading, and the design and manipulation of symbol systems. However, those practices do not help us in tackling novel problems attaching to environmental change. Business-as-usual models provide a comforting prop in dealing with a relatively unchanging world but lose their usefulness when living conditions change. Some examples:

- a) The rise and fall of civilisations as forests were progressively felled to destruction in Mesopotamia, Greece, Rome and the remainder of the Mediterranean littoral;
- b) The drastic decline of Easter Island population as all trees were removed, presumably for the movement of stone statues; and
- c) The destruction of varying civilisations in the American continents as resources were wasted;
- d) The current widespread popular failure to understand the role of oil in propping up food production.

These examples cover obvious conditions such as trees and food. Less obvious are conditions created by man, such as language, writing, mining for metallic ores, mining oil, the creation and enforcement of laws, exchanging goods and services, the use of money, political and religious beliefs, etc. From embodiments of human ideas whose time has passed, we can find huge



sources of conflict, economic recession and destruction of life. We are not good at discarding outworn institutions, but it is wise to acknowledge it and to identify them.

### Strategy

In Table 1 some high probability predictable events of the cheap oil age (this century) are recorded. From the perspective of effective adaptation to the run down of cheap oil, there are public relations problems at each end of the change-over period. In the immediate future, inertia, ignorance and groundless beliefs will provide an obstacle to essential investment in:

- a) New dedicated forests,
- b) Processing plants yielding alternatives to gasoline and diesel, and
- c) Methanol derivatives such as ersatz gasoline.

During the later part of the century, when cheap (i.e. accessible) oil is just a fading memory, copycat industrial and distributive ventures may imperil industrial methanol research that is an essential element of methanol's replacement role. For forestry purposes, a well-designed information programme should be developed for farmers and other land owners. For competitive protection (especially from oil companies, noted for trading ruthlessness) a single well-managed corporate entity should be entrusted with processing and distribution.

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Table 1  
Possible scenario of major events in global run-down of oil, 21<sup>st</sup> century\*.

Era 1		Up to years 2025-30
Population:		Doubling of 1974 level to 8 billion
Cheap oil:		Reaches 90% of extractable volume
Dedicated energy plantings:		Commencement in 2011 @ 150,000 ha./a
Dedicated energy harvests		From 2018, 3m.m3/a and increasing @ same rate
Methanol production:		Commence in 2012
Methanol use:		Industrial
Methanol sales:		Largely overseas
Vehicle motive power:		ICE plus small number of FCVs
Era 2		Years 2031 to 2050
Population:		Stable
Cheap oil:		Rapid decline in supply of last 10%
Dedicated energy plantings:		Expand to 3 million ha. plus
Methanol production:		Expand to exportable surplus point
Methanol sales:		Domestic transport plus minor exports
Vehicle motive power:		MDFCVs, declining number of ICEs & diesel

Era 3	Years 2051 to 2075
Population:	Declining through hunger and war
Cheap oil:	Rapidly running down to 0
Dedicated energy plantings:	Maintain in full wood production
Methanol production:	Expand to full possible volume, incl. carbo-v & aircraft fuel
Methanol sales:	Domestic transport range, industrial products & use in static FC stacks (esp. farms)
Vehicle motive power:	MDFCVs (including carbo-v or diesel)
*ICE=internal combustion engine	FCV=fuel cell vehicle    MD= methanol direct

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Omitted from Table 1 are possible energy contributions from ethanol drawn from tallow and whey. Similarly, no mention is made of raw materials sourced from wastes and from developing organisms such as algae. Currently, methanol technology is at a primitive level and needs updating through research. Membrane efficiency in fuel cells needs improvement. Developing technology in the Netherlands (Delfzijl) and in Germany (Freiberg) needs monitoring for possible adaptation and adoption. Energy efficiency in vehicles needs considerable improvement. The use of sour felling in dedicated forests for cheap and rapid wood drying needs examination. The Board of any processing company or management of any corporate body engaged in processing should undertake responsibility for urgent and competent research in these areas. If it does, it should receive governmental assistance and protection from competition in the national interest so that cost cutting for competitive purposes does not reduce or eliminate expenditure on such research.

Methanol is an established energy source that could be adopted in place of oil derivatives. The global record of efficiency patents suggests that oil interests will not be enthusiastic about possible damage to their NZ market. The replacement pattern suggested for current derivatives from petroleum oil (now supplying 95% of global transportation fuel) is as follows:

Refinery fuel	Suggested replacement
A. Petrol	M85 blend (85% methanol, 15% gasoline)
B. Diesel	Dimethyl ether (DME)
C. Jet fuel	Kerosene, biomass-based

The blend suggested as a replacement for petrol could only apply to ICEs. The gasoline content could be fabricated from methanol and would add to the energy content of methanol while methanol would add to the octane rating of gasoline. A methanol-to-gasoline process was introduced to NZ by Mobil in 1986. The feedstocks are methanol, DME and water, catalysed by Alumina. DME can be produced by the dehydration of methanol and is stored in pressurised tanks. The process yields about 600,000 tonnes of gasoline annually. The Shell process for jet fuel dates back to 1995 and involved a two-stage process from coal to synthesis gas to methanol, naphtha and kerosene. The basic change needed for the post-oil era is to substitute biomass for coal



The financing of new forest plantations needs special attention. Traditionally, Government grants have been used to encourage new forest plantings. For energy purposes, Government assistance may well be desirable, but there is no need for that assistance to take a grant form. If taxpayers' money is used in this way, it could be on a woodlot partnership basis protected by a security prepared and registered under the Forestry Rights Registration Act 1983. In this way, the taxpayer, through government, becomes a partner with farmer land-owners in creating woodlots and a wood feedstock base for the production of transport fuels. Returns to the partners can be on a relative input basis. Assuming a harvesting period of 10 years, a 40-year term of operations would yield returns from 3 harvests.

The selection of genera for an energy project is important. Wood quality is not an issue. Quantity of wood grown annually is the key factor. Also very important is reproduction. Only species that coppice freely will enable plantation regrowth after harvesting to be achieved at a minimum of cost. (A sharp pair of secateurs would remove unwanted coppice growth.) Possible candidates are fast growing Eucalypts and Poplars. Climate warming and the Victorian forest fires suggest that Eucalypts may be vulnerable to fire damage. However, the short time between harvests (say, 7 years), the consequential low level of tree litter, the lack of significant road or rail frontages and the location of forest sites in steep hill country all point to the fire risk of Eucalypt plantations being very low.

One of the most important problems in designing an industrial system to suit the needs of processing and distribution is to settle on an optimum number, location and arrangement of processing plants, their functions, and transport distances for raw feedstock. This plan must test and allow for the economics of using existing manufacturing and refining plants to handle parts of the energy stream. It should be designed to suit wood extraction from all existing forests (native and exotic) as well as from new, dedicated energy woodlots.

### Financial

The global explosion in the use of cheap petroleum oil is commonly seen as commencing around 1950. By 1960 it was well under way. NZ was involved in two roles. Raw oil and gas products were both imported and, in refined form, exported. Exports included methanol made from natural gas. Imports included the material from which the NZ Refining Company produced a variety of products, including petrol in particular. Those imports, under the heading "mineral fuels", cost some \$41 million in 1961 and constituted some 7% of total merchandise imports. By 2007, the import bill had risen to \$7100 million, or 16% of total imports. In other words, the bill had risen to more than double its proportionate cost over nearly 50 years, and before the dramatic price rises and fluctuations of 2008. Its omission from the annual import bill for 2007 would equal 22.7% of Direct Public Debt current in 2007 (\$31.2 billion).

The global depression that emerged in the world of finance in 2007-08 has been accompanied by a sharp rise in pump prices for petrol, a short fall and a



reversion to another climb. There is no evidence of a decline in demand resulting from international work on climate change. There is no evidence of such a decline happening before disappearing resources compel a decline in supply. From New Zealand's perspective, the driving forces behind a shift to forest fuels are both short term and long term. The short term benefits of substitutionary fuels arise from the elimination of oil bills from our overseas trading list and the impetus given to economic recovery (including employment) from the afforestation of dedicated woodlots and fuel manufacture. The long term benefits include:

- a) Elimination of NZ from the list of atmospheric polluters,
- b) The magnitude of the imported oil bill. If the bill were available as an annuity to Government, it would be able to repay the national debt within 5 years of the conversion being completed,
- c) The ability of government to eliminate the Public Debt, which would dramatically improve the value of the NZ dollar,
- d) The protection of EP land from further loss of topsoil,
- e) The protection of rivers and harbours from siltation, and
- f) A major step in the direction of creating a fully sustainable national economy.

If and when NZ plants EP land in new forests, its pattern of land use would be virtually set in a productive mould that could only be changed to favour a given sector by cutting down use in others. Self-sufficiency in food and energy means that stability of demand is an important goal. A key aspect of stable demand is a stable monetary system – the very opposite of what we have at present. To achieve it, we need to break the habit of using survey methodology that dominates economic theory and start to use scientific disciplines that can yield insights into the aetiology of human behaviour.

From news reports it appears that the most apparent "cause" of the depression is a massive amount of "toxic debt". Media analysis goes no further than this self-evident truth. Reference has been made to the banking practice known as securitization - a device for bundling unrelated securities and their debts into parcels capable of being sliced and sold regardless of the makeup, creditworthiness and uniformity of their contents. (Appendix A) Of the \$10.6 trillion of US residential mortgages outstanding in mid 2008, \$6.6 trillion were held by mortgage pools, presumably in the form of securitized bundles. Between 2004 and 2006 the share of subprime mortgages ranged from 18 to 21%. By October 2007 approximately 16% of subprime adjustable rate mortgages were either 90 days delinquent or the lender had begun foreclosure proceedings. This was about triple the rate of 2005. (Wikipedia) Competitive loan-chasing, securitization and the on-selling of securities had a lot to answer for in the financial woes of the US.

Outside America, very little attention has been paid to the characterisation of bad debtors. No detailed attention has been given to consumer debt arising from the purchase of chattels and services in NZ and the characteristics of its defaulters. No detailed study of bad debtors has reached the eyes of the public. The systemic failures that have shown up in the US in the form of subprime lending and its default rates that exceed those of prime lending by 3



to 5 times do not worry New Zealanders to the same extent, but their wash disturbs our waters. At this point, New Zealanders can, at their peril, stand aloof from issues of banking regulation but not from problems of adaptation to climate change.

On the banking front, however, the wiser course would be to ask the Reserve Bank to exercise its powers under section 74 of the Reserve Bank of New Zealand Act 1989. Specifically, the Reserve Bank should study the whole process of securitization. Behaviourally, the process appears to put the judgment function of approving a loan at hazard. Bank officers seem to be split into 2 groups: those who adhere to conservative lending by rejecting loan applications that fail the traditional tests of creditworthiness; and those whose attention is focused on quantum of mortgage sales. It appears to reward judgments based on throughput ahead of judgments based on likelihood of repayment. If the Reserve Bank is satisfied that the sale of securities in whatever form tends to diminish or devalue the frequency of tests for creditworthiness and so increase default risk, it should impose conditions banning the practice by registered banks. Such a ban could extend to single securities if laxity in applying the tests is found. In other words, banking regulation could be used to re-establish the unfashionable culture of savings and to discourage the maladaptive habit of consumer borrowing. Recessions and depressions are highly unpleasant experiences. Unless we learn how to avoid them, we are bound to repeat them. Avoidance must deal with maladaptive habits at the individual level.

The convergence of global oil and loan crises gives us the option of turning disaster into opportunity. Recession in America, Asia and Europe provide negative guidelines to the kind of conditions that can mop up NZ unemployment. That deployment can and should take the form of creating the infrastructure needed for forest fuels: highland EP forests and fuel processing plants. By shifting adaptation from the mining of fossil fuels to the sustainable management of energy forests, and by returning to sane, responsible banking practices, we create a basis for the confident prediction of income that is needed to avoid financial bubbles whose pricking has just disturbed world trade. More importantly for NZ, the relative stability that accompanies extracting fuel from land crops is inconsistent with the booms and busts characteristic of irresponsible capitalism. As time goes on, it becomes increasingly obvious that economic stability outranks blind economic growth.

New Zealanders are not attuned to the idea of economic stability and how to attain it. We always seem to be caught in the wash of big international players. Our role is thus reactive and passive when dealing with economic booms and busts. A shift to self-sufficiency in transport fuels could have more than a domestic effect. It would high-light a difference in dominant cultures influencing Government policies in the US and NZ in particular. The development of sustainable land management practices as they impact on energy use should have both an environmental and a financial effect.

NZ has a largely agricultural, pastoral and forestry economy with land management and diverse products providing the key to its understanding. In



such an economy, long term perspectives and stability are critical to success. US culture, on the other hand, is fully attuned to the mining of minerals, metallurgy and high technology. Rapid change is thus more natural and acceptable in the US than it could be in NZ. The model US citizen could readily be satirised as a gold miner, while the equivalent model for a New Zealander is still the farmer. Gold miners are essentially short term in their thinking. Farmers are not.

Money is just another commodity and is entirely man-made. For purchases of land, chattels and services, setting aside money through savings may not be an acceptable option in some circumstances. From the perspective of both borrower and lender, the ability of the borrower to set aside future income to repay principal and interest is the key to a workable lending contract. From their common perspective, a stable economy, capable of handling unpredictable variance in weather conditions, is the key to work and income retention and the ability of borrowers to pay on time. Clearly, that stability and the characteristics (i.e., habit patterns) of the borrower are the most important factors in determining whether a money-lending contract is in the interests of both parties.

Economic stability is not a concept that sits well with all New Zealanders. Many politicians have used "growing the economy" as a verbal lure to attract votes. Research may well show that, to a considerable extent, economic growth may simply reflect greater consumer use of energy. A shift away from oil in favour of forest fuels is attuned to policies tending to promote benefits in the form of an efficient financial system, stable employment, predictable quanta of fuel at the pumps, stable sales of fuel, and manageable levels of default under money-lending contracts. The pathway to a healthy environment can also be the pathway to a stable economy without the booms and busts that create billionaires and soup kitchens.

### Chemistry

Climate change experts share the view that the release of CO<sub>2</sub> from ICEs and the possible release of methane from Arctic hydrates pose immense dangers to human life. Hydrocarbons come in many forms. One of these is gasoline used every day in ICEs. The whole world seems to be either addicted to sniffing petrol fumes from vehicle tail pipes or would like to be. Compared with petrol sniffing, addiction to heroin and cocaine with their potential damage to human life makes conventional drugs look like bad habits in children.

Within this problem, the adoption of fuel cell vehicles and their propulsion by methanol raises a very important issue. In direct methanol fuel cells, the effective propulsion agent is hydrogen rather than carbon. Does a shift from carbon to hydrogen presage a shift from building up atmospheric CO<sub>2</sub> to building up water supplies? Olah et al. summed up the issue thus:

*"A switch to fuels that emit less or no CO<sub>2</sub> per unit of energy produced will be necessary.... Non-fossil fuel energy sources will.... need to play an increasingly important role to provide for our future energy needs.... Wind, solar and geothermal energy and energy from the combustion of biomass*



*represent an increasing – but still small – fraction of our energy needs. One of the main obstacles to a wider application of these renewable energy sources is their cost, as well as technological limitations."*

In this extract from their 2006 book, we can see the impact of cultural perspectives of scientific thought. The authors live in continental USA. Their country plays a leading role in agri-business, industry and IT technology by world standards. They see nuclear fission power inevitable on a massive scale in the future. That it is dependent on the mining of uranium makes it an unsustainable option, quite apart from the danger of proliferation and misuse by criminals. In NZ, by contrast, we already use wind and geothermal energy in the generation of electric power. This use helps us in our world third ranking for sustainable power. We are likely to extend this use. We are not likely to develop solar energy on a huge scale because we do not have massive deserts, subject to long exposure to sunlight, as a cheap resource base.

New Zealand's great natural advantage is our ability to grow anything. We already possess some 8 million ha. of forest. In addition we have some 2.7 million ha. of shrubland, some of it reverting to native bush. If we afforest a further 3 million ha. of EP land, we wind up with a potential 13.7 million ha. of forest biomass. The gross area of the North, South and Stewart Islands is some 26.6 million ha. Some of it (say, 5% or 1.3 million ha. at a rough guess) is high alpine rock, unable to support vegetation. Roughly 3.3 million ha. is covered by lakes and highways. This would leave some 22 million ha. as a resource base for vegetation. In the future, New Zealand's cover of forest biomass could possibly amount to 62% of productive land area. When environmental benefits are put into the equation, New Zealand's long term energy option is obvious – it must be biomass-to-energy for transport purposes. Equally important is the 38% or 8.4 million ha. available for food production. As time moves on, New Zealanders can expect to find themselves increasingly involved in value judgments when choosing between conservation, energy, wood and food uses of land. In the absence of new land for exploitation, economic growth can only come from doing it smarter. Creating a stable balance between human wants and soil capacity will become an increasingly obvious goal.

The methanol option needs to be put in perspective. The potential yield of 8.751 billion litres of pump fuel looks like a promising beginning to replace an annual consumption of 8.1 billion litres of gasoline. However, the energy potential of methanol is only 50% that of gasoline, but rising if used in gasoline blends. The practical implication for ICE vehicles is that the potential energy yield of new plantations is only about half that needed to replace gasoline. However, if used in fuel cell vehicles, the hydrogen-rich component of methanol reverses the energy yield so that it becomes roughly equivalent to the gasoline performance in ICE vehicles. Long term, New Zealand's strategy for transport purpose is:

- a) Forests to wood chips from wastes, residues and dedicated wood;
- b) Wood chips to methanol;
- c) Methanol in fuel cell vehicles;



- d) Methanol to gasoline (M85) blends, diesel and aircraft fuel for large volume use.

The Olah comment on cost and technological limitations needs to be put in perspective. In terms of trade balance, the elimination of the oil component in imports would represent a huge national advantage. The afforestation of EP land would represent a huge environmental advantage. The comment on cost does not square with American studies of biomass wastes. The comment on technological limitations merely reflects a long American history of scientific neglect of biomass-sourced energy, associated with a mining approach to economic goals. It strongly points to the need for NZ to establish its own research and development pathway to self-sufficiency in transport fuel usage. At this point, we need to overcome half a century of scientific neglect of our economic fundamentals.

### Vehicle design

If NZ reaches the position when its conversion to a substitutionary fuel is likely, the choice of methanol will be of intense interest to car manufacturers. The American Methanol Institute has already recorded a list of manufacturers who are moving steadily towards the production of fuel cell vehicles later this century. If NZ is identified as a methanol user within, say, 5 years, the advantages of direct methanol powering of fuel cells will be so obvious in this market that it will provide an important stimulus to changing the power base of at least some models of automobiles. Furthermore, the change could:

- a) Release manufacturers from the suppressive influence of the oil companies,
- b) Speed up technological innovation and
- c) Provide an economic stimulus in the direction of energy efficiency.

There is a further possible influence on the domestic economy. With:

- a) The recent technical developments in robotics,
- b) A domestic power base,
- c) Domestic production of steel and aluminium, and
- d) Domestic production of parts such as car trim and tyres,

the conditions for a domestic manufacturing base of vehicles exist.

### Suppression

From the US there have emerged a number of reports of attempts to prevent new inventions affecting automobiles from being commercially exploited. Mostly, the inventions targeted have been of the "free energy" variety. One of the reporters, who gives his name variously as Gary Vesperman, or Gary Vesperman Henderson, alleges that oil companies and banks have been involved in some 4000 incidents aimed at suppression of inventions. They include Standard, Atlantic Richfield, Shell Oil Company, World Bank and Wells Fargo Bank. Vesperman further alleges that victims of suppressive action include:



- a) Dead, missing or injured inventors, activists and associates: 53
- b) Energy inventors threatened with death: 13
- c) Energy researchers and associates imprisoned: 16

In NZ it is impossible for us to evaluate claims of intimidation made by individual inventors and commentators such as Vesperman. However, the position in the US is different. Their academic world is concerned at implications of suppression on the US economy. Kurt Saunders of California

State University, Northridge, and Linda Levine of Carnegie Melton University\*, for example, have this to say:

"Some inventions never see the light of day. Others enter the spotlight after long delays and the factors which slowed the arrival of that invention are ignored. Technology suppression is a real occurrence involving known and widely used products. In this article we examine the topic of energy suppression, seeking to reveal the tactics of suppression...."

From the experience of innovation suppression in the US, we in NZ would be wise to absorb a lesson. Some very powerful interests operating in the US seem to be averse to competition. Whether innovation comes from individual inventors in the US or from elsewhere in the world, those interests have money in huge quantities available to quench what they might judge as embryonic competition wherever it may appear.

This leads us to a balanced view of commercial competition. From the everyday experience of competitive retail services, competition can yield variable prices for consumer goods. However, benefits of this kind cannot be expected from all forms of competition. When technological development is threatened or slowed by "competitive" intervention, public interest demands its control. Politicians and legislative advisers have not yet come to grips with this problem.

From New Zealand's perspective, the development of dedicated energy forests and processing units for methanol should start at around the same time. Of course, the processing units could not draw on the new forests for raw material but could draw on wastes from native forests, scrub clearance and residues from plantations. The strategy of choice would be to settle on the most efficient number and positioning of processing plants and to start small, with single productive modules per plant. In this way, processing units have the opportunity and the motivation to learn rapidly from experience and to adapt and improve their technology. The suggested strategy is merely a variation on the theme that successful businesses should start small and grow naturally.

\* "Better, Faster, Cheaper - Later: What Happens When Technologies are Suppressed." Michigan Telecommunications and Technology Law Review, Vol. 11, No. 23, 2004.



### Action programme

Methanol technology based on wood gas has progressed very little since its origins. Clearly, it has a long way to go. As time goes on, it would be expected that processing methods will change considerably. By starting with small modules per plant, it would be simple to add modules of updated design as time goes on and the resource base expands. A slow build-up to full productivity suggests that the status quo for imported fuels should remain undisturbed until a reasonable level of production is reached by the substitutionary fuels.

At the point when production levels justify national distribution, imports could be discontinued on a replacement basis. This scenario suggests:

- a) Initial output from processing plants should be exported rather than distributed;
- b) Existing exporters and distributors of oil-based fuels should be consulted on takeover method;
- c) The existing manufacturer of methanol from natural gas in Taranaki (Methanex New Zealand Limited) should be consulted on a possible agency basis for the export of initial output;
- d) Regardless of the taking up of an interim export agency, Methanex output should be taken into the national distribution system at the takeover time;
- e) The terms for complete methanol retail sales in NZ should be discussed and (hopefully) settled when an agency deal is on the table;
- f) At takeover time, the most useful form of methanol offered for sale and use in ICE vehicles is likely to be in a blend of methanol (85%) and gasoline (15%) – known as M85 – to facilitate quick starting;
- g) Existing retailers of motor spirits should have the opportunity to apply for distribution rights when the takeover date approaches;
- h) To the extent that existing distributors are not interested in a substitutionary fuel, other retailers with suitable premises should be able to apply for distribution rights.

The emerging picture of a takeover of imported oil products gives us a shadowy picture of an organisational pattern. One of its most obvious components is the necessity of government and private interests to work closely together. Capital and management must come primarily from the private side. From government, a variety of legislative supports will be essential. So will the negotiating muscle vested in cabinet. (See Appendix B)

Government possesses the right and the power to represent New Zealand's position and policy to foreign governments and international organisations, and to offer New Zealand's co-operation in similar developments to nation states with the capacity to handle forest management on a large scale. Because the methanol scheme provides a pattern of adaptation to fuel needs not involving carbon, government, from a position of power, is able to handle the avoidance of the Emissions Trading Scheme. That position derives from



basic reform of global energy supply. NZ is thus able to handle problems of recession from a position rooted in fundamental economics rather than from a position derived from a symbol system (money) manipulable only by plunging further into debt – possibly, unmanageable debt. It is noteworthy that the federal government of Australia, mired in ancient mining culture, has recently announced its anti-recession package: a cash payment of A\$12.7 billion to reach its people's pockets next April. It is a move designed "to stimulate consumption and protect jobs". It is also the kind of governmental knee-jerk expected from its culture. It does not purport to modify individual behaviour or to decrease the probability of future recessions.

We can now flesh out the concept of the "Methanol economy" beyond the definition of Olah and his associates. While energy drives an economy, money provides the control system. A stable money supply can back the creation and deployment of capital, the avoidance of recessions, the prevention and/or cure of environmental damage and the avoidance of economic bubbles. For it to work comprehensively, it needs massive physical changes, improved management and substantial mental adjustments. None needs to be beyond New Zealand's capacity.

#### Global change

In the first decade of the 20<sup>th</sup> century, nobody could have predicted the huge physical changes that actually occurred. Those changes included the:

- a) Large scale development of small scale transport units,
- b) Use of mass transit by air,
- c) Extensive lateral expansion of cities,
- d) Massive shifts of rural population to urban areas,
- e) Use of oil to feed an ever-expanding human population in apparent contradiction of Malthus' predictions,
- f) Mining of fossil fuels to predictable extinction and
- g) Accumulating evidence of climate change brought about by human activity.

In the first decade of this century we face a similar difficulty. However, we have a slightly more realistic perspective on our own contribution to change. We are beginning to question the validity of belief that technology can always supply an answer to human mismanagement, such as the destruction of topsoil. We are beginning to become uncomfortable with some evidence of global warming such as wildfires. We are beginning to see the shape of required adaptation to both physical change and the behavioural patterns responsible for it.

Take oil. As part of our global substance, petroleum oil represents layers of vegetable matter laid down millions of years ago and subjected to enormous downward pressure from later deposits. It is found in two forms: free and bound. The free form is the familiar stuff known and mined as crude oil. It is accessible to humans, shows varying degrees of viscosity and is cheap to extract and refine. This is the source of what we buy at the pumps.



The second form is relatively heavy, solid to almost solid in stored form (akin to bitumen and tar) and is mixed with an interwoven material such as sand or rock. Known deposits are as follows:

Region	Volume in billion barrels
Athabaska and Cold Lake, Canada	2500 crude bitumen
Orinoco belt and Maracaibo basin, Venezuela	1200 bitumen
Rocky Mountains, USA (incl. Colorado)	1500 oil
Brazil, Estonia, Russia and China	1100 oil
Total oil	6300

(Source: Olan, et al., 2006)

The heavily mixed oil deposits are difficult and expensive to mine and process, and are damaging to the environment during the extraction process. In the case of oil shale, it is mined in rock form. It requires large amounts of heat to extract the oil content (tar and bitumen) and leaves large volumes of shale after processing. A number of attempts have been made to mine heavy oil commercially but, so far, have been abandoned in the light of their costs. Competition from the conventional light oil deposits has suspended operations, but they are certain to revive when such deposits start to run down and so boost pump prices. It is at this point that forest fuels are likely to become both competitive and environmentally benign. What cannot be predicted, of course, is world governmental reaction to oil prices when sand and shale mining recommences, and environmental damage becomes more apparent, especially on the surface of the planet.

The automobile and oil industries grew up almost hand in hand last century. The auto industry suffered somewhat from suppressive influence on power input from oil. In spite of such influence, the auto industry has taken steps to shake off the dominating influence of oil. It has actively supported the move away from oil-dependent ICEs through its compromise hybrid models, its plug-in electricity models and its fuel cell models designed for either reformed methanol-to-hydrogen or methanol-direct input. Globally, the US move to introduce an alternative biofuel in the form of ethanol has back-fired on the previous administration because of its effect in reducing the global food supply. This has left methanol with a clean commercial and environmental record when it is extracted from sustainably managed forests grown on EP land. (For governmental implications, see Appendix B.)

### Timing

Forests intended for the processing of wood for material use are planted years ahead of the construction of processing plants. This is because of the time taken to grow a crop of trees and the much shorter time needed to build a processing facility. When forests are grown for energy purposes, the time factors change. Wood quality is no longer a major factor, as it is in furniture or paper manufacture. Wood quantity becomes the dominant feature, with the capacity for regrowth from coppicing a close second. (Regrowth is much



cheaper than replanting.) Tree spacing in energy plantations can be much tighter than in material use in order to take commercial advantage of fast early growth and because wood quality is irrelevant. As between wood and energy plantations, the normal growth period in energy plantations is about one-third or less of that needed for wood plantations. A hypothetical estimate of production from a dedicated forest resource is given in Appendix C. It assumes planting at the rate of 150,000 hectares per annum. A number of factors explain this substantial break with tradition:

- a) A disastrous crisis would confront the country if oil shipments were cut off without notice;
- b) The relationship between oil exporters and the NZ government is essentially a commercial one;
- c) From a commercial perspective, it may be desirable to misreport any major diminution in supply;
- d) The record of exporting states and oil companies in reporting their oil resources is one of massive unreliability;
- e) Every NZ government should take urgent steps to protect New Zealand's access to reliable sources of transport fuels before the run-down of the global oil resource becomes apparent;
- f) Existing scientific evidence suggests that it is already too late to take a leisurely look at self-sufficiency in transport fuels;
- g) The current recession provides an opportunity for labour to be offered both rural and urban jobs directly linked to the need for national self-sufficiency in transport fuels;
- h) A new forest infrastructure can provide exactly the kind of stimulus to economic growth most needed at present;
- i) Self-sufficiency in fuel would have a major favourable impact of our chronic trade imbalance

Processing plants for methanol production can be based on wastes and residues from existing forests, both exotic and indigenous. From this perspective, small initial plants should provide a starting point. Initially, such plants would be inadequate to yield methanol in replacement volumes for transport purposes, and for this reason their production should be sold in world markets.

Their main advantage, however, would be different. Their operations would provide a learning platform for technology development. Extracting fuel from wood has not been a major industrial task for some 90 years. The technology suffers from lack of intensive development and this needs to be addressed urgently. A few plants in NZ should provide the practical working environment needed for rapid scientific and technological progress to be made and to be reflected in the design of later productive modules.

Apart from technological development, early plant installation gives the fuel producer the opportunity to develop and train skeletal sales, marketing and public relations staff and to establish storage and distribution systems. It is likely that the initial non retail period would last some 14 to 20 years and cover the harvesting of 2 crops of new forest plantations. This period is expected to be one of declining oil production, increasing demand and escalating prices

for oil-based fuels. It should also be one of large profits for the oil companies. The period should suffice to put NZ into a position to effect a petrol takeover about the 2025 to 2030 period when oil stocks are expected by Hubbert's research to reach their last 10% of recoverable volume. During the period, the oil companies can be expected to take all possible steps to protect their market access and profits. For this reason, New Zealand's strategic interest in transport fuels will need protection by government.

There is another factor that fits a distribution delay scenario neatly. Fuel cell vehicles are expected to come into mass production about 2010. By 2025 to 2030, they should constitute a significant part of the world's automobile fleet. At that point, NZ should be in a position to take advantage of a large domestic vehicle fleet, powered by electricity, and with a strong demand for hydrogen or methanol as on-board fuel – both of which could be supplied by methanol, with or without reformation.

From the shock medicine proposed as a basis for Appendix C production, it will be noted that energy from new wood in 2050 is predicted to show a value of 31.41 PJ. This is about 29% of the energy value of transport fuel products imported in 2007 (110 PJ).

### Economic values

In summary form, the developments suggested in this report embody the following changes in New Zealand's economy:

Change	Implications
1. EP land use	<ul style="list-style-type: none"> <li>a) Expansion of forest nursery production.</li> <li>b) Planting by forest consultants and contractors.</li> <li>c) Logging at harvest time.</li> <li>d) Drying on site.</li> <li>e) Chipping on site.</li> <li>f) Transport of chips to processing plants.</li> <li>g) Selection and execution of coppice regrowth.</li> </ul>
2. Processing plants	<ul style="list-style-type: none"> <li>a) Design of plants.</li> <li>b) Construction.</li> <li>c) Operation</li> <li>d) "Refinery" design and construction.</li> <li>e) Transport of methanol to refinery.</li> <li>f) Construction of anaerobic digesters for methane production.</li> <li>g) Transfer of methane to plants.</li> <li>h) Transfer of finished products to retail system.</li> </ul>



### 3. Consequential production

- a) Vessels for coastal movements.
- b) Possible manufacture of fuel cell vehicles.
- c) Methane from urban and rural wastes.

### 4. Research

- a) Processing method,
- b) Fuel cell development,
- c) Intermodal transfer of liquids and solids,
- d) Movement of methane to processing plants,
- e) Processing of methanol into other transport fuels.

## Appendix A

## Securitisation

In the "Financial" section of this report, a suggestion is made that the Reserve Bank institute an enquiry into the use of securitisation practice of trading banks. As between NZ and the USA, discussion of the issue may suffer from verbal differences, such as:

- a) "Subprime mortgages" is a term used in the US to describe credit rating of borrowers. It covers loans to borrowers who do not pass the tests for first class creditworthiness customarily used by banks.
- b) "Second mortgages" is a term used in NZ to describe the rating of mortgages on the land title. It does not equate to the creditworthiness of the borrower.

Banking practice has traditionally involved the lending of money by trading banks, their collateral securities, management of the repayment process and the release of securities on final repayment. Tests of creditworthiness have been developed over some 5 centuries to assist the lender in choosing between loans (with or without collateral security) which it will approve and those that it will not.

The concept and related practice of bundling and selling mortgage obligations and securities is a relatively new one. It goes back to the nineteen eighties, at least in NZ. It means that buyers such as mortgage pools take over the management and release functions at some point after the initial contract is made. When banks part with such functions without recourse, their initial roles reduce to something akin to that of mortgage brokers. When the sale occurs, banks are no longer interested in the creditworthiness of borrowers. Their returns are limited to fees for the initial contract and interest up to the date of sale.

Securitisation enables each bank to look to the magnitude of mortgage turnover to maximise profits rather than the differences between interest paid to depositors or institutional lenders and interest paid by borrowers. This change creates essential conflicts of interest within banks. For loans retained, the creditworthiness of borrowers remains the critical factor. For loans bundled and sold to mortgage pools, the quantity of securities sold rather than the quality of borrowers could be the critical issue. The American finding that in 2007 16% of subprime adjustable rate mortgages were in trouble suggests that banks were relaxing interest in creditworthiness in favour of sales volume.

There is a scientific principle bearing on credit testing. Compliance with the credit rules can be viewed as a staff habit whose strength depends on the magnitude and frequency of its reinforcement (reward). Non-compliance can be viewed as a similar but inconsistent habit. From the bank's perspective as an employer, reinforcement of the compliance habit may come from either:

- a) A high rate of contract fulfilment of mortgage obligations, or
- b) A high rate of turnover of obligations secured by mortgage.

Option (a) comes only from retention of contractual obligations defined by the lending contract. Option (b) comes from the securitisation and sale of



mortgages. What the bank elects to do, therefore, determines which of the 2 inconsistent staff habits receives most reinforcement. From a behavioural perspective, any bank that is heavily into dealing automatically puts its staff and advisers into an impossible situation of conflicting habits, loyalties and rewards as they impact on habit strength. Economics has nothing to say on the aetiology of compliance or non-compliance with credit rules.

In NZ, investment and superannuation fund managers such as ING (NZ) Limited and their elderly clients may be suffering from lack of care in concluding mortgage loans. This lack of care may have been brought on by the marketing of securitised mortgage loans and reduced attention to the bank's credit rules by bank staff and its legal advisers. It is this possibility that should be investigated by the Reserve Bank as the first step in a programme of re-introducing economic stability.

## Appendix B

## Government Role

New Zealand faces a transition from dependence on accessible petroleum oil for its transport needs to dependence on renewable organic material, chief among which is forest wood. NZ cannot avoid the transition but it can avoid crises brought about by preparatory failure. The transition involves a shift from mining for a mineral product of unknown magnitude to management of land of known area but subject to competing uses. Groups primarily affected comprise:

- a) Land owners;
- b) Government;
- c) Fuel retailers;
- d) Forest managers;
- e) Transport operators;
- f) NZ Institute of Forestry

Destructive opposition to a planned forest takeover may arise from oil interests. Government support will be needed to protect the takeover against improper interference. Existing legislation will need review as follows:

1. Conservation Act 1987

The great bulk of indigenous forest in NZ will be managed in accordance with the provisions of this Act. Protection of natural resources is the major function of the Act. Those resources include forest trees but augmentation, enhancement and expansion are within the definition of protection. Consistent with the goals of the Act would be enhanced rates of tree growth. This could be managed by removing fully mature, dying and fallen trees. Removal would open the canopy to sunlight and so promote new growth and maintain the health of the forest. It would also provide energy wood, revenue from the sale of such wood and income to support feral animal control and tourism.

2. Land Transport Act 1993

Methanol is inherently safer to use as a transport fuel than is gasoline. Its lower volatility means that methanol vapour in air must be 4 times more concentrated for ignition to occur. In the US, the EPA has estimated that switching fuels to methanol would reduce the incidence of fuel-related fires by 90%, save more than 700 lives p.a., prevent some 4000 serious injuries and eliminate property losses extending to many millions of dollars. (Olah et al., 2006) The Land Transport Safety Authority of New Zealand would need to take these differences into account in carrying out its duties.

3. Dangerous Goods Act 1974

The detailed controls introduced under this Act should be reviewed after a takeover in the light of the greater safety of methanol.

4. Petroleum Demand Restraint Act 1981

Following a methanol takeover, this Act should be repealed. Whether it should be replaced would depend on the emerging situation. It could not be predicted at present.



#### 5. Transport Act 1962

The warrants and certificates of fitness required under the above Act will require attention if any ICE vehicle switches from gasoline to methanol. Some of the materials normally used in gasoline storage, distribution, devices and connections are incompatible with methanol. Methanol can corrode aluminium, zinc and magnesium. It can also react with some plastics, rubber and gaskets causing them to soften, swell or become brittle and fail. During a takeover period, all vehicles built for petroleum usage will require modification before they are safe for methanol use. This issue requires attention by issuers of warrants and certificates and by enforcement authorities.

#### 6. Forestry Encouragement Act 1962

This Act has been reviewed from time to time. Any national programme designed to replace petroleum oil with wood should be subjected to similar examination by key stakeholders such as:

- a) The NZ Farm Forestry Association,
- b) The Federation of Maori Authorities,
- c) Federated Farmers of NZ,
- d) The NZ Institute of Forestry,
- e) The Ministry of Agriculture and Forestry, and
- f) The Department of Conservation.

#### 7. Reserve Bank of New Zealand Act 1989

The Reserve Bank should be directed to report on securitisation under section 74.

### Finance

It is hard to imagine any form of investment more deserving of the label "infrastructure" than the creation of an energy source to replace fossil fuels doomed to be mined to extinction by mid-century. The establishment and extraction of forest wood for sustainable transport fuel must get top priority as a long-term economic prop, an immediate environmental mop and a high status investment. The respective contributions of private and public fund managers thus become a matter of predestined negotiation between representatives of private and public interests. Investment opportunities arise from:

- a) The design and planting of woodlots of rapid growing, coppicing trees;
- b) The planning and building of processing plants designed to strike an optimum balance between economies of plant scale and minimal transport costs for raw material and finished product;
- c) The creation of a nation-wide distribution system.

Structural planning can assist with an economical deployment of investment funds. It takes time to grow trees and to build up the equipment needed for a chip supply, even if existing forests can supply a part of the raw material supply. By building only single module plants initially, design engineers can minimise beginning capital requirements. This should enable at least some future building capital to come out of plant income and so provide an attraction to early investors.



New Zealand's geography suggests that a number of processing plants yielding methanol as a common first stage product could also supply the building blocks for specialised fuels such as gasoline, diesel and aircraft fuel. In combination, their corporate owners could form a parent company whose major commercial tasks would be the purchase of raw material, their processing at the nearest plant on a fee basis, any specialist processing required, and the national distribution of the various fuels. The capital of the parent company could come from the bodies corporate involved in the processing plants, its promoters, the Government, Maori Authorities and private investors as deemed appropriate.

### Forest Wastes

Wood, of course, supplies the raw material for both solid products and energy. Forests established for solid wood use are useful to energy processing to the extent that they are logged for solid wood purposes. Foreign competition, and especially competition from the illegal logging of tropical rain forests, currently excludes high quality domestic hardwood timber from domestic sale. Trees yielding such timber thus sit, untouched, in their parent forests while local merchants fill their warehouses from cheap overseas supply. From an energy perspective, such woodlots are out of bounds until tropical forests are destroyed or the NZ government takes steps to protect them in the absence of law enforcement from their own governments. From the NZ perspective, such protection is achieved very simply. The government could direct the Governor-General to issue an Order in Council prohibiting the importation into NZ of all hardwood timber pursuant to section 3 of the Import Control Act 1988. Such a move would free up valuable wastes from hardwood forests, native and exotic, in NZ and stimulate further planting of hardwoods. It would also encourage foreign forest owners to manage their indigenous forests for energy and material use on a sustainable basis.

The same Act could be used to protect the methanol takeover against any oil company spoiling tactics. A prohibition order could be issued against the importation of petroleum oil-derived fuels. Further, the government could assist the takeover by letting world manufacturers know of government interest in forest fuels and fuel cell vehicles. In this way, the government could promote both economic and environmental goals.

A parent company involved in the national distribution of methanol might be looking at a volume of 4 billion plus litres per annum. Its gross turnover could exceed \$6 billion annually. Its operations would have a major effect on the national import bill and on the economy. It would be in the national interests to ensure that product prices were affordable and that deliveries were accessible to all motorists. Common sense suggests that government involvement is essential. Any discussions with government on an action programme, overseas competition, statutory changes and active support must also raise the issue of government investment as a natural corollary of what would be, in effect, a public-private partnership.



Through a previous government, NZ is heavily involved in the Kyoto protocol and the ETS trading scheme. A forest fuel scheme, of course, avoids the need for ETS because it,

- a) Shifts the basic energy carrier from carbon to hydrogen, and
- b) Removes CO<sub>2</sub> from the atmosphere and stores it in plants during their growth phase.

From this perspective, some remarks from the Potsdam Institute for Climate Change Research are revealing. The report on carbon markets for ETS (May 2008) covering NZ concludes:

*"Keeping in mind these ambitious goals as well as the projected increase in energy demand by 2030 and the somehow limited scope to significantly reduce emissions below a certain threshold, achieving carbon neutrality will require major efforts to transform the country's energy system. For this reason, we expect that abatement costs for New Zealand will clearly exceed those of most other regions considered in this study."*

To which NZ could respond: "But not if we sidestep the whole problem by intelligent adaptation that accepts human addiction to gasoline as a fact of life."

## Appendix C

## Dedicated Energy Plantations in NZ

Hypothetical planting and harvesting timetable  
(Harvest age 7)

Year	Planting (000 ha.)	Plant area (000 ha)	Harvest area (000 ha)	Harvesting (million m <sup>3</sup> /a @ 20m <sup>3</sup> /ha/a)	Methanol yield @ 3900 l/ha in billion l	Energy Content (PJ)
2011	150	150				
2012	150	300				
2013	150	450				
2014	150	600				
2015	150	750				
2016	150	900				
2017	150	1050				
2018	150	1200	150	3	.585	10.47
2019	150	1350	150	3	.585	10.47
2020	150	1500	150	3	.585	10.47
2021	150	1650	150	3	.585	10.47
2022	150	1800	150	3	.585	10.47
2023	150	1950	150	3	.585	10.47
2024	150	2100	150	3	.585	10.47
2025	150	2250	300	6	1.17	20.94
2026	150	2500	300	6	1.17	20.94
2027	150	2650	300	6	1.17	20.94
2028	150	2700	300	6	1.17	20.94
2029	150	2850	300	6	1.17	20.94
2030	150	3000	300	6	1.17	20.94
(Dedicated forests now fully planted)						
2031			300	6	1.17	20.94
2032			450	9	1.755	31.41
Ditto						
2037			450	9	1.755	31.41
2038			300	6	1.17	20.94
2039			450	9	1.755	31.41
Ditto						
2045			450	9	1.755	31.41
2046			300	6	1.17	20.94
2047			450	9	1.755	31.41
2048			450	9	1.755	31.41
2049			450	9	1.755	31.41
2050			450	9	1.755	31.41



TABLE 42

## Estimates of Cost of Transport Fuels from Non-Petroleum Sources in New Zealand

Source	Process	Product	Stage of Development	Capital (\$M/PJ/YR)	Downstream Costs	Resource Size	Indicative Costs (\$/GJ)	Market Size (PJ/YR)
Condensate	Refining	Gasoline	Operating	-	None	20 PJ/YR	3-4	80
LPG	-	LPG	"	-	Med.	10 PJ/YR	2-3	10
Natural gas	Reforming	Methanol	Adv.	7	Med.	Limited	3.5-4.5	10
	Mobil	M-gasoline	Pilot	11	None	"	4-5	80
	Synthesis	Gasoline	Adv.	6-8	None	"	3.5-5	80
		Methane	Adv.	-	High	Large	1-2	20
Coal	Synthesis	Methanol	Adv.	15	Med.		5-6	10
	Synthesis	Gasoline	Adv.	12-15	None	Large	5-6	80
	Pyrolysis	Oil	Adv.	-	None		4-5	140
	Hydrogenation	Diesel	Pilot	12+1	None		6-7	40
								Medium
Wood	Synthesis	Methanol	Adv.	15	Med.		6-7	10
	Synthesis	Gasoline	Adv.	12-15	None		6-7	80
	Mobil	M-gasoline	Pilot	16	None	Large	8	80
	Hydrogenation	Diesel	Lab.	18+	None		7-10	80
	Hydro. Ferm.	Ethanol	Adv.	22	Med.		10-13	10
Crops	Sugar Ferm.	Ethanol	Adv.	14	Med.		10-13	10
	Hydrocarbons	Gasoline	Lab.	-	None	Medium	6-10	140
	Fermentation	Methane	Adv.	8	High		5-6	20
Gas	Electricity		Adv.	12-15		Limited	4.5	20
Coal	"		Adv.	20-25	High	Large	5.5	20
Wood	"		Adv.	20-25		"	6.5	20
Nuclear	"		Adv.	50-60		Imported	8	20
Oil	"		Adv.	15		Imported	8.5	20
Hydro (new)	"		Adv.	25-30		Medium	7.0	20
Geothermal (new)	"		Adv.	25-30		Medium	7.0	20

## Appendix E

## 11.2 The Renewables Scenario

The Renewables Scenario builds on the Renewable Electricity Case presented in Section 8.2. It adds the energy efficiency improvements discussed in Section 11.1 above, and makes some extra assumptions about expected advances in technology. As in the Renewable Electricity Case, we assume that coal-fired generation is phased out by 2014 and that there are no gas imports before 2030. In addition, we assume coal is replaced with gas or biomass in industrial boilers by 2019. We do not assume the availability of 'medium confidence' renewable resources, as in the Renewable Electricity Case presented in Section 8.2.

To make up for the shortfall of gas- and coal-generated electricity, we assume ocean wave energy becomes available after 2015 at a cost of around 10.2c/kWh, which is at the low end of the potential range suggested in an analysis by PB Power.<sup>22</sup> This would still make it more costly than most conventional new plant generation costs (compare to Figure 8.1), but not by a huge amount. Since a new technology would probably be taken up gradually, we limited the amount of new wave generating capacity installed to 250 MW in the 2020 period, 500 MW more in the 2025 period, and 1000 MW more in the 2030 period. Ocean wave generation emits no carbon, and would improve electricity reliability by diversifying the generation mix.

On the transport side, we assume road transport gradually converts to biofuels. Biofuels are liquid fuels produced from vegetable or animal sources. As discussed in Section 6.3, there are generally two types of biofuels: bioethanol (a form of alcohol), which can be used as a substitute for petrol, and biodiesel, which can be used as a substitute for petroleum diesel.<sup>23</sup>

Bioethanol can be mixed with petrol and used in modern conventional vehicles in concentrations as high as 10%. Higher concentrations require the use of specially adapted vehicles, usually 'flex-fuel' vehicles, which are capable of automatically adjusting to whichever blend of bioethanol and petrol is in the tank. Millions of flex-fuel vehicles are already on roads in North America, Brazil, and Europe.<sup>24</sup> Biodiesel in any concentration is basically compatible with modern diesel engines with little or no modification to the engine or fuel system.<sup>25</sup>

We assume biofuels make up 3% of the supply of road transport energy by 2010, 10% by 2015, 20% by 2020, 50% by 2025, and 80% by 2030. This transition is only possible if large numbers of flex-fuel vehicles are introduced after 2010. We assume all newly registered road vehicles in New Zealand will be biofuel capable (flex-fuel petrol or biodiesel) by 2015.



## Borders in a Democracy

February 2013

M. D. Malloy

The world confronts a threat in the first half of this century far more serious than the megalomania that led to 2 world wars in the preceding century. Instead of the politics of envy and military power, the world must deal with a different cocktail. Its components are sex, poverty and kindness. Sex drives underlie procreation in large areas of Africa and Asia. Poverty in those areas prevents the general use of birth control devices. Overcrowding and the threat of famine underlie a looming population drive to migrate to less crowded countries. Kindness and sympathy underlie a lack of forceful resistance to illegal immigration in countries with moderate populations and surpluses of food. Target areas can expect floods of hungry boat people before mid-century. Their numbers are frightening. They have been estimated as something like the numbers of people born in impoverished countries and surviving at present through state borrowings, cheap fuel and cheap transport – say, about 4 billion. Threatening a continuance of such births is the run-down of a finite deposit – unbound petroleum oil. Its mining is expected to reduce deposits to their last 10% by about 2030. That is when mining gets to be most difficult and expensive.

Starting in embryonic cities some 26 centuries ago, tribal leaders have guided their flocks in the task of survival. Since then, humans have played with the idea of self-government as a desirable alternative to autocratic leaders who, occasionally, used brutal methods to enforce compliance with their will. Very slowly, that experience has developed ideas on what ought to govern the relationship between the chief and the governed, as well as that between groups. Democracy has emerged as the common label characterising those enamoured of the self-government hypothesis. The few religious cultures now surviving have developed their own set of beliefs. Beliefs held by large groups encompass received wisdom on behaviour patterns appropriate to their own and (sometimes) other large groups exhibiting stable patterns of behaviour over time. The strengths and weaknesses of autocratic and democratic forms of government form a kind of debating battle-field for their supporters as fashions change over time and geographically.

For the analyst, the critical issue is the exercise of power within groups, particularly nation states. The test of power is typically found in the reported outcome of conflict and influence between and among large groups. For the most part, all that is now old hat. Human control of the global environment is now so overwhelming that the magnitude of world population has, to a considerable extent, usurped the focus of interest of analysts. Power is measured by population statistics and by human behaviour relevant to successful adaptation of the species. A critical aspect of such behaviour is the power of human reproduction.

A popular aphorism that has been tossed into arguments from time to time is the statement that the pen is mightier than the sword. Swords and laws have their roles to play in history but so does sex. A glance at magazine shelves demonstrates that vast industries and





commercial activity are focussed on sexual attractiveness. That issue obviously commands enormous popular attention. It is part of the human "success" story covering domination of the species throughout the world. Clearly, sex is mightier than words.

Through the pen, society has developed a powerful method for controlling the behaviour of its citizens. Its formal implementation is achieved through the statute books and law reports, backed up by the courts. Its sphere of application is the nation state. Its no-go areas include other states and the bedroom. Within the bedroom, sex is more powerful than the pen. Supporting evidence is recorded by population statistics. In spite of two world wars last century, world population has escalated from 2 billion in 1927 to 7 billion in 2012. Growth of that magnitude is statistically abnormal. It took from the dawn of time to reach 1 billion in 1804. It took 123 years to reach 2 billion in 1927, but a mere 33 years (including one world war) to reach 3 billion in 1960. That's when birth inflation really set in. Succeeding billions were achieved in 14, 13, 12 and 13 years successively. Current projections suggest 15 years will be needed to attain the 8 billion mark in 2027 and a further 19 years to reach the 9 billion mark in 2046. Population projections for 2050 are a low of 7.4 billion and a high of 10.6 billion. (Wikipedia) Both recent and projected increases are heavily skewed geographically. Europe, America and Oceania are noted for successful birth control. Africa and parts of Asia are not. Relative prosperity seems to make the difference.

So much for human procreation. What about the environment? The mining of non-renewable "resources" and soil degradation resulting from excessive use of fertiliser threaten the world's habitable size. Uncontrolled, procreation capacity points inevitably to a damaged, bleak environment containing a fluctuating (but generally rising) number of humans reflecting the outcomes of pressure and conflict. On the one hand the pressure will come from sexual power as measured by population statistics. On the other hand, pressure for food will be measured by food produced per state plus increasing food sales among states so long as that food is affordable. This is where rising transport costs will bite.

Geographically, the population damage is uneven. The most vulnerable regions at present are parts of Asia (e.g., India and China) and of Africa. The critical life support of humans is food. As populated regions reach the limits of their domestic capacity to produce sufficient food to feed their occupants, the occupants set out to supply their empty larders by buying food from other states with food surpluses. Sometimes buying states borrow money to fund such purchases. The run-down of oil puts states with food indebtedness into the severely vulnerable basket.

Historically, reproductive power has been more or less held in check by famine and (to a much lesser extent) by war. However, during the 19<sup>th</sup> and 20<sup>th</sup> centuries the development of science, industry, cheap energy and cheap transport fuels has rendered the classical controls of reproductive power seemingly unnecessary. Such a belief is illusory. It is based on the idea that oil will last for ever, rather than expire in the year 2057. The threat to human statistics popularly assessed as the likely number at risk of famine deaths this





century is roughly 4 billion. As populations in weakly managed states have passed the limit of supply available domestically, they have turned to importing food by the exploitation of cheap transport. Such states (with the notable exception of the United Kingdom) are typically impoverished. Most of them have been characterised as being in the Alert status group by the US think tank "Fund for Peace" and are recorded in Table 1. In all, the Think Tank has produced a failed state index with these results:

- a) Alert: 33 states;
- b) Warning: 92 states;
- c) Moderate: 39 states;
- d) Sustainable: 13 states.

This assessment of failure has been based on the criteria detailed in Table 1.

Table 1

Criteria for assessment of success or failure of states (Fund for Peace)

Social:

1. Mounting demographic pressures;
2. Massive displacement of refugees, creating severe humanitarian emergencies;
3. Widespread vengeance-seeking group grievance;
4. Chronic and sustained human flight.

Economic:

1. Uneven economic development along group lines;
2. Severe economic decline.

Political:

1. Criminalisation and/or delegitimization of the state;
2. Deterioration of public services;
3. Suspension or arbitrary application of law; widespread human rights abuses;
4. Security apparatus operating as a "state within a state";
5. Rise of factionalised elites;
6. Intervention of external political agents.

The criteria used enable us to make certain judgments on what can be expected when transport costs escalate because of the run-down of oil reserves. It is common knowledge that energy drives economies. States most vulnerable (those in the "Alert" category) become prime candidates for dissolution and panicked emigration when petroleum oil costs rise with the run-down of supply. This is because of the correlative drop in the availability of imported food. How will we identify the prime targets for migrant landing? The 13 states in





the "Sustainable" category of Table 2, of course. The 33 states in the "Alert" category (see Appendix) are only the most likely to provide large numbers of starters in the race for food security. There will almost certainly be others – most probably from the "Warning" category. And the likely targets? Primarily, those states in the "Sustainable" category which produce food surpluses and have a low citizen/arable land ratio. Following this rationale, the 13 target states, ranked 165 to 177 in the failure stakes, and sitting uncomfortably in the potential target category, are:

Australia	Luxembourg
Iceland	Norway
Netherlands	Switzerland
Austria	Denmark
Canada	Sweden
Ireland	Finland
New Zealand	

It appears likely that some of these states will not appear on most migrant menus for obvious reasons such as geographic area. They include Iceland, Netherlands, Switzerland, Austria, Ireland, and Luxembourg. This leaves Canada, Scandinavia and Australasia as the most probable targets for migrant assault, legal or illegal. What should NZ do about it?

In the academic world, it is taken for granted that research scientists must specialise. This practise consigns some of our most intelligent, innovative and skilled people to lifetimes of narrow professional work with their correlative perspectives. Broad issues such as the operation of motor vehicles emitting CO<sub>2</sub> to the atmosphere are, for the most part, outside those perspectives. Other people, typically unversed in science and including many legislators and commentators, have to deal with such problems. They have become familiar with the crunch issues of climate change: the warming of global temperatures, the extension of deserts and diminished useful rainfall. Some have latched on to the problem of increasing concentrations of carbon in the atmosphere and the logical remedy for hydrocarbon misuse: the substitution of hydrogen-based for carbon-based emissions in mobile fuel cell vehicles using electricity rather than internal combustion for power. It is the misuse of hydrocarbons that is primarily responsible for the woes of the environmentalists, the unemployed and the politicians. In New Zealand, the Scion report on "Bioenergy Options for New Zealand", 2009, pointed the way to a rational solution.

It is unfortunate for NZ that it did not point out the whole way. New Zealand has been heavily influenced by US political and industrial decisions on new age fuels. Of the two possible alcohols available to replace the unsustainable petroleum oil on its exhaustion, the Americans, under the leadership of President George Bush, have chosen ethanol. For NZ, the preferred choice should be methanol for these reasons:

a) First stage processing of raw material for methanol is gasification of raw material in any form, from grasses through wood to lignite and coal. Gasification is unnecessary for





methane hydrates, which are present in huge quantities in oceanic ice-held deposits stretching from Gisborne to Cook Strait. Methane gas could be fed directly into stage two of the methanol conversion process.

b) Ethanol processing from wood and wood fossils requires the separation and rejection of lignin, which can be accepted in first stage methanol production.

c) Methanol contains a very high hydrogen content, which makes it the ideal alcohol fuel to replace the carbon-high content of petroleum. (See Olah, Goeppert and Prakash, "Beyond Oil and Gas", 2006)

d) The population explosion of the 20<sup>th</sup> century was made possible by the availability of cheap oil. When oil runs out about the middle of this century (we may be down to the last 10% about 2030!), any substitute must be as cheap as possible to mitigate the cost increases associated with substitutes, none of which will be able to replace the cheapness of petroleum oil.

e) The long term interests of people throughout the world demand that substitutes for oil as a base transport fuel be as efficient as possible in energy terms.

f) Most dry organic material can be readily gasified.

g) New Zealand, with its experience of agriculture and forestry, its reserves of steep, erosion-prone land, and its low population density is well placed to produce an efficient biofuel replacement for mined-out oil. This is likely to increase its attractiveness to victims of state borrowings for food and add to New Zealand's migrant threat.

Overall, the reproductive power of humans can be, and is in part, controlled voluntarily. The problem areas are the most impoverished areas of the world. If birth control methods are available in such states, they will be beyond the buying power of most inhabitants. One way or another, this issue won't run away. The world must either find a peaceful solution or face a very unpleasant alternative. History up to the present day and population statistics tell us that procreation urges are far more powerful than the fear of death as drivers of human behaviour. To date, New Zealand has failed to work out that this principle makes nonsense of any Governmental claims to provide border security for its citizens when escalating transport costs render food imports in remote failed states impossible.

It's an intriguing thought that hosts of poor, hungry Africans and Asiatics may succeed where Hitler's armies couldn't. It is also intriguing to speculate on the implications of success. Will the arrival and admission of overwhelming numbers of migrants destroy the cultures of recipient countries?





## Appendix

### "Alert" index of failing states – Fund for Peace think tank (US)

Somalia	Kenya
Congo Republic	Ethiopia
Sudan	Burundi
South Sudan	Niger
Chad	Uganda
Zimbabwe	Myanmar
Afghanistan	North Korea
Haiti	Eritrea
Yemen	Cameroon
Iraq	Nepal
Central African Republic	East Timor
Cote d'Ivoire	Bangladesh
Guinea	Sri Lanka
Pakistan	Sierra Leone
Nigeria	Egypt
Guinea-Bissau	





## Survival Games

August 2012

M. D. Malloy

### Essay

For millions of years, planet Earth has circled its sun, absorbing its rays to energise growth of life forms - vegetable and animal. Those life forms are now dominated by man. He has the means to use, manipulate and destroy other life forms as he pleases. He is master of his own environment – and his own fate. The supportive environment which has nurtured mankind during his relatively short enjoyment of planetary dominance is blind to the loss of specific life forms. Huge numbers of species have already disappeared, courtesy of human behaviour, as his whims have directed. Now the abused environment threatens to kick back. In so doing, it has the capacity to halve approximately the human numbers, still growing this century. The environment can do this, simply by passive support of human power to self-immolate through uncontrolled procreation. Humans have long known that the pen is mightier than the sword. They have a very short time to learn that the penis is mightier than the pen.

Can humans avoid kick-back by planet earth? The essentials of survival are:

1. Humans must learn how to control birth rates so that they approximately equal death rates.
2. Carbon must be managed to maintain atmospheric storage at a volume needed to ensure that climatic temperatures are stable.
3. Management of energy must not result in climatic instability.
4. Global temperatures should be maintained at a level which protects methane stored in ice from melting and being forced into the atmosphere.

The basics of human survival on planet Earth boil down to 4 factors: food, shelter, transport and responsible government. For a number of impoverished countries, the first and third factors are interdependent because their population numbers have passed the limits previously set by domestic food production. For most of a century, management of world-wide famine, human mobility and the transport of goods have depended on the availability of cheap petroleum oil and on the avoidance of war. As availability comes to an end in some 45 years, mobility and transport need to find new drivers. Cut it any way you like, such drivers will never be as effective or as cheap as oil and its derivatives. They must make use of human-inspired and human-derived brainwork and effort. Inevitably, the resultant products will be more expensive than oil derivatives. Energy costs can only rise significantly compared with other costs. This points to a simple conclusion: humans must learn to develop efficiency in their selection, production, use and distribution of alternative fuels quite different from anything seen in the past. Economies of scale and movement must be achieved as never before. Selection of alternative fuels must be guided by research. Raw materials need identification, planning and development. Industrial methods possible in a



world supporting a medium density of the human population need rethinking in a world lacking general access to affordable energy. A plethora of state governments has achieved only partial success in avoiding war. The military view of history needs replacement by a discipline based on a broad inquiry into basic survival.

Take raw materials. New Zealand leaders, including those in politics, if any, would need to take note of a report published in July 2009 by Huber and Dale: "Grassoline at the Pump". The authors found that agricultural leftovers, wood and fast-growing grasses contained methane and yielded a large variety of biofuels, including the alcohols. Their report was almost contemporaneous with a publication by Scion on "Bioenergy Options for New Zealand" – its energy project for 2009 involving 17 researchers. The Scion report did not deal with the problem of costs associated with the transport of raw materials (wood, grass and leaves) to processing plants. Those costs may vary as between the use of land and water transport. The difference is likely to affect the cost of oil alternatives in NZ primarily because of the differential impact of vehicle friction on the environment – negligible in the case of sea transport and high in the case of land transport. Those costs affect afforestation, the movement of chips, and the damage to road surfaces caused by heavy trucks. They could be reduced by using natural harbours as key points in a national water transport system. The harbour components of such a system are given in Table 1. Nationally, the cost of maintaining state highways is not insignificant. In 2005, for example, State expenditure on the maintenance of highway surfaces (most of it necessitated by heavy traffic) was \$362.5 million and rising by about \$15 million per annum. We can expect the figure to be doubled post oil.

The Huber and Dale report suggests a new approach to the provision of raw material for alternative fuels. In NZ we are accustomed to seeing Toetoe and other Pampass grasses as weeds. However, we now know that they are rich in methane and well worth harvesting for mobile energy. It may be useful to plant them in association with energy woodlots.

Regardless of the motive power used in vehicles post oil (internal combustion engines [ICE's] or fuel cell vehicles [FCV's]) the end products are likely to be alcoholic. But which one? There are 4 to choose from: ethanol, methanol, propanol and butanol. What the alcohols share is a high octane rating, which tends to increase fuel efficiency and to offset the lower energy density of alcohols compared with today's fuels and leads to fuel economy as measured by distance per fuel volume. Butanol and propanol have the disadvantage of being more difficult to produce than either ethanol or methanol. They are produced by fermentation using the Weizmann organism which is accompanied by an extremely unpleasant smell and suggests that, for the immediate future, they can be ignored.

This leaves 2 alcohols for possible inclusion in a national energy programme: ethanol and methanol. Incredibly, no published data exist enabling us to determine their quantitative yields from a given volume of biomass. World governments must accept responsibility for failure to guide research into this area. Energy values favour ethanol for use in ICE's and



	Lyttleton
	Akaroa
	Caroline Bay
	Otago
	Bluff
	Waikawa
Stewart Island	Paterson Inlet (Total 26)

The demands of efficiency in the production of alternative fuels suggest a number of imperatives are needed in the makeup of the biomass-to-liquid fuel route when applied to NZ. The most obvious issues appear to be:

- a) Where should a plant or plants be located for the most efficient processing of biomass and other raw material?
- b) What conversion technology is most efficient for the preferred alternative fuel?
- c) Should NZ play a role in the production of FCV's?
- d) If so, should NZ seek to import basic skateboards and manufacture vehicle bodies?
- e) What are the most efficient methods for the harvesting of woody and non-woody biomass?
- f) What proportion, if any, of harvested biomass should be left in situ to maintain or enhance soil fertility?
- g) What technology, additional to that needed for the gasification and liquefaction of wood, is needed to harvest, transport and process methane hydrates in advance of the global melting of marine ice?
- h) Can the extraction and processing of marine hydrates be melded efficiently into land-based technology for the production of methanol?

methanol for use in FCV's. Methanol is also preferred for volume of yield from raw forest biomass because its primary stage of processing (gasification) accepts complete wood input while ethanol requires the removal of lignin (some 25% of wood input) before cellulosic fermentation can take place. To date, technology gives the nod to methanol.

Table 1

Possible harbours available for use as part of a maritime sustainable transport system

North Island	West coast	East coast
	Herekino	Parengarenga
	Whangape	Houhora
	Hokianga	Rangaunu
	Kaipara	Manganui
	Manukau	Whangaroa
	Raglan	Kerikeri
	Kawhia	Opua
		Whangaruru
		Whangarei
		Mahurangi
		Coromandel
		Whangapoua
		Tairua
		Wharekawa
		Whangamata
		Tauranga
		Ohiwa
South Island	Nelson (Total 8)	Picton
		Port Underwood



## Crunchtime: Democracy on Trial

February 2013

M. D. Malloy

### Population growth

In theory, democracy is a system enabling the people of a nation state to govern themselves in a manner that accords with their combined will. Over the last two centuries, it has failed to represent the interests of under-age humans and to act in the interests of the unborn generation. Further, democracy has introduced a new game into the ancient sport of managing power. Large groups within states have found ways to exploit the fluidity of public opinion for their own ends. From a global perspective, however, a different problem arises. It is the size of the human population. The human capacity to reproduce means that, undisturbed, population grows in a geometric progression. Individual differences lead inevitably to a large group of impoverished people in every country and a small number of relatively wealthy people. Environmental support conditions either do not grow or grow very slowly. The relative growth rates inevitably point to a declining standard of living for the human family and, finally, a slump in numbers. Leading the reduction in population will be those countries with a large proportion of impoverished people, a high density count per unit of land and low reserves of arable land and food. They are located mostly in Africa and Asia.

The political game in democracies is based on producing short term gains for group supporters at the expense of "loser" groups. It does not, and possibly cannot, serve the long term needs of its state or regional populations. Of necessity, electoral gamesmanship has put at risk the ability of the holders of state or regional power to prevent their electorates from suffering the consequences of human folly, perpetrated within the electorate's laws, and affecting the electorate economy. As the global population rises from 7 to 9 billion this century, the pressure on human resources also rises. The most obvious form of loss (but not necessarily the most significant), closely related to population increase, is the reduction of arable land through urban spread. The most pressing forms of environmental degradation are:

- a) Looming water shortages;
- b) Farming practices leading to loss of arable land;
- c) The exhaustion of cheap, unbound petroleum oil, expected about 2057;
- d) High and escalating market prices for transport fuels as raw material reserves of unbound oil start to run down, expected about 2030;
- e) The run down of exploration for new oil deposits, now visible;
- f) Rising temperatures;
- g) Oil company moves to extract petroleum oil bound in sand and shale and so perpetuate





the build-up of atmospheric carbon;

h) Impoverished, failing states; (See Appendix A)

i) Increasing frequency of extreme forms of drought and flood;

j) Soil degradation;

Result: we can expect increasing illegal migrant attempts to reach more benign countries by starving escapees.

We will return to the detail of these global issues shortly. Meantime, some related issues come to mind. Do they affect New Zealand? If so, what could the NZ government do about them? Do the issues, or some of them, involve international cooperation? Has the NZ government any duty of care, legal or otherwise, arising from inaction? What about local bodies? If such duty exists, to whom should it be owed? Should it be restricted to actual voters? How should it be created?

In New Zealand's case, it does not possess a founding document recording the duties of members of Parliament. Colonial self-government was imposed by an Imperial Act entitled "New Zealand Constitution Act 1852". This happened only 12 years after signing of the Treaty of Waitangi in 1840. Settlers (most of them from the British Isles) and Maori were not consulted. Compared with the constitutions of Canada and Australia, the independence of New Zealand appears to have been recognised with almost indecent haste. This may have happened because of the pesky machinations of the NZ Association (Company) in London, which included opposition to the Treaty of Waitangi and arguments favouring the establishment of a line from Mokau to Cape Kidnappers designed to confine Maori to the north and settlers to the south. Following passage of the Imperial Act by one year, the first provincial elections were held in 1853 and were followed by the first meeting of Parliament in Auckland in 1854. Self-government was established by Parliament appointing its own Executive Council members to act as responsible Ministers in place of appointment by the Governor.

A constitution defines a relationship between power holders and the governed. It is used in everyday company formations to establish rights and duties of the power holders – the directors. There is a remarkable inconsistency between the provisions of the Companies Act 1993 and the Constitution Act 1986. Under the Companies Act and its predecessors, its provisions and practice have established the duties owed by directors to shareholders. They are routinely recorded in Articles of Association or company constitutions. The duties of directors are referred to 8176 times, and in 663 sections of, the Companies Act. The people to whom those duties are owed are the shareholders. It is notable that no similar obligations exist between members of Parliament (who are all potential Ministers of the Crown) and their electors, in spite of the fact that there is no constitutional restriction on the collective powers of MPs or on the individual powers of Ministers granted by the collective will of Parliament. (The doctrine of state sovereignty can be, and is, used to oppose any suggestion of limits on the powers of Parliament.)





Furthermore, there is no defined population to whom duties of care are owed. Should such duties include infants, young people about to become adults, and the unborn? What about criminals and the incompetent? Should legislators be required to ensure that commercial practices do not damage the quality of the environment that will pass to offspring? If not, why not? Within companies, people to whom power is entrusted are required by law, created by Parliament, to exercise that power in a way designed to protect the interests of shareholders who entrusted them with that power. Within Parliament, MPs accept no comparable limitations or controls whatsoever. Without any supportive evidence, MPs believe that they are different from other people and, unlike all other citizens, are not in need of qualifications of any kind, supervision, management or control in the exercise of unlimited, delegated power. Bluntly, this is absurd.

Another issue not dealt with in the Constitution Act is the qualification of persons acting as Ministers of the Crown. By convention, all persons elected to Parliament are potential Ministers wielding the executive power of the state. Candidates for Parliament are not required to possess any qualifications for Ministerial office. The selection of Ministerial appointees is in the hands of the Prime Minister for the time being. Can any party guarantee that its candidates, if elected, will possess the raft of skills needed for the effective management of power granted to them by members of Parliament? Should candidates produce evidence of good character? Of trustworthiness? Of leadership capacity? From the perspective of the voters, quality protection starts with standing as a candidate. Every candidate faces the vagaries of voter preference. It follows that every candidate should possess the minimum qualifications to act as a Minister of the Crown or the leader of the House should be able, with Parliamentary approval, to appoint Ministers from outside Parliament.

In summary, the glaring deficiencies in the existing legislation boil down to:

- a) Lack of definition of the legislative responsibilities of successful candidates;
- b) Lack of definition of the persons to whom the duties of office (legislative or administrative) are owed;
- c) Lack of specification of the qualifications of candidates for legislative or administrative tasks;
- d) The absence of machinery to address breaches of duty;
- e) The issue of appointing Ministers from outside Parliament.

The glaring deficiencies in the constitution reflect the self-interest of Parliamentarians who were allowed to draft the relevant legislation without any voice from the governed. The deficiencies suggest that, as a whole, New Zealanders are both naïve and lacking in political interest.





## Population problems

### A. Water

At present, NZ does not suffer severe problems of actual or looming water problems apart from local deficiencies from time to time, and inefficiency in its use. The latter problem can be mitigated by developing efficiency, such as by the use of drip irrigation and by regulating to enforce efficient use. Globally, the story is different. Growing populations are putting ever-increasing pressure on stored water for drinking, hygiene, sanitation, industry and food. It has been estimated that by mid-century growing population pressure will imperil access to water for  $\frac{1}{3}$  of the earth's population. (Rogers, Sci. Amer., August, 2008.) It is certain that large numbers of people so affected will seek new homes. Some have already attempted to migrate to Australia. That trickle could turn into a flood, reaching NZ, if Rogers' prediction turns out to be correct. What will we do about it? Let 'em in, or boot 'em out? Test "em for citizen competence? Estimate procreation numbers? These issues are better faced now rather than later.

### B. Arable land

Lester R. Brown (Sci. Amer., May, 2009) argues for a world-wide effort to conserve soil. He suggests that the most important soil conservation measures are terracing the ground, planting trees as shelterbelts against windblown soil erosion and practicing minimum tillage. Contrary to the views of John Key and David Shearer, expanding cities outward to accommodate new housing is not a good approach. It would be far wiser to expand cities upward if population can't be contained. Such a policy would be necessary to save civilisation (his Plan B). Brown's proposed essentials would comprise:

- a) A massive effort to cut carbon emissions by 80% from their 2006 levels by 2020;
- b) The stabilisation of the world's population at 8 billion by 2040 (?);
- c) The eradication of poverty (how?);
- d) The restoration of the planet's forests, soils and aquifers.

### C. Cheap oil

Recent scientific research suggests that free-flowing, unbound oil will run out completely about 2057. This means that peak oil can be expected next year and we will be down to the last 10% (when oil will no longer be able to satisfy world demand), at the latest, by 2050. Inasmuch as cheap oil has made it possible for poor countries to import food as population growth has pushed past the domestic capability to produce, expensive oil will wipe out that option. People in food importing countries will then be forced to migrate or perish. This is the stark reality confronting the world. Four billion lives are at stake right now. The nightmare of massive deaths by starvation this century is already visible. We can forget about the turn of the economic wheel righting the present depressed conditions. That is just a 20<sup>th</sup> century pipe dream. From the NZ perspective, we have an option: we can plant





our steep country in trees as suggested by the Scion group of 2009 and, incidentally, reduce unemployment; or, we can sit back and await global famine deaths and the migrant deluge.

D. Rising temperatures

Michael E. Webber writes (Sci. Amer., January, 2012) : "...Climate change implies that food production will be hurt by crop losses from droughts and floods, salt water intrusion into aquifers, higher temperatures (which will decrease the effectiveness of photosynthesis in many places) and competition from biofuels for farmland. As a consequence, experts predict that food production will have to double by 2050. How do we do that? His first suggestion demands a little editing. He rightly suggests that Americans should stop using corn kernels for starch-based ethanol. Kernels should be used to feed people and livestock. The cellulosic stover (stalk and leaves) should be used to make methanol rather than ethanol because of methanol's more effective use of wood as raw material, its use of hydrogen rather than carbon for energy yield, its zero pollution effect and its high energy content when used in fuel cell vehicles. Further, the first stage gasification technology enables NZ to mine its marine methane deposits (vulnerable to melting as global temperatures rise) and feed them into the second stage liquefaction process with inputs similar to corn stalks (wood chips, grass pellets etc.) Webber also suggests that Americans could change their eating habits. Low energy grains could make a huge difference to efficiency if eaten instead of high energy eggs.

E. Bound oil

Both plantation forests and bound oil can provide the raw material needed for the processing of substitutionary fuels. In both cases, processing costs must substantially increase fuel prices. However, there is a major difference in environmental impact. Fuels drawn from bound oil can only continue the existing steady increase in climate warming. Fuels drawn from wood, grass and leaves will not. Unless there are major differences in cost, the forest option must win the popularity stakes, especially from the perspective of the unborn generation.

F. Failing states

Lester Brown raises the possibility that the failure of certain impoverished states could, in combination, bring down global civilization. His concern is a series of food crises in poor countries. He cites the failure of world grain production to match consumption in 6 of the 9 years preceding 2009. He points out that as demand for food rises faster than its supply, food-price inflation puts severe stress on governments "already teetering on the edge of chaos." When hungry people are unable to buy grain or grow their own, they take to the streets. If the situation worsens in succeeding years, we may find a significant number of food-vulnerable states at the same time becoming sources of terrorists, drugs, weapons, and refugees, threatening political stability everywhere. A list of the 20 most vulnerable states is given in Appendix A. Recent history suggests strongly that other states also





fall into the vulnerable category in that they cannot provide food security for their citizens.

#### G. Drought and flood

The burning of carbon in motor vehicles is the human activity that has now reached a level threatening human survival on planet earth through the build-up of atmospheric CO<sub>2</sub>. If we want to stop the process, we must stop burning carbon. Here, NZ parts company with the USA. Scion heralded the move in NZ when it advocated the afforestation of steep country. Trees yield both timber and energy. Mobile energy comes from (among other things) wood. The most obvious solution to the problem of storing carbon in the atmosphere is to release hydrogen rather than carbon from transport fuels. Simply taxing carbon release (e.g. Adele C. Morris in *Sci. Amer.*, April 2010, p. 43) does nothing to address carbon storage. Providing a commercial substitute like hydrogen hits at the core issue where the damage is done. The Scion suggestion addresses the central issue, leads to a practical and commercially acceptable substitute fuel, enables NZ to exploit efficiently an otherwise dangerous fuel embedded in ice beneath our coastal waters, promotes industrial and rural employment, provides a new outlet for investment and does all this by providing a market and a first class fuel for fuel cell cars that emit dribbles of water rather than the gas CO<sub>2</sub> from their tailpipes. America has nothing to teach us on this topic. This is largely because their scientists cannot rid their thinking from their dominant cultural belief in man's fundamental right to mine the earth for its finite riches regardless of the wellbeing of future generations.

#### H. Soil degradation

In NZ, one of the steps open to us is the stoppage of urban sprawl. Farmers need to concentrate on their commercial knitting by the removal of sprawl enrichment on neighbouring rural land. Towns and cities must learn to develop upwards rather than outwards. Farmers should learn to work for enrichment by intensive use of arable land rather than by waiting for urban boundaries to shift their way. Third world states should refuse to allow clearance of tropical forests and other ecosystems. (See Eric F. Lambin, *Sci. Amer.*, April 2010 p. 43). In the US, farmers have been urged to use less fertiliser and, in corn country, to plant winter cover crops such as rye or wheat which help the soil to hold nitrogen. (Robert Howarth, *ibid*, p. 42) Howarth also deprecates the use of ethanol as an oil substitute and advocates the planting of grasses and trees to provide the raw materials for biofuels. NZ conditions, of course, are very different from those in the US, but also provide a pressing need to develop efficiency in more intensive farming practices.

#### Starvation migrants

A number of factors contribute to New Zealand's capacity to earn a living in the hard world of international trade. They include agricultural knowhow, a favourable climate, a substantial area of arable land and, above all else, a fairly low population density. That





density is at stake if illegal immigration is allowed to succeed. NZ cannot feed a significant proportion of the people predicted to die of starvation this century. (Such deaths could show up by 2030.) It follows that security dictates the need for a small but powerful and efficient armed force to protect our borders against illegal migrants. That force should be well armed in all its services, well trained and well equipped with modern surveillance equipment. The state of Israel provides a model of what a small state can do to defend its borders against invasion. If necessary, conscription should be used to ensure that adequate defence manpower is available at all times. The number of failing states who have exhausted their ability to feed themselves is without precedent. Cheap oil has enabled them to breed beyond the domestic food barrier. When the oil prop disappears, governmental weakness and a plenitude of small boats give their populations the means and the motivation to attempt anything that may prolong life.

### Conclusion

Let's face it – world governments have never before faced issues arising from an exploding global population of human beings and a finite resource base. Where stands democracy in this new world? Basically, the evidence available suggests that the quality of demographic governments as measured by intelligence, wisdom, leadership capacity, education and social skills is no better than the average expected of the parent populations. (We get what we want but not what we need.) Their interest in, and ability to make use of, scientific knowledge is spotty and limited. Their failure to address the issues discussed above probably reflects the lack of interest of their reference groups in topics seemingly remote from everyday experience. It is this narrowness of perspective and judgment that enables a governmental focus on appetitive drives, mobility and entertainment to bypass the inevitable conflict between unlimited human reproduction and finite global resources. In other words, we, the human family, get exactly what we deserve. (This conclusion may not please the inhabitants of Kaipara District.) The looming global future may include the frightful predicted population loss. So far, the signs of effective, survival organisation in a world lacking cheap oil are notable only for their absence.

In New Zealand, there is a possibility (a very remote one) that long term vision and planning may be seen as desirable and attainable. Our leading professional organisations could combine as a body to consider the pros and cons of developing a well thought out constitution for the country. The agenda of the body might encompass the issues discussed above and the possible contributions of science to the problems of future environmental crisis prevention and/or management. A survival scenario may include the design of a system prescribing:

- a) The makeup and role of a screening organisation charged with responsibility for establishing a system for testing candidates for central and local body office for the aptitude, character and leadership qualities needed;
- b) Recording and publishing the duties of people elected to public office;
- c) Punishment for failure to carry out duties in a competent and timely manner.





The New Zealand situation is generally one of low public esteem for the quality of work done by elected officials. It may be that that esteem is at its lowest ebb ever. It is timely to take another look at ourselves. We put them where they are. We get what we deserve, even when we don't like what the mirror shows. Is anyone up for a long term survival debate?

#### Appendix A Failing States

Twenty countries in the world closest to collapse according to Fund for Peace and Carnegie Endowment for International Peace.

Country	Pop. 2012 (m.)	Country	Pop. 2012 (m.)
Somalia	9.797	Guinea	10.824
Sudan	30.894	Bangladesh	152.518
Zimbabwe	12.974	Burma	48.724
Chad	11.274	Haiti	10.085
Iraq	33.33	North Korea	25.554
Democratic Republic Congo	69.575	Ethiopia	84.321
Afghanistan	25.5	Uganda	34.131
Ivory Coast	21.395	Lebanon	4.292
Pakistan	182.146	Nigeria	166.629
Central African Republic	4.576	Sri Lanka	21.278
Totals	401.461		558.356
Grand total	959.817 millions (approaching 1 billion)		
Current world population	7064.133		
Proportion failing	13.6%		
African states	11		
Asian states	8		
American states	1		





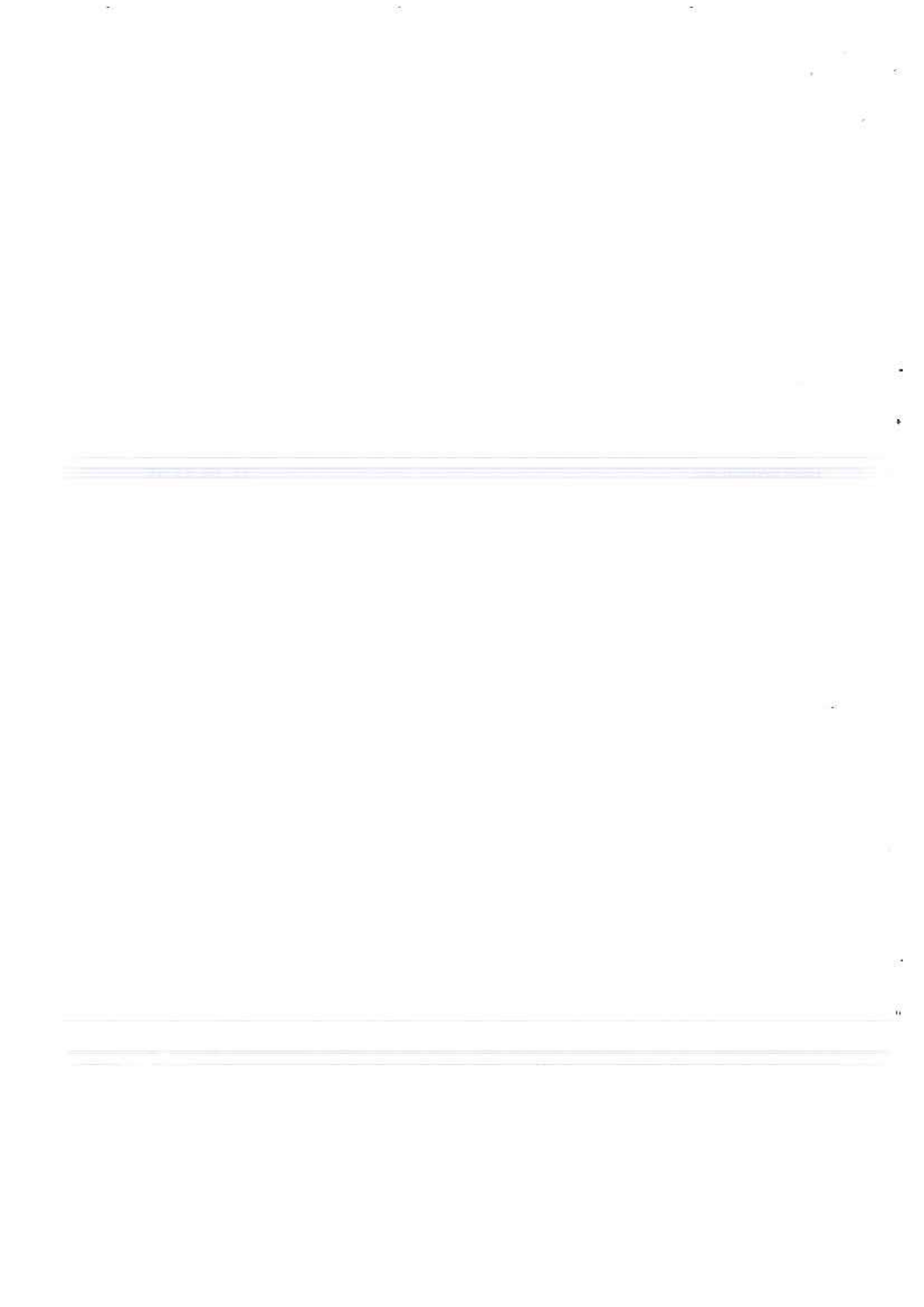
# SUSTAINABLE TRANSPORT FUELS





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## SUSTAINABLE TRANSPORT FUELS

July 2012

M. D. Malloy

### Problem

The world confronts a major crisis. It arises from the human habit of using unsustainable sources of cheap energy drawn from petroleum oil to drive the global economy. The habit supported the most significant increases in the human population and the global economy that history has ever recorded. The world has found an enormous range of practical uses for oil. They range from the obvious (e.g. lubrication and fuel) to the sophisticated (e.g. chemical intermediates like polyester, acrylic and nylon used in synthetic fibre production.) Oil uses include inks, paints and coatings. That form of usage may comprise the largest number of petrochemical applications. (24)

Fibre manufacture can be based on either petrochemicals or wood. Wood's cellulosic content (viscose, acetate and copper) yields garment fibres and, in addition, can be fermented to yield ethanol. Taken together, these man-made fibres supplied 58% of global fibre demand in 2006. (5) Their production is energy intensive and, with their distribution, oil based. However, these are only the beginning of oil dependency. Within automobiles, we find tyres, plastic components and petrol tanks drawn from petrochemicals. Around houses, we find a never-ending range of products including furniture, asphalt, kitchen utensils, hoses, buckets, containers of all descriptions and bags. A more detailed sample of products drawn from petrochemicals and their derivatives is given in Appendix 2. The current problem is that all mankind's clever manipulations have failed to provide an answer to the basic issues of sustainability and scale in the selection of substitutes. If we want petrochemical-based products, we will have to find substitutionary raw materials in quantity. (Natural gas constitutes a temporary replacement but is unlikely to last for more than 10 years after the run-down of oil. It will not be cheap.) It is unlikely that substitutes for such oil derivatives will ever be found at comparable prices. Evidence now available paints a picture of the post-oil economy very different from that of the present world. During the transition, we may expect huge changes, pressures and demands in everyday life unlike anything previously experienced. In some parts of the world, famine and famine deaths are expected to become a common experience.

Temporary conditions of oversupply of raw petroleum oil have led to cheap transport, domestic utilities, coatings, fabrics and food. Cheap oil has provided the material used in the

production of a host of products based on nylon, polyester and acrylic fibres. These usages of oil-based fuels have allowed the human population to blow out to unsustainable levels over the last century and have produced an extra 4 billion mouths to feed. The most vulnerable people live in the impoverished parts of the globe and rely upon imports to make up domestic food shortages. Those imports reach their consumers by land, sea and air transport powered by cheap petrol. That form of energy has just reached its maximum level of supply and should deplete to its final exhaustion point between 2050 and 2057. At current levels of production and investment, petrol is likely to cease to provide a commercially useful service for the world within about 10 years. Thus, the year 2022 represents the best available estimate of the time when the cost of transporting food to impoverished hungry people in the northern hemisphere will become finally beyond their purchasing capacity. In 10 years' time the world may experience a famine unlike anything previously experienced. Should New Zealanders worry about comparable raw material prices? Take items such as fabrics and house framing. We can produce substitutes drawn from wood. The catch is that exotic forests grow on land and require planning, finance, propagation and planting. These processes are necessarily more expensive than the simple mining of oil. They demand incursion into low food-producing areas. Their adoption as an addition to the farmers' productive repertoire will drive up land prices and, therefore, the cost of land products. From whatever angle we approach the run-down of oil, its loss means that huge numbers of oil-derivative consumers will never become substitute consumers.

The NZ government funded the Scion project. That project set out to quantify New Zealand's capacity to grow energy forests in hill country – specifically, steep, erosion-prone land – and produced an extremely valuable report. Nothing has been done to implement its suggestions. Whether the government has been influenced by American experience with the distasteful first generation biofuels is unknown. It seems likely that the current US government knows little or nothing about second generation biofuels, and is not interested in finding out how the negative aspects of the first generation may be avoided. The ideology of its previously dominant political party is heavily market-oriented and may contribute to a hands-off stance on transport fuels. Such a stance becomes maladaptive in a country like NZ whose major economic advantages are its soil capacity, climate and population density enabling it to grow virtually anything.

From a political perspective, failure to act becomes grossly irresponsible. Our overseas trade figures give one outcome. According to the Business Herald of the 21<sup>st</sup> June 2012 "For the year ended March the deficit (trade) widened to \$9.7 billion, equivalent to 4.8 % of gross domestic product. That is up from 4.2 % in December and the biggest it has been since June 2009."

In 2006 Olah, Goeppert and Prakash published a book (18) giving a full account of the processing of wood to wood-gas and from wood-gas to liquid fuel (methanol). It showed how the global economy could switch from carbon fuels and carbon emissions to hydrogen



fuels and water emissions and so bring to an end the man-made influence on climate warming. NZ is in a position to implement the methanol economy by addressing its own erosion land problems and so end up killing three birds with one stone (climate change, soil loss and vulnerability to fuel shortages). For NZ, the sustainability production of mobile energy boils down to new farm crops, new wood processing, new vehicular fuels, efficient land use, and expanding employment opportunities. Given a world population containing massive numbers of people dependent for survival upon imported food, one of the major issues confronting the government in a world without oil should be careful attention to efficient farm land use for sustainable mobile energy and food.

Global stores of unbound petroleum oil will be at or approaching exhaustion by mid-century. What factors, if any, are hindering effective adaptation? Global stores of any mineral useful to man face depletion as an arithmetic progression. Human population grows as a geometric progression. The slowest geometric progression always overtakes the most rapid arithmetic progression. The solution is obvious in its essentials. In the area of mobile energy, man must eschew quick but unsustainable fixes of wasting global "resources" and make use of sustainable raw materials such as producing fuel from energy-rich wood, leaves and grass whose sustainable growth is powered by the sun. (Science can help with developing production efficiency.) Man must cease to destabilise climate by releasing accretions to atmospheric carbon. The oxidation of hydrogen must replace the oxidation of carbon in the technology used for mobile energy. In the messy world of politics, man must somehow learn how to plan, invest and regulate for long term survival rather than short term profits. Because of its level of technology and favourable population/arable land ratio, NZ may be the only country able to give a lead in basic survival techniques.

In the past, land use in NZ has been heavily influenced by the need for, and marketability of, food. Mobile fuels have been imported, while domestic oil has been exported. This pattern should change this century. As free flowing petroleum oil runs out, the big oil companies will attempt to use their huge reserves of cash to exploit massive deposits of raw oil, bound in sand and shale, as the natural replacement of unbound oil. This course would represent a continuation and extension of the carbon economy. Climate change would remain an unavoidable aspect of the world to which humans must adapt or perish. The initial work to extend the carbon economy beyond the extinction of free oil is already under way. The oil companies would like to see its position (and theirs) set in concrete. The implications for the environment are horrendous. Support for this move is where governments around the world are heading. They can do this with a show of respectability because planet earth contains petroleum oil bound in sand and shingle deposits as well as unbound, free-flowing oil. The bound deposits are huge. Their drawbacks are:

- a) They must be mined on a large scale;
- b) They must be freed from their bindings at considerable cost;



- c) They must add enormously to the atmospheric concentration of carbon by processes extending well into the next century;
- d) They will be responsible for continuous and indefinite deterioration in climate;
- e) Their use will incur considerable cost increases for fuels;
- f) They may have a significant depressive effect on the world economy;
- g) They will lead to a structured dominance of the world economy by large oil companies

NZ is in a position to challenge the oil companies' push for dominance. Theoretically, two alcohols could challenge gasoline as sources of mobile energy: ethanol and methanol. Both are liquids and are efficiently marketed as liquids. Both are hydrocarbons. Of the two, methanol appears to release its rich hydrogen component as a source of power in fuel cell vehicles more readily than does ethanol. (18) The US has taken a kind of lead in moving to replace the world's carbon economy with a hydrogen economy. American land use has been substantially switched from growing food to fuelling the family car. Thus, global consumers of corn grow thin, American farmers grow fat and American taxpayers grow angry. The US has made three serious mistakes:

- a) Fuel in the tank has replaced food in the stomach without compensatory adjustment of food production;
- b) A better choice of alcohol would have been hydrogen-rich methanol for use in the growing market for fuel cell vehicles.
- c) Only the cellulosic component of wood can be fermented to produce ethanol.

The lignin content of wood cannot be fermented and must be extracted and rejected for ethanol production. The major lesson for NZ, if it wishes to learn from the American experience, is that low-producing land growing wood in volume should be the primary target as a source of energy production. All tree material can be used in methanol production (including leaves), plus grass. So can natural methane gas, currently in danger of spontaneous release from ice storage as global temperatures rise. More intensive production of food from residual farm land should be developed as a consequence. In other words, NZ farming as a producer of energy raw material must increasingly become guided by efficiency in its management of hill and rolling country.

### NZ Government Policy

For effective adaptation to a world confronting the run-down of free oil deposits, New Zealand needs to adopt four major changes in its mode of living:

- a) It must adopt a carbon-neutral emissions programme (or lower) for transport of all kinds;
- b) It must work towards shifting its vehicle motive power from internal combustion engines to fuel cells in all transport modalities;
- c) It must adopt a shift to energy-efficient methanol for use in fuel cell vehicles as its dominant source of transport fuel;
- d) It must adopt the protection of erosion-prone land by energy forests as its key move to



provide a permanent solution to the two problems of finding a sustainable source of energy for transport and of stabilising soil on steep land.

Shifting from oil to biomass as the source of energy for transport means a shift from carbon build-up in the atmosphere to the creation of a methanol economy. That economy will pose no source of pressure on global climate because the growth period of dedicated trees will absorb all the carbon subsequently released to the atmosphere by methanol burning. This is what is meant by carbon neutrality. In a hypothetical world of expanding adoption of forest fuels, the carbon neutrality of energy crops equates to atmospheric reduction of CO<sub>2</sub>.

Like the rest of the world, New Zealanders are addicted to petroleum oil. By Hubbert's law, free, or unbound oil, was expected to run out completely by about 2075. More recent research in Oxford suggests that the period suggested was too long. The Oxford expiry date is 2057. A French scientist, Yves Cochet (2008) has predicted that oil will run out in 2050 based on a statistical review of world energy by BP in 2007 (7). The more recent predictions throw light on old suspicions that some governments have exaggerated their countries' oil reserves. People with seemingly paranoid suspicions of government actions were correct. Similarly, the reserves were expected to run down to their last 10% (the beginning of the end of commercial exploitation) by 2030. That estimate will now have to be shortened to about this year! Governments throughout the world have done nothing about it. No fall-back position has been discussed or even contemplated. No comprehensive study of environmental damage to be expected by burning oil derivatives has been carried out. In North America, the big oil companies are attempting to protect their economic position by mining bound oil, freeing it from its binding sand or shale, and delivering the freed oil by pipeline from its point of origin in the Canadian Athabasca region to the US – all at the physical expense of the environment. So far, governments have not intervened. If the fall-back policies of the oil companies succeed, global warming can be expected to continue indefinitely because the magnitude of resources of bound oil, heavy oil and bitumen on planet earth is known to be substantial. The result of the oil companies' policy, if implemented globally, would be MAD – mutually assured destruction. Global temperatures must rise. From this scenario, Greenland and Antarctic ice shelves will melt and sea levels will rise to inundate low lying land, including the waterfronts of Wellington and Auckland. Ice bound methane hydrates will melt and release methane in huge volumes to the atmosphere. Because methane is about 25 times more powerful as a greenhouse gas than CO<sub>2</sub>, life as we know it on planet earth is likely to become extinct. This is what governments ignore. This is why massive numbers of books have been written to warn readers of what governmental incompetence means to them in real life. A sample of these largely unread books is recorded in Appendix 1.

Back to the history of trade negotiations. Recently, the lobbying influence of the big oil companies has come to light in part. Globally, there are some 28 oil and gas companies each showing a gross annual revenue in excess of 50 billion US dollars. Their revenue for 2011



amounted to some 4.5 trillion US dollars. The 7 largest companies by throughput show profits averaging 7.4% of gross revenue, which work out at an average of 339 billion US dollars apiece. What does this mean? With what should we compare \$US339 billion? In 2009 the New Zealand GDP amounted to some 127 billion US dollars. In the same year, the Australian GDP amounted to some 925 billion US dollars. Each of the 7 largest companies enjoyed a throughput greater than the GDP of NZ but not up to the GDP of Australia. In 2011 the revenue of the 28 largest oil companies was some 4.5 trillion US dollars. The GDP for the US in 2009 was some 14 trillion US dollars. The figures for the 28 oil companies are at least comparable – about a third of the US GDP. Post oil, will NZ wish to become a contributor to the oil companies' revenue and profits?

The most obvious problem confronting New Zealand's adaptation to the energy crisis is lack of general understanding of forest growth. Before trees can be planted they need to have seed collected and distributed. Nurseries are needed to grow seedlings to plant size – say, 3 years for preliminary work. Meantime, farmers need to complete preparatory work. Finance must be arranged. Woodlot boundaries need definition. Mortgagees need to be consulted, and to approve, financial arrangements and their security. Planters and forest nurseries need to be identified. Planting density needs to be set in place and silvicultural plans developed with harvesting time in mind. Once planted, woodlots may allow early harvesting to meet processing needs, possibly in the form of thinnings. All in all, at least 15 years should be taken into account to gain access to some supply of raw material for processing. During that period, a pilot plant will be needed for preliminary evaluation and processing trials followed by start-up production. Scientific research during the period should include inspection of and discussions with representatives of the failed (but technically important) German venture: Choren Industries, Freiberg, Saxony. (Biodiesel project.) Acquisition of a site for processing must take time. So will the plant's design, approval, financing and construction. Plant development time should fit into, and run parallel with, the tree growth period of 15 years. If we assume the development project becomes a matter of national urgency, we could possibly be looking at a start-up in 2027. If we allow 20 years of run down to complete exhaustion of cheap petroleum oil, we are looking at an alternative commencement date of 2037 for full takeover. That is just 10 years after the predicted year of initial processing.

How much planting could be expected annually? New Zealand's history gives some indication of the possibilities. The first nationally driven planting scheme occurred between 1922 and 1935. During those 13 years, Government agencies planted some 150,000 hectares while private interests accounted for a further 120,000 hectares – a total of 270,000 hectares. This works out at an average rate of 20,769 per annum. During the 1970's, planting took place at an average rate of 20,000 stems per annum. Let's assume that the nation adopts Scenario C of the Scion proposals. That would require the planting of 3,500,000 hectares and would take some 11.7 years at a rate of 300,000 stems per annum. That rate is 15 times the average planting rate achieved during the twenties and thirties.



If Parliament seeks to justify a claim to provide leadership of NZ, it must address the looming energy crisis. Its starting points should be:

- a) To find a sustainable solution to the problem of providing mobile energy;
- b) To develop a plan for establishing a public/private partnership to create and oversee the development of an adequate land resource for raw materials and an efficient processing system to convert raw material into a form of liquid energy that fits comfortably into the existing distribution system.

These starting points suggest that Parliament should work in close association with existing farmer organizations such as the NZ Farm Forestry Association and Federated Farmers of NZ and with local bodies. Progressively, development might look something like this:

1. A pilot processing plant should be established at Auckland in support of research on woodlot establishment and processing technology.
2. Long term, a major processing facility (not necessarily the only one) should be established at Gisborne to handle raw material from energy woodlots and marine ice storing methane.
3. Research. A wide range of energy-related issues plus the production of cellulosic and synthetic fibres and the mining of methane hydrates will require urgent research. The suggested pilot plant could play a major role in supporting such research.
4. Plantations of tree species selected for wood volume (energy) and wood quality (strength and durability) should be established nationally in accordance with the Scion scheme for stabilising erosion-prone land.
5. Trees selected for durability should produce wood with sufficient fibre density to avoid energy-intensive treatment.
6. Trees selected for strength should enable house framing to comprise timber dimensions allowing slimmer and fewer members.
7. The prime energy goal should be to produce methanol and biodiesel to replace gasoline and petroleum-based diesel.
7. A secondary goal should be to produce high quality wood not requiring energy-consuming treatment for construction purposes.
8. Regulation should be used during the transition phase and subsequently to protect the new fuels from unfair competition and pollution-producing fuels derived from bound or unbound oil.
9. Funding. Approaches to funding the suggested takeover of petroleum-based energy could include:
  - a) The government could use some of the capital acquired from the sale of shares in energy companies as loan finance for farmers developing energy woodlots;
  - b) The Government could use further capital from cashing in energy companies to provide guideline equity funding of a biofuel processing company named, perhaps, Forest Fuels Limited. (The writer has protected the use of that name.)
  - c) Farmers developing energy woodlots might like to invest in equities in the processing

company.

d) The public of NZ could be invited to invest in processing company shares.

### Democracy

Robert Dahl (8) records 3 critical stages in the growth and development of democracy. Some 2500 years ago Greece witnessed the first transformation: non-democratic city-states morphed into participatory democracies. Over the subsequent centuries, and as the population grew, broad participation in the government of city states became impractical, and led to the second transformation: representative government of nation states, showing up, for example, in the United Kingdom of the 17<sup>th</sup> century and in the United States of the 18<sup>th</sup> century.

Further growth in population and in the diffusion of information has led to the third transformation: the present. Dahl describes the development of transnational systems reducing "the political, economic, social and cultural autonomy of national states", including one as large as the United States. (Foreign creditor participation in its public debt of \$US15 trillion encourages the process.) The proud boast of the Roman legionnaire was "civis Romanus sum". Increasingly, educated people may see themselves as citizens of planet Earth rather than as denizens of a particular city or as members of a given nation-state. Nationalism may go the way of city allegiance – another fading definition of faith; another commonly held symbol with form but no substance.

It is not highly educated people who tread the corridors of Parliament. It is men in the street with a gift for verbal persuasion who appeal to men in the street. This appeal has nothing to do with leadership, wisdom, long term issues, knowledge, or the needs of the next generation. The business of government boils down to detecting and oiling the loudest squeak. It has to do with money in the pocket. It by-passes life support issues such as: (a) the run-down of cheap oil this century, (b) its implications for the production and sales of motor vehicles, (c) the costs of transport, (d) the composition and supply of grassland fertiliser and (e) the problem of providing a free oil substitute. One possibility in addressing the latter problem is the use of energy from sustainable sources like biofuels from biomass grown on erosion-prone, steep land as recommended by Scion. Those recommendations have been ignored by Parliament.

The Scion proposals are of special interest to farmers. Farmers own the bulk of the land deemed appropriate for the development of energy crops. Farmers would benefit from being able to use their low-value, uneconomic steep land to produce efficiently and in an environmentally friendly manner a commercial crop neatly fitting both economic and environmental goals. The public at large benefits through being able to buy alternative mobile energy grown and processed domestically. The unemployed benefit from finding new employment opportunities available. Government benefits from finding new sources of taxation opening up. Farmers benefit from finding a profitable use of low-value land. Through the opportunity to develop a processing company, they may also participate in downstream distribution. The world benefits from being able to compare an economy displaying a



low fire risk for vehicles with an economy suffering from high fire risk in vehicles. If some members of Parliament can't be bothered learning about novel land use and different forms of processing in a world confronting the run-down of its only large energy source for transport, they serve the interests of big oil and should not be in Parliament.

Both the theory and the practice of democracy in establishing governments during the 21<sup>st</sup> century are out of date and flawed. The man in the street has a basic understanding of, and empathy with, the man in the street. In its working out, democracy produces governing representatives who can readily understand the working of differing ideological principles favoured by varying social groups. Left wing and right wing parties merely display the prejudices for the time being of the dominant social group in each country by their varying fortunes at the polls. Leadership in realpolitik reflects the swing of the political pendulum among those social groups rather than variance in personal attributes. The result is that the task of government tends to become the plaything of that pendulum rather than an intelligent approach to the presenting problems of the public – the governed. Globally, the human needs of adaptation to the environment play second fiddle to a time-worn ideological game based on ignoring scientifically established individual differences. As population numbers assume a critical role in human affairs, the incompetence of political "leaders" thrown up by an outmoded ideology tends to lower their popular esteem to one of barely concealed contempt. The need for a selection system reflecting current problems of adaptation to an environment increasingly man-made has never been greater.

### Environment

The environmental failures of NZ pale into insignificance compared with the crimes committed in the northern hemisphere. Take the Aral Sea. In the first half of the previous century it was one of the four largest lakes in the world: it covered an area of some 68,000 square kilometres. If we compare it with the Great Lakes of Canada, the latter covered an area about 3.6 times that of the Aral Sea. That was before the Soviet Union went to work on Aral in 1960. By 2004, the area of the Great Lakes covered the ground area of Aral a whopping 14.2 times. Aral's waters had shrunk to 4 separate lakes. Those lakes covered an area of just 17,160 km<sup>2</sup> in 2004 – about a quarter of the 1960 area. They still served the original catchment area of 1.5 million km<sup>2</sup> in the basin countries of Kazakhstan, Uzbekistan, Turkmenistan, Tajikistan and Afghanistan. That region is now heavily polluted, with consequential serious health problems. Its weather has changed. The summers are hotter and drier. The winters are colder and longer. The fishing industry has been essentially destroyed. So has the region's economy. The cause of what has been labelled "one of the planet's worst environmental disasters" was the diversion of feeding rivers by large Soviet irrigation projects designed to promote the growth of cotton. Attempts to redress the damage have been undertaken, but with little effect. In 2008 the water level of the northern lake had risen by 24 metres from its lowest level in 2007. Some fishing has been restored. However, it is not expected that the damage done by interference with the rivers will ever be fully undone. (15) All in all, the Soviet diversion of water for cotton has only been matched by the American diversion of corn from food to fuel.

The lesson from Aral is this: man's ability to destroy the environment which supports life is so enormous that unless man can manage self-control, he may well wind up committing mass suicide. At the minimum, this factor strongly suggests that Dahl's analysis of international monitoring of



national sovereignty as it impacts on the global environment should be enlarged and international influence on the prevention of environmental damage strengthened.

The factor which reigns supreme in all issues affecting land productivity and security is human population. It is now counted in billions. Until recently, the periods needed to add 1 billion to the world total were declining. Mainguet (15) quotes the data in Table 1 for additions in the billions:

Table 1  
Growth of the human population

Period	Billions added	Gross billions	Years of interval
a) From time immemorial to 1830	1	1	Unknown
b) From 1830 to 1930	1	2	100
c) From 1930 to 1960	1	3	30
d) From 1960 to 1975	1	4	15
e) From 1975 to 1987	1	5	12
f) From 1987 to 2012 (Wikipedia assessment))	2	7	25 (2b. added)
g) From 2012 to 2040 " "	2	9	28 " "

These figures suggest that the rate of increase may have bottomed out with average periods of 12 to 14 years per billion, but at this time the future trend is mere guesswork. Mainguet records that the populations of the developed world (Europe, Russia, North America, Japan, Australia and New Zealand) declined by 1.26 billion between 1992 and 2001. It is in the rest of the world where growth is occurring. Mainguet's reference to the developed world looks impressive statistically, but the developed world defined by her probably represents only 22% of the world's total population. It is the developing world, with 78% of the global population, where the problem lies. Except for China and India, the developing world is most vulnerable to economic threats posed by the wind-down of unbound oil. Food supplies are bound to become more costly and more dangerous in those areas where imported food is a staple. Of course, nobody seriously expects governments to be able to control population growth, or the lack of it. What the population trend does do is to render 19<sup>th</sup> century thinking on constitutional issues grossly irrelevant.

The control of soil degradation is now an issue of public concern. Eswaran, Lal and Reich (9) report that the productivity of some land has declined by 50% due to soil erosion and desertification. They conclude: "On a global scale the annual loss of 75 billion tons of soil costs the world about US\$400 billion per year, or approximately US\$70 per person per year." Mainguet proposes a new goal for agriculture: "A new degree of maturity has become visible through numerous local approaches developed by groups of ingenious cattle farmers and agriculturists to escape climatic adversity, aridity and drought. These solutions no longer follow traditional patterns of land use or programmes imported from developing countries, but represent adaptive behaviour developed on site in the face of two major challenges: the rapidly growing population and the environmental degradation. These new approaches try to replace extensive environmental exploitation – still a common practice at the beginning of the 1950s – by intensive land use." Eswaran and associates take the issue further. They say: "Land degradation remains a serious global threat but the science concerning it contains both



myths and facts..." They suggest that the important challenges are:

- \*To mobilize the scientific community to mount an integrated programme for methods, standards, data collection, and research networks for assessment and monitoring of soil and land degradation.
- \*To develop land use models that incorporate both natural and human-induced factors that contribute to land degradation and that could be used for land use planning and management.
- \*To develop information systems that link environmental monitoring, accounting, and impact assessment to land degradation.
- \*To help develop measures that encourage sustainable land use and management and assist in the greater use of land resource information for sustainable agriculture.
- \* To develop economic instruments for the assessment of land degradation and encourage the sustainable use of land resources.
- \* To rationalize the wide range of terminology and definitions with different meanings among different disciplines associated with land degradation.
- \* To standardize methods of assessment of the extent of land degradation.
- \* To develop non-uniform criteria for assessing the severity of land degradation.
- \* To solve the problem of evaluating the on-farm economic impact of land degradation on productivity.

The importance of land degradation on basic food production can be glimpsed from statistics. The gross area of land on planet earth is some 14.8 billion hectares. The gross area of land damaged by soil degradation is some 1.96 billion ha.: about 13.3% of the total area, including mountains, urban areas and deserts. How will this loss fit future needs? According to a chemist employed by the California Institute of Technology, humans will need to generate more than 10 trillion watts of carbon-free energy by 2050. That is more than twice the amount of hydroelectricity that could be generated by damming every lake, river and stream on the planet. If nuclear power were used to bridge the energy gap, the world would have to build a new reactor every 2 days for 50 years. Needless to say, the world is not buying into that proposal. (19) However, the important issue is that human needs for both food and power increasingly put pressure on land use. Not just any use. It is now sustainable use that should make good damage to soil stability and productivity or, for preference, prevents such damage. That should be the world goal.

How can mankind attain such a goal? It is simple to work out where the damage originated. Burning oil derivatives as vehicular fuel involves burning carbon. It is the carbon component of CO<sub>2</sub> that does the damage in the atmosphere. The basic chemistry of hydrocarbons suggests that it might be possible to shift from burning carbon to burning hydrogen. Curiously, there is more hydrogen in 1 litre of liquid methanol than there is in 1 litre of pure cryogenic hydrogen. It is now possible to energise hydrogen without reformation via the Direct Methanol Fuel Cell. (18, p.191) This discovery is of major importance to future transport. It ensures that the tailpipe emission of fuel cell vehicles is a small dribble of water. The significance of these findings is that a global switch from oil to biomass-based methanol in fuel cell motors would solve the world's problem of maintaining a healthy and climatically stable environment. This, however, is merely the scientific finding. Governments throughout the world are not interested in science. It appears that the focus of their interest is money, and especially easy money. In NZ, for example, the government is actively pursuing the possibility that oil of some sort may be found in deep sea sites – regardless of the issue that any such discovery could only satisfy global demand (at the most) for a few days. More recently, government has displayed a willingness to trade its power to legislate on gambling for the non-governmental



financing of a convention centre in Auckland. In so doing, it has further weakened its power to limit the ability of gamblers to impoverish their families. It has also diminished public respect for its standing as a government of principle.

Only about 11% of the earth's land area is sufficiently warm, moist and level to be used naturally for food production. (say, 1.628 billion hectares – Malory{16}). In a world geared to promote human adaptation rather than economic pipe dreams, this area would define the limit of global land used for food production. In reality, the actual area is some 3.3 billion ha. In other words, population pressures have already compelled growers to turn to cooler, drier and steeper sites for food production. Cooler land requires more of it to compensate for slower growth. Drier land compels farmers to seek irrigation from nearby rivers, streams and lakes to supplement water shortages. Most irrigation methods are grossly inefficient. (Drip feed is rare.) Steeper land needs forest cover to prevent wind and water erosion of topsoil. Agricultural uses increase risk of such erosion, and are thus self-defeating. As population pressures increase, so will volumes of soil erosion. The evidence is clear; mankind has already reached and passed a critical point in adaptation to his environment. Mankind in general, and governments in particular, have failed to address, let alone solve, the problem of successful survival. Our basic mistake has been to ignore the implications of using an arithmetically finite resource (oil) to counter a geometric increase in human numbers. The developed regions where population seems to be under control are, proportionately, numerically insignificant.

Where have we all gone wrong? Among media journalists, issues like food and mobile energy don't rate a glance. Unemployable graduates get passing mention but journalists routinely turn to politicians for insights into their problems and, of course, come up with syrupy nonsense. Unemployment in NZ is a major problem, as it is elsewhere in the world. It can't be solved by finding the right addiction and by feeding it to the masses in some form. It can be solved by addressing basic issues of food, sustainability and mobile energy from the most recent perspectives thrown up by science and by acting on the insights. However, while the media are obsessed with trivia, the flow of relevant, problem-solving information to the public won't get through. Without it, we are stuck in an employment rut of our own making.

### Transport energy

New Zealand can't solve the world's problems on its own. It can, however, learn from those problems. The critical lesson is that, just as the human population needs food to survive, the world in general and the hungry parts in particular need transport energy to support mobility and to drive commerce. Transport energy is now an indispensable part of international trade. It is also the most difficult part to comprehend and manage on a long term basis. The world economy as we know it is unthinkable without convenient, safe, transportable fuel. To be useful, it must also be cheap. For practical purposes, the Scion proposal to grow the raw material on erosion-prone land is not just a good idea. It is a recipe (perhaps the only effective recipe) which could promote the health and development of the NZ economy in an oil-extinct world.

Some global statistics shed light on New Zealand's position. Population density throws no light on the production of food and energy in different countries because of variable areas of infertile land.



Arable land offers some insight into possibilities of combined production. A few examples of population density per square kilometre of arable land are given in Table 2.

Table 2

Population density for food production

State	World ranking for food producing density	Population/km2 arable land
Japan	34	2924
Netherlands	47	2205
United Kingdom	74	250
China	81	943
Germany	114	712
New Zealand	185	272
United States	205	179
Australia	218	43

A virtue of the Scion report is its capacity to address a number of problems. Sustainably managed, the Scion proposal would obviously help to solve the problem of wind and water driving topsoil from steep land, leaving bare rock only in its place. Successfully grown, processed and marketed, energy farming would provide farmers with a new, significant and welcome addition to their farm income. The Scion proposal would add value to unwanted, low value, vulnerable land and stabilise its soil. It should favour tree selection based on coppicing ability from stumps to obviate replanting after harvest. It could open the farming door to a new form of business: the processing of wood, bark, leaves and surplus grass into safe, mobile, efficient fuel (methanol), fitting well into both the existing commercial establishment and the most recent concept of developing power for motor-vehicles: the fuel cell car. This will involve the upgrading of processing method through research.

It does more. The technology developed to produce hydrogen-rich methanol requires the introduction of wood gas (essentially methane) to the liquefaction process. In principle, a methanol manufacturing unit could accept marine, ice-stored methane for second stage processing into transport fuel. The logical site of a major processing unit for NZ is Gisborne. It would have convenient access to both land-based forest growth of energy wood and sea-based methane hydrates extending from Poverty Bay to Cook Strait. The technology for mining the deposits needs urgent research to develop it commercially and to prevent the escape of methane gas to the atmosphere. However, the strategic value of the East Coast methane deposits is enormous. If NZ manages to by-pass the resistance of politicians to taking steps designed to protect New Zealand's dependence on mobile energy, its first step must be to create a sustainable, indigenous resource. Scion has suggested a workable programme for such a project: the afforestation of erosion-prone land of low value for food production. Whether that resource can be established in time for wood-gas to yield a liquid fuel meeting demand in a post-oil world in sufficient quantity remains a pure gamble at this point. Present indications are that governments over the next two decades will side-step the DIY issue in favour of big-oil companies offering the seemingly easy option of mining bound oil and charging whatever they like for the separated oil. This scenario will be highly damaging to the NZ economy but will represent death by famine to huge numbers of residents of impoverished countries. The evidence for such a prediction already exists. According to UN calculations, the world



life expectation at birth is 67.2 years. At 73.9 years, Tunisia marks the top 10% above world average – a group into which NZ fits comfortably (80.2 years). The bottom 10% is marked by East Timor with an expectation of 60.8 years. Within the bottom group, descending to a low of 39.2 years for Mozambique, is a long list of countries (133 in number) reading like a geography lesson on Africa and Asia. These are the countries which will be highly vulnerable to severe famine when the real cost of transport fuel escalates and food imports become a dream from the distant past. A sifting of country names recorded as having both low life expectancies and net imports of food reveals the apparent identity of the world's most vulnerable candidates for mass burials when cheap fuels run out – namely, Botswana (pop. 1.9 million as at March 2012), Cote d'Ivoire (pop. 19.3 million), Kenya (pop. 37.5 million), Namibia (pop. 2 million) and Swaziland (pop. 1.1 million).

From a political point of view, NZ takes a great deal of notice of what happens in the US. Its government reveals national inconsistency in addressing the problem of finding a replacement for petroleum oil when its store runs down. On the one hand, the US is the home of George Olah and his associates (18) who have publicized the properties of methanol that make it the obvious choice to replace gasoline. (Wikipedia seems to agree but suggests that the efficiency of fuel cells needs research attention.) On the other hand, the federal government has managed to get legislation through Congress that omits all reference to methanol. It refers to ethanol as if it were the only possible replacement for gasoline. The supporting legislation enables a switch of corn use from food to energy without any disturbance of the taxpayer subsidy. The scheme worked brilliantly. There is now a massive collection of ethanol plants accepting subsidized corn as raw material and converting it into ethanol. In turn, motorists have become accustomed to burning ethanol in their cars, typically in blends with gasoline. What brought about this choice of replacement fuel was the American farm lobby. (21) Economic values, scientific knowledge and international standing were distorted and/or ignored by the effects of the corn subsidy on its recipients.

The US became the top world producer of ethanol fuel in 2011 when it accounted for the production of 52.6 billion litres and 62.2% of global production. At the same time, Americans could buy methanol freely (but not at the pump) for \$1.00 per gallon. (19) The upshot of the Bush Intervention was that Americans paid \$1.60 per gallon for subsidised ethanol in 2010. The taxpayer and the motorist thus came to subsidise the use of the uneconomic ethanol. Almost nobody protested at the avoidable fuel charge of 60 cents per gallon! American farmers were "ecstatic". In one stroke, they almost doubled the yield from cropland.

The American intervention in food markets has certain unintended consequences. If China turns to the world markets for massive quantities of grain (as it did for soybeans) it will have to buy from the US. Customers in the US will then have to compete for grain with 1.3 billion Chinese customers with rising incomes. The US government will be tempted to control exports but will find it difficult to do so. American public debt now exceeds \$US 15 trillion, of which Chinese citizens hold over 1/15<sup>th</sup>. The upshot is that US consumers will have to share their grain with Chinese consumers, no matter how high prices rise. Three years ago, China was attempting to lease land in Australia, Brazil, Burma, Russia and Uganda. A Chinese company has now received official approval to buy farmland in NZ. Increasingly, NZ is being pushed into a position of critical choice. The greater the demand for farm-produced energy, the less land there will be available for food production. The problem is not merely one confronting NZ. Propelled by steadily rising population numbers, other primary producers face the same issue. The alternative, favoured of course by the oil companies, is to substitute heavy oil



and sand-bound and shale-bound oil as substitutes for unbound oil. This course, if applied globally, would add to climate warming indefinitely and is likely to lead to warming sufficient to destroy most life on planet earth. It is noteworthy that the big oil companies and the US government are already pursuing the bound oil course by mining the Athabasca sands and constructing a delivery pipeline from Canada to the US. They are fully aware of the magnitude of the Orinoco deposits of heavy oil in Venezuela amounting to a recoverable value of 513 billion barrels. They are also aware of global deposits of extra heavy oil (bitumen) so important to road work. They seem to assume that, regardless of the magnitude of the American public debt, the rest of the world now constitutes their commercial colony and will follow the oil dollar trail through transport use to destruction. (They may be right!) However, what emerges from this analysis should affect our agricultural and trade policies. Confronted with a Chinese and American consensus on prairie grain, New Zealand's potential to produce fuel from hill country (quantitatively insignificant by world standards) will not rate a mention.

In NZ, the planting options start with a choice of varying topographical maps. The 4 Scion scenarios involve the use of scrub, idle, marginal and low productivity land as base areas, expanding to larger resource areas progressively. Scenario A contains the greatest area of steep land as a proportion of the whole and scenario D the least. Thus, scenario A results in the least proposed interference with pastoral grazing and scenario D in the most. Perhaps the most valuable aspect of the Scion proposals is their potential to stimulate domestic vehicle manufacture by the ready availability of new age fuel. (12)

Propping up oil usage in NZ in two ways is the national preference for land transport, regardless of our island geography. Road maintenance bills reflect the use of machinery for working purposes and the use of bitumen for sealing. For the National Land Transport Programme of 2008/2009 the bill came to \$2.7 billion, an increase of 11% over the previous year. According to Roothing New Zealand, this amount was barely sufficient to preserve the then existing condition of the country's road network. This is now an area of extreme sensitivity as global unbound oil reserves reach their last 10% while population figures continue to rise. Can NZ afford to continue road maintenance as costs escalate? Should it examine financial aspects of water-borne transport in the top half of the North Island stretching from Tangiteroria to Cambridge with its prospects of near-zero costs of maintenance? Common sense suggests that safe inland waterways deserve careful study now. A possible consequential issue is: should NZ ban trucks from its main highways if there is a water route available for passage? A second is: could NZ instigate a deal with bitumen and heavy oil producers to trade biomass fuels for heavy and super-heavy oil? Such a deal could open the door to a global extension of plantation forests for large-scale transport energy and its trade for the small-scale and relatively unexploited heavy oils.

### Climate change

The other side of the disappearing oil coin is climate change. Cities around the world, including those in the US, are setting out to reduce the sources of climate change. Motivating the move is the geographical position of most of them. Some 86% of urban residents in wealthy countries live and work on low coastal land that is at risk of flooding from rising sea levels. Around the world, cities are beginning to address four interconnected issues: Reducing emissions, preserving water, keeping transportation systems moving and protecting public health. (20) Experimental research is producing



some insights:

- a) Higher CO<sub>2</sub> concentrations can enhance yields for crops such as wheat, rice, barley, soybeans and cotton, but in some locations ozone pollution may reduce or negate the effect.
- b) Deciduous trees are relatively insensitive to drought because of their deep roots but surface soils dry out quickly and cause high mortality among young seedlings and small saplings.
- c) In a CO<sub>2</sub> enriched environment, greater root growth could enhance the productivity of developing trees.
- d) Global warming and rising CO<sub>2</sub> concentrations could promote the invasiveness of many agricultural weeds, lowering crop yields and demanding more herbicides.
- e) Future CO<sub>2</sub> concentrations could impact public health, including pollens that trigger allergies, and lead to greater growth and toxicity of poison ivy and other invasive species. (26)

The interests of city residents are important but so are the interests of occupiers of low-level island states found in great profusion throughout the Pacific. Most islanders lack the capacity to migrate to higher country as sea levels rise. Carbon burning threatens their survival.

NZ climate and experience suggest that we may be able to profit indirectly from limited climate warming. This supports the need for a careful selection of tree species as energy crops on steep land. Within the list should be Eucalypt species because of their number, variety, growth rates, coppicing habit and wood quality – the latter property being common among a number of species exhibiting properties of strength and durability. Such species would yield highly acceptable timber framing, thus by-passing the need for the treatment of construction timber and, of course, the energy required for pressure impregnation. Another factor in species selection is the capacity of some to regenerate well from stump coppice growth following harvest, thus avoiding the need to replant for follow-on crops and so maintaining root vigour. The chemistry of using hydrocarbons as fuels raises the issue of CO<sub>2</sub> accumulation in the atmosphere. Burning carbon in motor vehicles has done the environmental damage up to the present. In future, the adoption of fuel cell vehicles would shift power input from carbon to hydrogen and most emissions from CO<sub>2</sub> to water. Because the whole process of using trees as raw carbohydrate material will, of necessity, release CO<sub>2</sub> as well as water, the CO<sub>2</sub> will be taken up in continuing tree growth. This point has major implications for NZ. Americans want to use solar energy as the source of transport fuels. Their culture drives them to look first at mining technology. They naturally turn to photovoltaics as the tool enabling them to capture and use solar energy. New Zealanders just as naturally turn to plantation trees for raw material and the possibility that they may achieve multiple goals through such methods. Scion is right. If we plant trees to fuel cars, we might as well build houses from the tree crop and save treatment energy in the process. Let Americans keep photovoltaics to themselves.

At present, the presenting problem of atmospheric pollution is its carbon content. It is too high. We use trucks for transport purposes. Their internal combustion engines emitting carbon. What would happen if the world shifted from dependence on carbon to dependence on hydrogen? After all, oil is basically stored hydrocarbon derived from growing carbohydrates in the form of various plants. The wood-to-methanol route is somewhat similar to the corn-to-ethanol route. Both wind up converting carbohydrates into hydrocarbons and carbon emissions into hydrogen emissions. (They differ, of course, in their handling of lignin, about 25% of wood content. Ethanol technology rejects it. Methanol technology accepts it.) The findings from the use of ethanol as a fuel in North America are environmentally favourable. The CO<sub>2</sub> released from ethanol production and use is less than that



absorbed by the plants and organic matter used to produce ethanol.... By increasing its organic content, the soil acts as a significant sink for CO<sub>2</sub>. (Wikipedia) There is no reason to suppose that the use of the alcohol methanol rather than the alcohol ethanol as a gasoline replacement would have any different effect on the net atmospheric storage of CO<sub>2</sub>. However, we find a very different result if we compare oil to gasoline propulsion with wood to fuel cell propulsion. Emissions from the former accumulate carbon in the atmosphere. Emissions from the latter do not. In other words, methanol provides the complete answer to climate warming through gasoline emissions. Environmentally, the sooner we shift to a hydrogen economy, the less we need to fear extinction by intolerable conditions.

### Food

Michael E. Webber (26) writes: "Simple math shows that food production is an inefficient process. Plant growth is not energy-efficient: photosynthesis typically converts less than 2% of incoming solar energy into stored energy. That low rate is worsened when animals convert plant matter into beef (5 to 10% efficiency) or chicken (10 to 15%). We then ingest that food and convert it into human energy stored as glycogen in muscles and as fats – notably around our middle sections. Given the abundance of photons striking the earth every day, low efficiencies hardly seem to matter. But when faced with limits on land, freshwater, fertilizer runoff, and fossil-fuel affordability and emissions, the inefficiencies can be daunting. The energy used to make food is vastly greater than the amount of energy we get out of it. The US expends roughly 10 units of fossil energy to produce one unit of food energy.... The food energy needed to feed the world's 7 billion people is about 25 quads a year, which is only about 5% of the world's 500 quads of annual consumption. It is not that the rest of the world is more efficient than the US. Rather, one billion people are hungry, another billion are at risk of hunger and many more simply do not consume much."

Webber is clear, logical and, from his cultural perspective, right. This comment applies to his recommendations on drip irrigation, the avoidance of food waste, and no-till planting. From a New Zealand perspective, however, he is a short term thinker, and wrong in some of his conclusions. He suggests the conversion of agricultural wastes into power. They are probably better used to restore soil nutrients. Webber also suggests the laser-levelling of fields and GPS-driven machinery. This may not be practical in NZ, especially in the forthcoming high-cost energy era. His thinking and that of his compatriots could wind up putting the US into place as the biggest commercial colony of the big oil companies. It may also send the country into bankruptcy if its complacency builds further on a public debt of over US\$ 15 trillion, rising at the rate of US\$ 4 billion per day since 2007. Thanks Dr. Webber, but no thanks! The only lesson of immediate use to NZ is his insistence on efficiency, applied particularly to intensive food production. That is a lesson that NZ badly needs to heed, but especially if it decides to avoid becoming a minor commercial colony of the big oil companies. One of the implications of intensified food production in NZ will be the need to abandon speculation about "growth" in the national economy and to adopt intelligent care of resources as a leading national goal. We are moving into a new and different world. (16)

For food-producing countries the most important lesson to be learned from the run-down of oil is the global need to substitute intensive farming for extensive farming. An international team of experts coordinated by Jonathan A. Foley (9) examined this problem and settled on 5 steps that in 39



years could raise the food available for human consumption by more than 100%, while lessening greenhouse gas emissions, biodiversity losses, water use and water pollution. The 5 steps are:

- a) Stop agriculture from consuming more tropical land;
- b) Boost the productivity of farms that have the lowest yield;
- c) Raise the efficiency of water and fertiliser use worldwide;
- d) Reduce per capita meat consumption; and
- e) Reduce waste in food production and distribution.

Three of these points bear directly on the intensity of farming land use. The research team found that average global crop yield increased by only 20% over the last 20 years – far less than what has been typically reported. It is nowhere near enough to double food production by mid-century. It also estimates that agriculture has cleared some 70% of the world's prehistoric grasslands, 50% of the savannahs, 45% of the temperate deciduous forests and 25% of the tropical forests. The conclusion: agriculture's physical footprint is nearly 60 times that of the world's pavements and buildings. In spite of that dominance, humans confront massive abnormal deaths this century on a scale never before even contemplated (i.e., up to 4 billion lives) unless government intervention and intensive land use are successfully undertaken.

National success has now taken on a new meaning. It started with success in agriculture, with towns contributing to knowledge, finance, skills, commerce and education. Success in agriculture must now be redefined using criteria derived from food and energy production. It's a fundamentally different perspective. It supports a fresh view of the physical world and a revision of social values. It demands a revision of the role of the man on the land. Because cheap energy must become a thing of the past, the labour needed to produce both food and energy must become greater, more skilled and deploying different technology. Relations between town and country are likely to change and become more intimate. The foci of research are likely to change. Universities will need to modify their curricula. Individuals may need to learn and relearn specialist skills as the rate of change escalates. The relative status of generalist and specialist may change in favour of the generalist. To the survivors of oil-based change, the environmental message is: nought for your comfort.

Food trading comes in two forms: survival foods (mostly cereals) and the more expensive luxuries (meat, dairy products etc.) An issue of concern today is where the survival bullet will strike. It happens that a significant proportion of the global population is currently undernourished. They are the poor of the world. About one billion people now live in absolute poverty – their income is less than US\$1 per day. Their countries of domicile exist in South America excluding Argentina, Central America, Africa and Asia except Japan. Life expectancy in such countries tends to be short among the poor. Countries with low percentages of chronic hunger include Greenland, Canada the United States and Argentina in the American zone, Europe and Oceania (Australia and New Zealand). Such countries tend to be relatively wealthy and life expectancy relatively long. They include food exporters and importers of luxury foods. Post oil, only the well-to-do in the developing countries and the middle to wealthy classes in the developed countries will find it possible to buy imported (and, therefore, high cost) foods



## Transport

World-wide thinking on transport technology is dominated by the internal combustion engine. Its success has damaged popular ability to think outside its square. The success has not inhibited scientific innovation. Norbert Muller is a mechanical engineering professor at Michigan State University. He has invented a wave-disk engine that eliminates pistons. The device is the size of a cooking pot and requires less equipment than does a piston engine. The reduced mass and higher fuel efficiency could propel a plug-in hybrid car with regenerative braking as much as five times farther on the same amount of fuel, according to its inventor. He also reports that the device could cut manufacturing costs by 30%. His co-inventor is Janusz Piechna, an associate professor at the Warsaw University of Technology. He says that wave-rotor machines are already used in superchargers in some sports cars. (2) They are only one of a number of innovative devices poised to upgrade the technical side of motorised travel – including the use of new fuels.

Reference has been made to the perils of methane. NZ is geographically vulnerable to its climatic threats because of a major deposit of methane hydrates lying south of Gisborne and extending to Cook Strait, and a minor deposit situated close to Puysegur Point in Southland. A study of Arctic permafrost revealed that it is already thawing, creating lakes that emit methane. The significance of the thawing arises from the size of the permafrost area: it covers 20% of the earth's land surface. Currently, one third to one half of permafrost is within 1°C to 1.5°C of thawing. The scientific findings are that, at predicted rates of thaw, by 2100 permafrost will boost methane released into the atmosphere 20% to 40% beyond what would be produced by all other natural and man-made sources. Because atmospheric methane has 25 times the heating power of CO<sub>2</sub>, the earth's mean annual temperature could rise by an additional 0.32°C, further upsetting weather patterns and sea travel. (1) Governments have yet to come to grips with this current threat. Seen in this light, the moves by the big oil companies to extend oil use indefinitely are tantamount to a criminal attempt to profit from mass extinction of the human species.

Biofuels constitute the obvious alternative to the use of oil as a fuel. They go well beyond the comic moves by George Bush to turn subsidised corn into ethanol – a first generation biofuel. He made no attempt to protect corn (and subsidised corn at that) as a source of food. He made no attempt to make use of the full constituents of wood. (In his scenario, wood lignin had to be discarded so that the cellulosic content could be fermented.) He made no move to remove the subsidies attaching to corn production for food when shunting the raw material to a non-food use. As a result, first generation biofuels released a malodorous reputation that they did not inherently deserve. The afforestation scenario suggested for NZ by Scion solves a number of contemporary problems, including avoidance of the use of prime, food producing land areas. The scenario gives NZ the opportunity to provide world leadership in the huge task of weaning drivers off oil and putting them (and their supporting growers, manufacturers and distributors) at the head of the clean energy drive. It provides the NZ government with an opportunity to lead a move to heal the deforested land, to claim the global lead in addressing unemployment, to stimulate productive and relevant research, to control climate warming, to solve urban transport problems and to lead the move to put effective energy adaptation in the limelight ahead of mere economic "growth".

A major objection to adopting plantation wood as the raw material for transport fuels is cost. A recent paper of biofuels appeared under the eye-catching heading of "Grassoline at the Pump." Its



lead-up said: "Scientists are turning agricultural leftovers, wood and fast-growing grasses into a huge variety of biofuels – even jet fuel. But before these next-generation biofuels go mainstream, they have to compete with oil at \$60 a barrel." (13) That was nearly 3 years ago. A glance at the NZ Herald of the 30<sup>th</sup> March shows a market price for Brent Crude at \$US 124.26 per barrel. How things change when <sup>we</sup> neglect energy crops!

Inspection of the global atlas reveals that the 20 states most vulnerable to food-induced failure (with one exception) are located north of the equator. Some 20 % of the earth's land area affected by permafrost is also located north of the equator and therefore unable to grow essential grains. What happens when unbound oil stocks are depleted? Whether the grain producers opt for bound oil or biofuels to ~~energy transport, massive movement of grain from south to north can only take place if~~ consumers can afford substantial increases in food transport costs. Mostly, they can't. The conclusion facing the world is that we face the destruction of civilization. To meet the threat, Lester Brown puts forward 4 suggestions(his Plan B):

- a) A massive effort to cut carbon emissions by 80% from their 2006 levels by 2020;
- b) The stabilisation of the earth's population at 8 billion by 2040;
- c) The eradication of poverty; and
- d) The restoration of forests, soils and aquifers.

In discussing CO2 emissions, Brown (4) writes: " Net carbon dioxide emissions can be cut by systematically raising energy efficiency and investing massively in the development of renewable sources of energy. We must also ban deforestation worldwide as several countries already have done, and plant billions of trees to sequester carbon." Scion, take a bow! On the question of cost, Brown writes: "Yet the cost we project for saving civilisation would amount to less than \$200 billion a year, a sixth of current global military spending." Brown's credibility might be enhanced by a little less eloquence and a little more detail.

### Summation

The world faces an ever-expanding human population and declining resources, especially in oil and metals. Its population faces a rapidly changing future, sharing a belief in economic growth that is not based on the availability and cost of energy and on efficiency in commercial operations: the economic foundations of prosperity. New Zealand faces the future with:

- a) A low but avoidable level of unemployment,
- b) A constitution lacking both any definition of the duties of members of Parliament and any sanction for non-compliance,
- c) A culture of popular downgrading of the status of MPs and of tolerance of, if not support for, the mining of minerals (regardless of its impact on the welfare of future generations), and
- d) A significant area of steep, low producing, low value, erosion-prone land.

Its legal system lacks any constitutional protection of the environment and of the interests of youth and of future generations. Man-made changes to the environment now demand protective action to support (a)intensification of farm production from land not devoted to the production of energy, and (b)the use of erosion-prone and steep land for the production of mobile energy. In turn, energy and in particular the sustainable production of the raw material for transport fuels, should become a Parliamentary and scientific priority. The changes also demand the conversion of biomass from low



value land to farmland supportive of the raw material for transport energy, thus providing directly for human needs while mopping up climate-threatening atmospheric content.

An examination of the contents of Appendix 2 gives a glimpse of the huge range of manufactured articles contained in households. They are all derived from petrochemicals. When petroleum oil runs out, the world must either do without the products or must use other raw materials to produce intermediates and substitutes. In many (perhaps most) cases, the finished products will be significantly more expensive. While it is true that manufacturing methods must change to accommodate new materials, the market place must also change in directions that are now unpredictable. Massive productive and commercial uncertainty must be a component of major economic change showing up before mid-century.

The production of wood for energy can make use of legislation enabling the separation of new energy plantations from land devoted to pastoral use. (Forestry Rights Registration Act 1983) Finance may be needed for plantation development. If so, the legal separation of energy plantations from other use is possible and will be important for security purposes. Finance will be needed for the establishment of processing plants. This will require government involvement but need not involve government investment. It could take the form of encouraging investment by creating favourable conditions for the input of private capital. The construction of pilot processing facilities can be undertaken immediately based on input of raw material in the form of waste wood and vegetation. This would enable research to be undertaken a) in a realistic environment b) speedily while plantation crops are being established, and c) during their growth phase. It would also enable the early use of methane hydrates for energy ahead of their spontaneous release by climate warming. It should be recognised that spontaneous release of those hydrates could destroy life on planet earth as we know it by excessive climate warming.

If NZ were to shift the production of mineral fuels and vehicles to a domestic base, that shift would have a major influence on its terms of trade. Based on the latest available data (2010), NZ imports some 16% of its main import commodities in the form of "petroleum and products" and 9% in the form of "vehicle parts and accessories". Producing fuel domestically and vehicles in part domestically could cut some 25% off its annual import bill. A cut of this magnitude would represent a huge change in New Zealand's international standing and trading position.

Globally, NZ is a microcosm of actively governed states. (Somalia, Afghanistan and Haiti are examples of the 20 states least actively governed.) It contains pockets of knowledge among the public of issues, typically among an array of specialists, suggesting that something is wrong with the country's governance. There is no organization able to put the pockets together for examination of the big picture. The representatives don't know what they don't know. The result: NZ, like every country so afflicted, drifts through the shoals of a global environment severely damaged by man-made interference, like an old, rudderless boat. Failure to upgrade the boat could result in massive loss of human life this century through, for example, galloping, methane-driven climate warming. In other words, the realities of adaptation to an environment affected by man-made interference through an expanding human population make nonsense of any theory of governance, whether states are democratic, monarchic, autocratic or theocratic. We must remember that oil is only the first major natural resource due to run out shortly. It is likely to be followed by natural gas – say, about 10 years after oil and by metals – some 15 of them between 2012 and 2064, including gold,



silver, zinc, tin, lead, copper, nickel and platinum. The run-down of oil must cost lives – many lives. Its lessons will be hardest to absorb in states inheriting a strong mining culture. The key lesson is simple; we must all learn to live within our productive income. As a corollary: internationally, we must outlaw would-be cheats.

New Zealand's processing needs for wood-, waste-, and gas-based energy could be met by establishing a public listed company. Its major shareholders could be:

- (a) Government,
- (b) Participating farmers,
- (c) Local bodies,
- (d) ~~Other investors,~~
- e) Pension funds.

This raises the issue of foreign takeovers. That problem could be handled by company regulations providing that private shareholders by subscription or purchase must be citizens and residents of New Zealand. The directors would be responsible for ensuring that this regulation is strictly complied with.

Hanging over the people of the 21<sup>st</sup> centuries is a very dark cloud. It has a name: population pressure. It grows blacker by the day. In the 20<sup>th</sup> century it helped to spawn two world wars, a major slump, a number of minor wars and in some countries the illogical dominance of the miner over the farmer in public esteem. In the 21<sup>st</sup> century the economic game will be forced to change by visible resource depletion and the zero effect of warfare on population numbers. The global culture of the present century, if influenced by reality, seems bound to shift from mining to plant growth. Both materials and energy in everyday use will be fundamentally affected by the shift. The demand for fuel, food and wood to be supplied by the farmer will compel new learning, capital expenditure, intensification of land use, research, and expansion of rural employment. A question arising from that demand relates to lignin. The longer we postpone the shift to plant growth, the more difficult will be the transition and the more lives will be lost. The difficulties include the onset of conditions that in the past have induced widespread warfare.

Throughout the world, Greenies protest at the man-made damage done to the environment by a host of interventions. What they don't search for is the means whereby civilised mankind can live within its income. The key to this goal was discovered by George Olah. It was he who found the secret of ending the growing accumulation of carbon in the atmosphere parked there by land, sea and air transport. To shift mobile energy from dependence on carbon to dependence on hydrogen, transport fuels needed to exploit the hydrogen in energy-rich hydrocarbons rather than the polluting carbon. Olah found out how to do it. He publicised the formula in the form of DMFC – standing for direct methanol fuel cell vehicles. Within fuel cell motors, the electric power derives from the hydrogen component of methanol. By good fortune, the energy component of methanol changes from a low of 50% of gasoline's when used in internal combustion engines to equality when used in fuel cell motors. Olah's work enables the civilised world to live within energy income by growing the raw material for methanol in forest plantations and powering transport vehicles by fuel cells. Plantation wood can be extracted from coppicing tree species as well as from others. However, over time coppice growth may lose its early capacity for high growth rates and may require replanting following harvesting. This is an aspect of plantation management requiring research in the interests of cheapness of transport fuels.



## International

Present indications point to North America adopting bound oil, supplied by the major oil companies, as the key to national survival in an age lacking cheap transport fuel. NZ may decide to go for the growth of biomass energy. Australia may stick with mining culture because of its economic dependence on mining. How will cultural differences on mining work out?

The US has already given a lead on how auto manufacture could change. Parallel with the development of fuel cell technology and the disappearance of the internal combustion engine, a new form of international trading becomes a possibility. It is based on the auto skateboard. The concept envisages a separate drive for each wheel, fuel storage, power generation through an electric motor, and the basic vehicle control system being designed to fit into a flat, low, box-like structure sitting on the chassis. This constitutes the "skateboard". It could be mass-produced and exported around the world. This would enable NZ to import its base automobile units and add whatever superstructure local manufacturers saw fit to suit consumer needs. (6)

Taken together, the production of energy wood and high strength timber, plus the importation of skateboards, would stimulate energy processing, technology development and vehicle manufacture in NZ. They would significantly reduce imports and, by exploiting the country's low population density, assist NZ

- a) To adapt constructively to a world with relatively expensive mobile energy,
- b) To reduce demand for automobiles,
- c) To increase demand for bus services, water transport and home-grown domestic fuels,
- d) To create vehicle exports, and
- e) To achieve a positive trading balance.

## Leadership

Approaching economic changes could provide a stimulus for, and an opportunity to invest in, NZ enterprises in different forms. Fonterra supplies a home-grown model of what might be achieved by investment in the processing of energy wood and tree, grass and mill wastes with a short term back-up of methane hydrates for raw material supply. The problem with such an approach is time. It would take years to evolve a second nation-wide processing entity based on farmer participation when the groundwork has not even been in contemplation. The solution for processing seems to be to set out with entrepreneurial investment on a large scale involving interested groups.

The skateboard supplies a possible high-tech base for domestic automobile and truck manufacture without a huge bill for the establishment of new technology if it can be used for fuel cell propulsion. Science gets a new-look menu. Gas stations would simply shift to a new fuel in their pumps. Distributors would access new vehicles for their showrooms. NZ exporters would find new opportunities to diversify their offerings. The stock market could find new names on its holdings list. Young people would be able to find jobs with wider career choices. Rural living would receive a shot in the arm. Internationally, NZ would present a different face to the world - not before time! It is a sobering thought that NZ may be one of a very few countries with the resources, skills and climate needed for the indefinite supply of mobile energy without damage accruing to planet earth. We need to learn that leadership has its responsibilities as well as its rewards. Unlike the look of the United States, it is a look designed, among other things, to provide a future for its youngest citizens.

The future of impoverished, energy- vulnerable nation states appears to be heading for economic oblivion and mass funerals. The longer a transition to well managed second generation biofuels is delayed, the greater will be the number of premature funerals.

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## Appendix 2

### Common petrochemical products

Additives  
Adhesives and sealants  
Agrochemicals  
Aircraft deicer fluid  
Ammonia  
Ash trays  
Bottles  
Carpets  
Catalysts  
Cellophane  
Cleaning agents  
Computer casings  
Construction chemicals  
Corrosion control chemicals  
Cosmetics raw materials  
Costume jewellery  
Cushions  
Cutlery handles  
Detergents  
Dishes  
Door and window frames  
Door knobs  
Electronic chemicals and material  
Engine coolant  
Epoxy resins  
Ethanol  
Fishermen's floats and tackle  
Flavourings  
Football helmets  
Fragrances and food additives  
Glue  
Healthcare products  
Inks dyes and printing supplies  
Instrumentation  
Insulators  
Lubricants  
Marine fuel oil  
Methanol  
Mouldings  
Nylons  
Packaging bottles and containers  
Pharmaceutical products

Piano keys  
Piping  
Plastic films  
Plastic wrap coverings  
Polyurethanes  
Refrigerator insulation  
Roofing materials  
Salad bowls  
Shoe heels  
Showerheads  
Skylights  
Solvents  
Synthetic rubber goods  
Telephone casings  
Toothbrush handles  
Unsaturated polyesters  
Venetian blinds  
Windshield wipers



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## Adaptation versus Economics

### By-passed national problems

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M. D. Malloy

#### 1. Financial break-down.

Following the collapse of Lehman Bros. in New York, finance companies around the world struck difficult and sometimes fatal trading conditions. A number went into liquidation or receivership. Why?

Money-lending is an ancient commercial practice. Over the centuries, the business has built up a great deal of knowhow on how to cope with the risks of recovering money lent and correlative interest. Since the beginning of the Industrial Age, the ability of large scale business to make use of borrowed money has become a key factor in development. Scale of borrowing has increased enormously. Take the United States, popularly regarded as the world's wealthiest nation. Its public debt as at the 25<sup>th</sup> March 2011 was US\$14.26 trillion. It has increased by over US\$500 billion each year since fiscal year (FY) 2003. It rose by US\$1 trillion in FY 2008, US\$1.9 trillion in FY 2009 and US\$1.7 trillion in FY 2010. Its ability to service loans is now of increasing concern. Standard and Poors have downgraded the state's credit outlook to "negative", with consequences we are yet to see.

Historically, techniques were developed to minimise the risk of default in payment. The history of the borrower, his or her earning capacity and stability, and the nature of any security offered as collateral to assure payment, all come into the picture. One form of collateral, the value of land and buildings offered, has increasingly dominated borrowing for housing. Lawyers have traditionally been involved in securing real estate as security for low-interest loans. A few principles for risk-takers have been developed:

- a) The financial history of the would-be borrower must be "good".
- b) His or her income and its stability must be established.
- c) The value of real estate offered as security must be established.
- d) Only first mortgages should be considered as security. (Subsequent charges get to be written off when a mortgagee's sale takes place.)
- e) The stability of the would-be borrower's character needs to be established.
- f) The real estate equity of the borrower needs to be at least one-third of market value.

Traditionally, loans were personal and criteria were human. Lenders in NZ included companies whose primary purposes had lost their bases, such as commercial dependence on kauri timber. Second and subsequent mortgages were a no-no.

So much for the traditional theory and practice of low interest lending as it existed in the middle of the 20<sup>th</sup> century. Their validity got a thorough work out during the Great Depression, 1929-35. Large numbers of borrowers lost their jobs and abandoned their houses. Mortgagees took possession and put in tenants. Such tenancies ran until well after World War II. During the fifties and sometimes later, mortgagees in possession sold their secured properties when tenancies came to an end. After taking account of rentals and sales, mortgagees typically recovered the whole of their loan investment plus interest and found themselves in possession of surplus funds which they were obliged to return to the original borrower.

The record of security realisations clearly validated the wisdom of traditional mortgage practice. However, as the 20<sup>th</sup> century ran on, the traditional practices were watered down. Banks entered the housing business by lending on first mortgage securities. The demand for funds was scaled up as industry morphed into large units. Finance companies accepted second mortgage securities. Accountants, economists and loan clerks gradually replaced personal and corporate lenders and their lawyers. Statisticians and securitisation entered the picture. It all led to the 1988 financial melt-down triggered by the Lehman collapse. The crucial lesson: traditional experience and knowledge of borrowers' behaviour were ignored at the cost of severe, world-wide economic damage. In New Zealand the dream of economic growth managed by political know-how took a hammering. Between 2005 and 2010, annual GDP figures showed a drop of some \$15 billion. This was most unusual. It pulled the rug from the base of the economic growth mirage loved and misused by politicians.

## 2. Leaky buildings.

The core problem of leaky buildings in New Zealand is not that they leak – all buildings can do that – but in many cases their basic structure is threatened by rot and structural collapse. How has this arisen?

Only some buildings are at risk. Those with framing of steel or durable wood such as kauri are not similarly threatened. Those with framing of untreated *Pinus radiata* are threatened. Some have already failed.

The history of the milling of *Pinus radiata* in NZ goes back to 1905. In that year, the sawn timber output of kauri reached its peak, some 133 years after its first felling by Europeans. In that same year, a number of large pines were blown down in Canterbury and sawn. They yielded a few thousand feet of sawn timber used by Duncan Rutherford in his own sheds. This small beginning was followed by pine planting, logging and milling in the North Island, where the species was known through experimental plantings in the Okahukura peninsula of the Kaipara district during the 1860s. During the 20<sup>th</sup> century, pine displayed dramatic commercial growth in a number of uses ranging from plywood to sash and door production, joinery, wallboard, Kraft pulp, paper, paper



bags, turpentine and tall oil. (T. E. Simpson, "Kauri to Radiata", 1973, ch. 7.) The expansion of radiata growth and usage continued despite a warning by Henry J. Matthews (chief forester of the Lands Department) at the Timber Conference of 1896 convened by the Seddon Government that radiata pine was fit for nothing but firewood.

Its growth also continued, regardless of scientific knowledge of its wood properties. K. R. Bootle ("Wood in Australia", 1983), in dealing with pine heartwood, says: "Heartwood (is) not sufficiently durable for external use in exposed situations; it is resistant to impregnation with preservatives."

On sapwood he comments: "The wide, readily impregnated sapwood enables a substantial cylinder of preservatised wood to be provided in round timber." In other words, the bulk of pine sawn timber is sap, and is not naturally durable. Bootle writes (p.192): "All sapwood has poor resistance to decay. Resistance is determined largely by the extractives formed when sapwood changes into heartwood.... The sapwood of all species is non-durable because of its life-supporting starches and sugars...."

The expansion of treated radiata as a framework timber was essential to remedy the inherent lack of natural durability of radiata pine. Treatment meant the forced injection of water-borne preservative salts into timber. What, then, about energy use post oil? A critical factor in the success of the oil economy was its cheapness. The continued use of energy post oil means that, because of the capital required for processing new forms of raw material, cheapness cannot be its bedfellow.

Pressure treatment becomes expensive treatment, whether used for boric acid, borax, sodium fluoride, or copper-chrome-arsenic salts for fungal or borer protection. There is a simple way of avoiding expensive treatment: grow framework timber that is naturally durable. When grown on erosion-prone land, the capital investment is not great.

If trees are grown as a dedicated energy crop for transport fuel, they can contain species chosen for strength and durability, as well as trees chosen for wood bulk, thus enabling treatment of wood for framing timber to be avoided and providing an additive energy crop through their leaf, bark and wood residues. Their growth rate may be slightly behind that of *Pinus radiata*, but their timber costs should be lower because of the greater relative volume of heartwood and inherent heartwood density. Long term planning may well open the door to frame affordability in the post oil era. Examples of this type of wood include *Eucalyptus microcorys* (tallowwood) and *Syncarpia laurifolia* (turpentine), both natives of Australia. Given 100% wood usage post oil, the growth of such trees must become economic.

### 3. The gasification route to liquid fuels.

Exploratory work by Choren Industries in Freiberg, Saxony, seems to have established an economic technology for the production of wood-based fuels. The most impressive feature of the technology



is its capacity to process a variety of materials. Waste wood, used tyres, lignite, bituminous coal, clathrate hydrates etc. are all welcome. In this way, the use of gasification-liquefaction technology lends itself to mass production in a way that the chemical removal of a normal wood component (lignin) for the production of ethanol does not.

The Pike river experience may arouse a cautious or even a negative approach to such a course. However, there are other aspects which may push for more science. A fuel such as methanol attracts an energy rating comparable with petrol if used in a fuel cell vehicle. This is because it is hydrogen rich and can be used directly in a fuel cell motor. (Chan, Goepfert and Toksoy, "Beyond Oil and Gas", 2006.) If the feedstock is a fossil fuel, CO<sub>2</sub> is extracted during the gasification process. But what should happen to that gas when it emerges in quantity as a by-product of yielding a hydrogen-rich fuel? Sequestration is the answer and for this purpose the hills of the West Coast provide a natural solution. This is not the answer apparently preferred in the US. There, natural land fissures seem to be envisaged. However, in NZ disused mines seem to provide a possible option for sequestration that may have economic advantages. The issue needs testing. However, the sequestration issue must not cloud the wisdom of using plantation wood as a feedstock for methanol. When carbon is taken out of the atmosphere by leaves, its storage in trees diminishes its contribution to the quantity in the atmosphere. Its loss of CO<sub>2</sub> during wood processing and its emission from fuel cell vehicles or internal combustion vehicles as waste cannot exceed its original atmospheric quantity.

The mining of clathrate hydrates from the ocean floor is not yet an established technology. The problem is not insuperable. Their release through man-made temperature rise becomes a form of mass suicide, albeit one not contemplated by oil miners. If such hydrates can be mined in ice form, their conveyance to a processing plant should be technically simple. Their melting would enable methane to be introduced directly into the liquefaction stage of processing and so lead to economically acceptable transport fuel.

#### 4. The Achilles heel of democracy.

The 3 forms of human behaviour discussed (large scale money lending, use of untreated sapwood as framing timber and sustained burning of oil derivatives as fuel) are all problems which should engage the attention of world leaders. They have not. Given a positive attitude to environmental change and science, all are solvable. This is the weakness of democracy. People in general are short term thinkers. They can understand and identify with short term thinking in would-be leaders. Short term thinking is characteristic of business. It works well when the relationship between man and his environment is a constant. When that changes significantly, a different form of thinking is needed. Long term planning becomes an essential ingredient of the thinking that must precede adaptation to change. The issue then becomes how to find and use such planning.



Each problem could have been avoided by decision-makers drawing on established knowledge when making go – no go decisions. Money-lending knowhow was well worked out through commercial history. House framing had both an historical and a scientific background warning of the tendency of sapwood to succumb to rot in moist conditions. In the late 1970s, cheap oil was scientifically predicted to drop to its last 10% of reserves by 2030, when its commercial use on anything like the present scale would be impossible. The issue of oil's replacement has been studiously avoided by world politicians. Their failure to act has been estimated to put some 4 billion lives at risk simply because of time wasted in finding substitutes. In the case of NZ, failure to act is simply madness in the light of a Scion finding that some 3.4 million hectares of steep land was available and should be afforested to prevent topsoil loss. Forest design could see that land supporting trees able to provide growth shelter on ridges, strong and naturally durable timber for housing and commercial building as well as bulk wood and foliage for liquid mobile energy.

In NZ the failure of successive governments has not simply reflected indifference to the future. An inspection of merchandise imports since 1960 reveals that mineral fuels have been imported in significant quantities that have placed a high and avoidable burden on our trading health. In 1961 mineral fuels accounted for some 7.04% of our import bill. By 1981 the percentage had risen to 22.33. The world financial problems showed up in NZ in 1989 when the percentage dropped to a low of 5.22%. Since then, the percentage has gradually increased to 15.91% in 2008 and 15.73% in 2009. In spite of this clearly visible burden on New Zealand's export dollars, government inaction has continued and Parliament has blessed the inaction by its silence.

All 3 failures are referable to a fundamental weakness in democracy. If political leaders are selected by popular vote, voter popularity is of crucial importance. Short term behaviour by candidates matches short term thinking of the man in the street. Popularity, however, is not a recipe for problem solving. Acute intelligence is. Problems arise from a multitude of causative factors. One of these is conflict within humans. Given supporting conditions, humans can populate their planet very rapidly. Supporting conditions, however, can only improve in arithmetic progressions. Populations lacking birth control increase in a geometric progression. Here's the rub. The slowest geometric progression will overtake the fastest arithmetic progression. Human numbers are thus constantly at war with food supply and like supports. Throughout history, famine has been the effective controller of population numbers. From this perspective, warfare is merely a minor contraceptive, used occasionally to defer the impact of famine.

There is another aspect to this conflict. Human appetitive drives (sex, food, shelter etc.) exert constant pressure for one generation to consume, regardless of whether or not it is at the expense of another generation. In this way, nothing has changed since hunter-gatherer days. The most obvious resource at risk of excessive generational demand is food. Current food production is massively supported by oil. Remove oil without providing a substitute and food supply decreases. People then die of malnutrition unless a form of support energy equivalent to that provided by oil can be found and put in place at the critical time: the actual run down of oil. Unless the gradual run



down can be matched by a gradual substitutionary supply, dependent humans will die. Famine then again becomes the effective controller of the human population.

Where does all this leave us in a quest for substitutionary transport fuels? A few fundamental issues must be addressed:

- A. Plant scale. Engineers are well acquainted with efficiencies of scale. To obtain the greatest benefit from this kind of planning, a single processing plant for NZ should be established for transport fuels derived primarily from forest wood – probably methanol and a form of diesel.
- B. Feedstocks. The fewer the processing plants in NZ, the greater the distance that feedstocks will need to move to reach them. The more plants that are established, the lower will be the gross transport costs but the higher will be the cost of feedstock per tonne/kilometre brought about by the greater capital cost of multiple plants.
- C. Transport modes. In theory, feedstocks can be moved by land, sea or air. The air option is not realistic for low cost raw material. Land transport causes road damage by trucks and leads to substantial road maintenance bills. Water transport does not. For an island nation like NZ, water becomes the preferred transport mode, but is itself subject to efficiencies of scale: the longer the trip, the lower the cost per tonne/ kilometre.
- D. Ship size. The experimental tests of transport efficiency carried out in the early 20<sup>th</sup> century gave top marks to large ships. Why? The answer seems to be the ratio of manpower to ship tonnage. Given that, within limits, a given crew size can move either a large ship or a small ship, crew overheads will obviously be lower per tonne/kilometre in large ships.
- E. Geography. From a forestry and clathrate hydrate perspective, the most obvious site for a single processing plant will be Gisborne because:
  - a) It has useful road access from about 40% of the woodlot sites identified by Scion for planting;
  - b) It immediately adjoins the largest marine clathrate hydrate deposits in NZ sitting on the Hikurangi margin stretching from Gisborne to Cook Strait
- F. Solution. A single processing plant (gasification and liquefaction to liquid fuels) should be sited at Gisborne. The design of its plant, mining and transport equipment needs to be established. Assistance is available from Choren Industries at Freiberg. A pilot plant for experimental development could be established either at Gisborne or elsewhere in NZ. Wood wastes from the wreckage of buildings torn down in earthquake-ravaged Christchurch might be an important resource but the question of contamination by preservatised salts would need careful study. Feedstocks would be mainly dry wood chips, old tyres and hydrates, but fossil fuels could be added if needed. Hydrates would require melting and capture of methane for direct access to liquefaction. Dry wood chips could be moved to Gisborne from distant parts of the North Island and the whole of the South Island. Marine movement should be by large motorised barges to allow for maximum penetration of



shallow coastal inlets. Assuming that the existing refinery at Whangarei and existing distribution outlets remain in use, liquefied fuels will require transport to Whangarei for refining and distribution. Barges capable of handling feedstocks should also be capable of handling liquid fuels.

### Consequences.

Shifting from oil-based to tree-based fuels must involve an increase in the retail price of food. For consumers on limited budgets, rising food prices must require a reduction in non-food expenditure. A recent TV programme dealt with impulse buying. Using its figures, it appears that the purchase of non-essentials could account for about 5% of GDP. The elimination of non-essentials could act as a cushion (at least in part) against the loss of more vital consumer goods and so affect the makeup of the business community.

Another loss is likely to follow the substitution of trees for oil. It is the contribution of commuters to the Auckland economy. They make up a small but significant portion of the work force (3.7%). They work within the Auckland metropolitan area but reside in all parts of the North Island, from the Far North to Wellington. To sustain their work habits (including commuting), their productivity is likely to be above average. Their numbers could be severely threatened by a significant rise in transport costs. At present, the 17,500 Auckland commuters make a contribution to New Zealand's GDP of at least 1.6 billion international dollars. A significant rise in transport costs could put this contribution at jeopardy.

In summary, democratic "leadership" has failed to address 3 important issues:

- a) The world is still floundering in the wake of its abandonment of established, prudent moneylending practices. In this area, our ancestors appear to have had a better understanding of the variation and predictability of human behaviour than we have today. Governments have not bothered to study the issue. Markets can't.
- b) Leaking buildings plague a number of countries, including Canada and the US. Wood is an important contributor to framing because humans have a tendency to attach hangings to framed walls – something they can't do with steel frames. Durable wood can be grown. This would provide a long term and durable solution to the problem. Such a step is anathema to democratic (i.e. short term) politicians, whose main life interest is the outcome of the next election.
- c) Forest woodlots and a wood processing infrastructure provide a long term, sustainable solution to the predicted run down of oil. They are beyond the ken of democratic politicians and most oil companies. Through their deliberate avoidance of the oil problem, national politicians in NZ have reduced the country to the status of a commercial colony of the oil companies.



Political theory needs to address the problem of leadership in a democracy with urgency. It remains trite but important to remember that, if we base today's predictions of Government behaviour on recorded Governmental behaviour in the 3 areas discussed, today's long term view will morph from our trading impoverishment to our grandchildren's nightmare. A part of our current problem is political culture. Almost any problem can, by convention, be solved by "growing" the economy. The most convincing politicians are those who can sell their capacity to manage "growth" most convincingly. However, they are all flogging a dead horse. "Growth" is merely a mirage. What provides economic grunt is energy. The cheapest and most abundant form of mobile energy we have stumbled on to date is petroleum oil, a liquid. All we have to do is dig up the oil and refine it. With other energy carriers (possibly in gas or solid form), we must invest, and invest heavily, in processing plants and transport vehicles. This involves capital and new forms of labour. If we seek to replicate the comfort of the oil age, we must find ways of increasing efficiency in the ways we convert energy carriers into energy products in liquid form with (hopefully) greater safety margins than those accepted by gasoline users. The task is the basic one of adaptation to our environment. Success or failure in this task will be measured by the numbers of humans that survive the disappearance of the oil prop to our economic comfort.

The nightmare of our grandchildren will commence when cheap oil shows clear signs of running down. At that time, its role as a carrier of mobile energy and as a prop for food supply will start to show evidence of frailty. The brutal reality of expensive energy will start to dawn on people everywhere. The early victims of run down will be poor people in Third World countries who cannot feed themselves and their children. Famine will show up and will progressively get worse. The expected loss to famine deaths has been assessed at 4 billion.

The assessment gives us a convenient standard by which to assess the quality of leadership displayed by world politicians. During the second half of this century, the number of famine deaths may fall below or exceed 4 billion. The actual number will become a useful measure of the success or failure of world political leadership in handling a basic problem of adaptation. Here we stumble across a fresh insight. The world-wide failure of politicians of all stripes to tackle the oil problem threatens life on a vast scale. How can we understand the failure? Conspiracy theories will not wash. Oil dependency may. One particular form of oil dependency is air mile addiction. It afflicts the world's politicians severely, regardless of their country's political structure. They need popular support to survive. Some of that support can be engineered. A skilled politician can influence support by photo opportunities – the more the better. Hence, their air-mile addiction and their use of oil-based fuel in quantity. This common form of dependency could explain their silence on measures to deal with biofuels and other alternative forms of energy without any base of overt conspiracy.



**Michael D. Malloy, M.A., LL.B.**

9 April 2013.

## Auckland

The Secretariat,  
Constitutional Advisory Panel,  
c/o Ministry of Justice,  
SX 10088,  
Wellington.

Dear Sirs/Mesdames

re NZ Constitution

I understand that you are tasked with recommending the form of a modern, effective constitution for New Zealand. The task is not before time. As a non-practising lawyer with a strong interest in diversified forestry, I am appalled at the issues left untouched, at issues ignored because of lack of popular pressure, and at the gamesmanship of M.P.'s.

Over the last two decades, I have researched a number of issues of long term significance to NZ but lacking popular and media understanding. As an aide memoire, I have written sundry papers on those issues. A review of the papers suggests that some should be passed on to your Panel for study. I now enclose 10 such papers. I suggest that each be treated as a submission on constitutional issues. For the record, the papers are:

1. A methanol economy for New Zealand. (Marc, 2009)
2. Comments on "adaptation." (March, 2010)
3. Adaptation versus economics. By-passed national problems. (April, 2011)
4. Food, fuel and famine. (2011)
5. Eight wonders of the world. (August, 2011)
6. New Zealand – exporter of transport fuels? (September, 2011)
7. Sustainable transport fuels. (July, 2012)
8. Survival games. (August, 2012)
9. Crunchtime – democracy on trial. (February, 2013)
10. Borders in a democracy. (February, 2013)

Yours faithfully,

(M. D. Malloy)





## **New Zealand – exporter of transport fuels?**

September 2011

M. D. Malloy

### **Theme**

NZ has a global reputation for very little – say, its scenery, its proximity to Antarctica, playing rugby, its freedom from corruption, and food production. In transport, it is an importer of vehicles, ships and aircraft and even fuels. Economically, NZ is a colony. In energy terms, it exports mineral fuels worth some \$2.15 billion annually and imports petroleum and related products worth some \$7.35 billion annually, while possessing a petroleum refinery at Whangarei. It has made efforts to grow plantation forests but has permitted corporate sales of plantations to vest ownership of large areas in foreign owners, whose major interests reside elsewhere. As a trader, NZ has chronic concerns about its terms. In the year ended June 2009, for example, it exported merchandise worth \$43 billion and imported goods worth \$46.1 billion, leaving a balance of trade deficit of some \$3 billion. NZ has never quite recovered from the shock of losing its preferential trading position in the UK stemming from the latter joining the European Economic Community in 1973. The immediate result of that change was that, between 1970 and 1990, NZ GDP per capita declined from 115% of the OECD average to 80%. However, the public debt was a manageable 29.3% of GDP in 2009 and foreign reserves amounted to US\$20.6 billion last March.

What is not so bright is the longer term outlook. Global reserves of petroleum oil are predicted by scientists to be down to their last recoverable 10% in 19 years' time. Petroleum prices can be expected to sky-rocket, permanently. This must happen because there is no cheap replacement for petroleum oil as the base of the world economy. The last 10% will be the most difficult to extract and to clear of contaminants. Oil companies are likely to attempt to mine bound oil and then free it from bindings such as shale and sand – an expensive undertaking, and one bound to raise the price of fuels and damage the environment through an increase in global warming.

Globally, the oil company response to the run-down of unbound oil is unlikely to be of benefit to NZ. Accepting it is only one of a number of options that are available to the nation. Our national strength lies in the land and in growing things. In particular, we are experienced in growing plantation forests and in producing large volumes of wood from the

least attractive working areas. Common attitudes suggest that the most popular of responses to the disappearance of oil will be one of national self-help, if it is feasible. NZ is reasonably well placed to compete with the rest of the world in the production of mobile energy and, more importantly, to develop freedom from economic colonialism. So far, Government has been appallingly negligent in failing to protect New Zealand's strategic interests. Most citizens close their eyes and ears against the intrusion of evidence of events still some 19 years in the future. There is a kind of national, child-like faith that something will turn up. Old people can't be bothered with an event unlikely to bother them in their lifetimes. Young people are too busy enjoying life to take seriously any event occurring 19 years ahead. In reality, NZers have an opportunity to head off disaster if, and only if, they act promptly.

The looming disaster has two faces. The first is the threat to mobile fuel posed by the run-down of unbound oil. The second is its effect on global warming and on the atmospheric concentration of CO<sub>2</sub>. This problem was studied by an American committee of scientists appointed by the National Academy of Sciences in October 1980 and chaired by Bill Nierenberg. They wrote 5 chapters of the final report, all of which confirmed the dangers threatening coastal life and buildings by increasing concentrations of atmospheric carbon. Two economists were also involved. They represented political appointments, wrote the opening and closing chapters, and in effect rubbished the scientific reports. The overall impression was one of doubt and confusion – just what the White House wanted. The whole episode represented a deliberate ploy initiated by powerful lobby groups to maintain the status quo and their power bases, regardless of the threats posed by bound oil to coastal cities throughout the world and civilisation itself.

When confronting disaster, the first priority is to play to your strength. In NZ, we have two major advantages: we can grow anything; and, our population is still a paltry 4.4 million people. With that resultant density, we are not making full use of our known, growing medium. Especially when that medium is the high, erosion-prone (EP) land beneath the snow line and above the tractor country. If we use our brains, we can grow the raw material needed without timber treatment for the structure, floors, furniture and rafters of houses and tall buildings as well as for fuels used in vehicles of all kinds, all grown on EP land. Preferably, long term plantations (say, 25 to 35 years) should be used for rafters, flooring and framing timber and short term plantations (say, 6 to 10 years) for energy plantations. Gisborne could be used as the site for a major processing plant, at least in the North Island, because it is within practical trucking distance of some 40% of possible EP sites and sits on top of the huge methane hydrate deposits lying below the waters extending south to Cook Strait. Auckland could well serve as the administrative and scientific centre for the production of sustainable mobile energy and as the site of a pilot processing plant.

For assistance with design and scientific work, NZ could look to help from Choren Industries in Freiberg, Saxony and Calera Corporation in Moss Landing, California. Choren has built a



processing plant for biomass to yield fuel. Calera has built a power plant whose smokestacks emit CO<sub>2</sub> in large amounts. The corporation has developed ways of bubbling that gas through seawater so that some 90% of the gas can be converted into cement. There is a possibility that a plant at Gisborne could learn how to mine the adjacent hydrates for methane and then convert the raw gas into methanol and cement. In the alternative, the CO<sub>2</sub> might be shipped to Portland for use in cement manufacture there. All in all, a Gisborne plant would need a substantial but manageable amount of research and development work. It is assumed that both Government and processors in NZ would be interested in long term issues such as a sustainable EP resource and a pollution-free set of fuels. In choosing to use methanol as the prime fuel for motor-vehicles, producers and processors would take advantage of the hydrogen content of methanol to eliminate the emission of CO<sub>2</sub> from the tailpipes of fuel cell cars. They could also take advantage of: a) the high hydrogen content of methanol to reverse its low energy content [from about 1/2 that of petrol in ICE vehicles] to parity when used in fuel cell motors; and b) the concentration of CO<sub>2</sub> produced by its processing plant to yield cement.

The run-down of oil and climate change comprise the two sides of a single coin. The coin is fashioned to serve the human need for energy. Both static (electricity) and dynamic (transport) needs can be met from the same hydrocarbon source. A common method is used to convert stored energy into active energy: the burning of carbon. It is this method that is directly responsible for climate change. However, energy can also be supplied from hydrocarbons by burning hydrogen. If that route is chosen, then the carbon content of the raw material is extracted in the processing stage rather than by vehicle emissions. This enables CO<sub>2</sub> build-up in the atmosphere to cease if sustainable methods are used in the production of the hydrocarbon fuel.

Trees and their wood product provide the solution to greenhouse gas build-up. While trees are growing, they extract CO<sub>2</sub> from the atmosphere. When wood is extracted and processed to yield hydrogen, the other gas released is CO<sub>2</sub> which cannot exceed the amount of CO<sub>2</sub> absorbed in the growing process. In other words, forest biomass, when converted into an energy carrier, provides the complete solution to the build-up of greenhouse gases in the atmosphere that has so disturbed weather patterns over the last few decades. When used for material purposes, forest biomass yields wood that reduces atmospheric storage of CO<sub>2</sub> while tree roots serving coppiced regrowth retain carbon extracted from the atmosphere. Thus, forest biomass can be used to control all of the negative aspects of current fuel usage.

Nothing can replace the cheapness of oil. When the supply runs out, it leaves us all without a replacement. The significance of this loss is not generally understood. There will be no return to the "good old days". Reliance on sustainable sources of energy is being forced on humans by the results of their own mining habits. During its hey-day, cheap oil supported economic development and made possible an increase in the global population of around 4 billion. This represents about 58% of the existing population. As oil-based fuels become

more and more expensive, food needed by poor nations to survive will become increasingly unobtainable. Famine will reappear and will become more intense as the last 10% of unbound oil is burned. Some authors have suggested that 4 billion famine deaths will occur this century. Whether or not humans adopt a renewable growth option in timely fashion will determine the magnitude of the drop in numbers. The greater the delay in planting energy crops, the closer the famine loss will get to 4 billion. So far, the attitude of the US government is opposed to the use of biomass as raw material for energy. NZ appears to have adopted a similar attitude, regardless of its valuable reserve of EP land, in an attempt to improve its chances of negotiating a favourable trade treaty with the US.

### Implications

In 2008 former US President Bill Clinton had this to say: *Food is not a commodity like others. We should go back to a policy of maximum food self-sufficiency. It is crazy for us to think that we can develop countries around the world without increasing their ability to feed themselves.*

How right he was! As oil runs down and global population continues to climb, food prices, like fuel prices, must escalate. The trend is only in one direction. Whatever fuel or fuels are adopted to replace unbound petroleum oil, they can never match its price at the pumps for cheapness. Wikipedia tells us that worldwide around 852 million people are chronically hungry due to extreme poverty while up to 2 billion people lack food security intermittently. Among the non-controversial factors are world oil prices at around US\$100 a barrel, global population growth, climate change, loss of agricultural land to residential and industrial development, and growing consumer demand in China and India.

In brief, the main factors responsible for famine on a global basis are:

- a) A global water crisis;
- b) Land degradation;
- c) Lack of population control;
- d) Man-made climate change;
- e) Poverty, and the cost of energy for transport and farming support.

A shift from reliance on cheap oil to reliance on biomass to source transport energy carries with it implications for how we work and how we develop energy. Fundamentally, the mining of fossil oil to power transport vehicles is insane because it requires a build-up of CO<sub>2</sub> in the atmosphere and collateral climate warming. A sane forest policy carries with it no build-up of atmospheric carbon and an intelligent harvesting policy. Looking at economics and energy/forest policy, we find the following issues coming to the surface:

- a) Changes in employment;



- b) Town planning changes brought about by the death of suburbia;
- c) Transition from ICE to imports of fuel cell vehicles;
- d) The development of energy efficiency in its production and use;
- e) Expansion of the export menu to include liquid energy;
- f) Separation and extraction of moisture and methane from leaves, surplus grasses and soft growth;
- g) Use of all wood wastes, and effect on land clearance;
- h) The demise of timber treatment through tree species selection;
- i) The use of research in all aspects of energy development;
- j) An expanded and more focussed role for government.

### Famine

One of the essentials in people's ability to feed themselves is the availability of water. Deserts are areas where rainfall is negligible and plant life rare. Deserts occupy some 40% of the land surface (2006 assessment) compared with some 20% in 1963. Large areas comprise jagged mountains, rugged boulders and rocky plateaus. Sand deserts make up an increasing proportion of the remaining areas. It is likely that they represent directly the result of human intervention.

Man first made his presence felt on the nature of the earth's land surface some 4700 years ago. It started in the Fertile Crescent, Mesopotamia, where Gilgamesh, the ruler, wanted to create a city, probably as a memorial to himself. Close by was a vast primeval cedar forest. Gilgamesh ordered his men to fell trees and produce timber. His city was built but so were ships for trade and war, tool handles and some weapons. Well after Gilgamesh the inhabitants of Carthage and Rome found that forest land had value as farm land, and so increased pressure on forest destruction. As destruction increased, so did aridity. Where underground rivers or springs could be tapped, oases developed and were used to produce food such as dates and sugar cane. Land overuse for farming has developed and has led to the abandonment of nearly a third of the world's farmland in the last 40 years.

The UN has established a Secretariat to combat desertification. It faces a problem of global magnitude: how to deal with 200,000 square kilometres of arable soil or forest becoming a wasteland each year. Desertification currently poses a threat to the lives of over 1.2 billion people in 110 countries. The threats are believed by the UN to stem from unsustainable agricultural practices, water management and human settlement. Cheap fuels derived from petroleum oil play a significant role in all three activities. The UN appears to be fighting an uphill battle. According to Wikipedia, around 852 million people are chronically hungry due to extreme poverty. Up to 2 billion people lack food security intermittently due to varying degrees of poverty. Six million children die of hunger every year. All this is happening while cheap oil is freely available. As the population grows, the numbers in these categories can only increase. As cheap oil runs down and expensive oil kicks in, the numbers must increase further. When cheap oil disappears later this century, the numbers must escalate as if the



sky were falling down, because there is no simple replacement. (Petroleum oil is, after all, a fossil.)

Over the last few millennia, famine has acted as the sole effective control of population growth. Regulation can't solve the problem. Nanny state can't intervene in the bedroom. The only practical alternative to famine is education. This is not the finding of UN studies. They conclude that, because three fourths of the world's poor make their living from agriculture and are most vulnerable to hunger, any attack on the problem should focus on improving agricultural productivity. The first priority in addressing the issue is thus to raise prices, and so enable farmers to diversify production and grow higher-value crops. This is merely the money man's off-the-cuff view. An alternative approach would be to concentrate on education and use learning processes to develop self-help, improved farming methods and sustainable energy.

New Zealand has a special interest in the issue. As transport increases in price, increasing numbers of people from vulnerable areas of Africa and Asia will be motivated to attempt illegal migration to this country by boat. As migrants, they could not be less welcome. Those of them bringing intolerant religious beliefs and maladaptive procreation beliefs introduce a dangerous and expanding minority into a tolerant society. It appears that NZ may be forced to adopt a military-based defence shield to protect the country from this type of invasion.

New Zealand also has a special interest in using its low population density and EP land to supply domestic needs and export capacity for biomass fuels. The magnitude of the global problems is not understood by Government. Best evidence now available suggests that a shift from unsustainable mining to sustainable farming of raw energy material must take place between 2030 and 2050. There is no argument that supply can shift from the mining of unbound oil to the mining of bound oil. That possibility leads to retention of internal combustion motive power, continuing build-up of atmospheric carbon, increased global warming, the melting of Arctic and Antarctic ice and the rise of sea levels. Revelle has estimated that warming would lead to the melting of 2 million km<sup>3</sup> of ice from the West Antarctic Ice Sheet and a world-wise rise in sea level of between 5 and 6 metres. This would lead to the flooding of all existing port facilities and other low-lying coastal structures, extensive sections of the heavily farmed and densely populated river deltas of the world, major portions of Florida and Louisiana and large areas of the world's major cities. (Oreskes and Conway, "Merchants of Doubt", Bloomsbury, 2010, ch.6.) In the case of Auckland, its adjoining harbours (Waitemata and Manukau) would pose threats. Flooding would affect built-up areas of the CBD, the Onehunga port area, motorways, bridges, suburban land, airport, and rail infrastructure. Similarly, central Wellington would be affected. The ability of Wellington to continuing to act as the administrative capital of NZ would be threatened.

New Zealand's interest in its capacity to adapt to the global and domestic environment demands that global warming and rising sea levels be stopped. Threatening both is the action of the US Congress in quashing the entire scientific voice on fossil fuels and the



reckless move to mine bound oil by the big oil companies. Also posing an equivalent threat is the attitude of the NZ Parliament in accepting and following the anti-science move of the US administration. NZ needs a stable atmosphere. It needs stable sea levels. It needs to participate in a shift in motive power from carbon to hydrogen. It needs a supply of vehicles able to operate on fuel cells rather than internal combustion. To assure such participation, it needs to set up a land source of raw material and a processing system to assure biofuels are in place and available when oil runs out. That is most likely to occur some time between 2030 and 2050 – say, 2040. By that date, all systems should be in place to enable the whole of the market for mobile fuel to be supplied from domestic sources. New Zealand's bioenergy strategy envisages that by 2040 only 30% of the country's fuel needs will be met from domestic bioenergy. It implies that the electorate could not stomach any policy demanding short term financial sacrifice for the sake of long term energy security, regardless of the role of energy in underpinning the whole of the national economy. It also implies a lack of belief in the ability of Parliament to supply leadership when needed, even when desperately needed.

### Climate Change

As global reserves of oil run down, the world will suffer disruption of transport capacity and agricultural support in a highly uneven fashion. NZ, with its external shipping lanes, its internal rail and road systems, and its low population density (say, 10 to 50 people per km<sup>2</sup>), is well placed to survive the loss of oil in working shape. Not so the highly populated regions of Asia and Europe (say, 200 to 500 people per km<sup>2</sup>), and the arid regions of Africa. In such regions, the survival of the poor will depend on the willingness and ability of state governments to fork out food support cash. Based on present evidence, some will and some will not.

In the developed world, the most noticeable effect of high fuel prices must be automobile sales. We must expect demand for cars and (to a lesser extent) trucks to drop severely. Public transport is expected to show a rise in usage. A corresponding drop in imports of cars can be expected. Urban values may show a preference for central city dwellings and a loss of value for suburbia. Similarly, we can expect major changes in relative values to show up on the NZ Stock Exchange.

When energy prices rise significantly, raw material prices can be expected to reflect cost increases. The more trees can produce material not needing treatment to make good quality deficiencies, the greater will be their demand. In general, this points to a developing preference for hardwoods over softwoods because of the greater strength and durability of hardwoods. Large quality differences in the timber yielded can be expected to be more important in the future market than minor differences in growth rates. Market-wise, both the strength and durability of timber are expected to show up in framing and rafter use but



not so much in boat-building. The superior colouring and grain patterns of timbers such as Blackwood and Walnut are expected to show up in preferences for quality finishing timbers.

### Employment

Differing levels of unemployment throughout the world suggest that cheap energy has been adopted for efficiency but carries a human price. Muscles are not as highly valued in the market place as they were during the colonial era. Trained brains and symbol systems win hand over fist. As mindless mining reaches its logical end point, a biomass alternative demands the cultivation and use of soils that would otherwise be treated as of little or no value. The use of muscle plus brain would then be in demand in the employment field, so would the skills of trained foresters. In the field of research and development, considerable work would be needed to develop technology appropriate for the harvesting and extraction of methane from leaves, grass and large "weeds" otherwise regarded as of no commercial value (Huber & Dale, Scientific American, July 2009, 40-47). Work would also be needed to ensure that leaf extraction did not have a detrimental effect on wood extraction; on sour felling for wood drying; or on wood chipping for energy use. Research would also be required to perfect processing methodology and to mine methane hydrates. Planning and research would be needed to enable the introduction of alternate fuels to coincide with the wind down of oil and so avoid commercial problems associated with pointless competition.

There are major social issues arising from a biomass economy. High country work requires forest workers who are fit, reasonably strong and adaptable. The work is centred around planting, maintenance and harvesting of trees. The end results comprise production of construction lumber, the base material of furniture production, outdoor amenities and a variety of fuels powering manufacture, cars, trucks, aircraft and ships – the base of any economy. Knowledge of effect gives NZ forest workers a pride in accomplishment that is unobtainable when finite deposits of oil are mined overseas and imported. A biomass economy thus offers its core workers a future – better self-worth, self-confidence and social value that is unobtainable otherwise. We could thus expect improved health ratings, lower suicide numbers and improved marital prospects for forest workers, both male and female. Such benefits are rare in the industrial world, but very real. They should be expected to have a reflected benefit on any Government showing the courage to implement a defensive response to dwindling supplies of petroleum oil. There are a number of lessons that can be learned from history. Perhaps the most durable is this: political displays of courage coupled with wisdom are so rare that, when they occur, popular recognition always follows.

### Urban planning

Whether NZ does nothing about the run-down of oil or introduces national self-help such as dedicated energy biomass, the cost of transport fuel must rise – significantly. This has



implications for how we design our cities. Design must change. The need to change is illustrated by the fact that world economic energy efficiency is presently improving at half the rate of world economic growth. (Wikipedia, Climate Change Mitigation.) Lateral urban spread is the rule in NZ. The result is a galloping spread of houses over prime arable land. Rising fuel prices demand a brake on lateral spread and the introduction of efficiency in transport modes. In general, we should plan for city central buildings to rise upward, dwellings to do the same but to a lesser extent, efficient public transport to replace the family car and public green areas to replace the family garden for recreation, sport and relaxation.

The impact of the future energy outlook on urban design has strong implications for Christchurch redevelopment. One way of looking at earthquake damage is to view it as an opportunity rather than a disaster. It appears that groundwater is both a source of potable water for the citizens of Christchurch and a potential threat to the stability of buildings during an earthquake. Perhaps the first thing to do is to sort out the priority of values and/or a method of reconciling them. Drawing off potable water is helped by the water table being close to the ground surface. Avoiding liquefaction in a shake is helped by drainage, such as that carried out by Mussolini in 1932-34 when he engineered the drainage of the Pontine Marshes. The withdrawal of Christchurch cover by insurance companies might possibly be rectified by an intelligent re-engineering of the water-table problem coupled with a redesign of dwellings and commercial buildings to convert low-lying, shake-prone areas into green areas.

### Fuel cells

NZ does not produce cars – yet. If it decides to adopt a self-help approach to oil replacement, it should ensure that future car supplies should fit future fuel supplies and make-up. A methanol replacement scenario would yield a fuel rich in hydrogen and available in a liquid form that enables the direct input of methanol to the fuel cell (FC) motor. (George Olah and his associates are the authorities on method for this usage.) Timing is the important issue for a successful takeover. Attempts in the US to achieve a competitive substitution of ethanol for gasoline have all failed, as they were bound to do. (Any commercial venture that relies upon George Bush's view of the world or on continuing government subsidies of a raw material like corn is suspect.) Dedicated energy crop trees should be available for harvesting about the time free oil reserves are down to their last 10%. At that time, all the readily mined (unbound) oil will have been taken and only the difficult (bound) oil from a mining perspective will be left. The residue is expected to be mixed with sand, water and mud and require expensive extraction. Based on the work of M. K. Hubbert (1971), C. J. Campbell (1998) and M. R. Simmons (2005), we can predict the timing of severe decline to start in earnest about 2030. Current evidence from scientists and



the oil media suggests decline may already be under way – i.e. we have already passed peak oil.

Time data suggest that governments throughout the world have already made it impossible to effect a smooth shift from unsustainable sources of transport energy to sustainable sources. The critical times for preparatory work have already passed, unnoticed. It is elementary knowledge that sustainable energy comes to planet earth from the sun and that leaves represent the only known way of converting that energy into large-scale, usable form. The fossil fuels simply represent stored solar energy, of ancient vintage and in finite amounts. As they run out, humans must learn how to tap solar energy in new ways. If we are wise, we will adopt sustainable technologies that enable the maximum number of humans to survive the takeover. Globally, we are not wise. We are too short term in our planning to adapt without major losses of life. The immediate task is not to avoid loss of life – that is a given. We can now only try to minimise its magnitude. This is where timing comes in.

New Zealand's task is to plant 3.4 million hectares of difficult country in carefully selected trees, so that future needs for mobile energy and construction material can be met, and at affordable prices. If we allowed 2 years for learning and planning, that would suggest a start in mid-2013 at the earliest. Opinion on annual planting rates suggests that figures of around 100,000 to 300,000 hectares of new plantings per annum may be achievable. A processing plant, accessible to 40% of new plantings at Gisborne, is achievable within the resources of the existing economy. It could serve new plantations and input from methane hydrates located in marine deposits stretching from Gisborne to Cook Strait. Its main product, methanol, could be used as a fuel in FC vehicles and as the base for production of aircraft and shipping fuels. What can't happen is to make production of the base material possible in sufficient quantities to satisfy demand if that demand reflects the current appetite for cheap oil. The message is simple: a bland conviction that nothing serious can upset life in Godzone has already consigned the economy of NZ to a severely reduced level. It has rendered human life and global adaptation possible but only at a level comparable with what is possible in NZ with its low population density. The outlook has strong implications for defence against illegal immigration.

If we allow a mere 8 years for tree growth to an acceptable size for energy harvesting, this would mean that some 3 million hectares of EP land needs planting by 2022 – some 9 years after a commencement in 2013. Stuntily, it can't be done. It demands planting at an average rate in excess of 300,000 hectares per annum. Our politicians do not have the brains needed to set the wheels in motion. Our people do not have the willingness to make "sacrifices" for their own future well-being and the well-being of their children. The only way disaster can be avoided is by the establishment of an effective partnership between Government and people devoted to a single issue – replacement of the economic base of the economy by the



creation of sustainable, large scale alternative. There is no sign of this happening. Popular belief has it that science will come to the rescue – somehow! This is a belief in magic.

### Leadership

The world has forgotten about a human trait that used to be a common topic of discussion: leadership. Mining for oil, like felling forests for food production, has become a no-no in polite conversation. We enjoy food (for the most part) and we want it NOW. Never mind who cleared the forests that once clothed the land. That is always something in the distant past. We all want cars and the fuel needed to make them go. And we want fuel whenever the fuel gauge runs low – not when something is done about deserts! Timing, in other words, governs the “real” world and sets limits to what can be done by “leaders”.

Doing something about the run-down of oil creates a critical problem for leadership. Politicians who are voted into power for their supposed capacity to lead tread on the oil issue as if it were a large, delicate egg-shell. Dealing with the man-made disaster of oil run-down demands a commitment to steps, some of which create future benefits for present minor sacrifices of comfort. If grandchildren who are minors benefit, that is of no interest to the slob who votes. Sacrifices for grandchildren? Some parents and grandparents regard the mere existence of children and grandchildren as evidence of “sacrifice” on their part. So democracy is no guarantee of wisdom in managing the environment. The wastage of petroleum oil provides an example of how the theory of democracy bends before the reality of individual selfishness. A man-made disaster provides evidence of human failings that operate to limit human capacity to adapt to an environment that preceding generations have damaged.

Governments sit at the apex of the information pyramid. They have the capacity to do something positive about the destruction of primary forest, climate warming and the dominance of man-made deserts. They can, if they had the intestinal fortitude, reverse the destruction of generations past. They could, if they were so minded: a) instruct scientists to research the nuts and bolts of sustainable, adaptive behaviour; b) commit their states to the development of sustainable energy for transport; c) set their economies on a base of renewable energy; d) use intelligent land management to provide a sustainable base for youthful employment; and e) for the first time, hand the United States a model for a sustainable culture.

In NZ at present, leadership comes a poor second to popularity in the political stakes. Popularity provides a short term prop but a long term broken reed. The opportunity is there for somebody to re-establish leadership as the needed long term prop for democratic government and as a possible trigger point for adaptive behaviour – but don't let us hold our breath. The issue goes to the heart of New Zealand sovereignty. As things stand, NZ is



scheduled by its own government to become an economic colony of the big oil companies. They currently provide the fuels derived from unbound oil needed to operate the domestic economy. They intend to retain that role when unbound oil runs out by using the run-down period (say, 2030 to 2050) to enable the world to effect a smooth transition to dependence on bound oil, separated and freed from binding by the oil companies at the cost of the consumer. Events in Canada show the outline of the takeover plan. It involves the mining of bound oil from the Athabasca tar sands, its extraction from binding material and its transfer by pipeline to the US. "Green" protesters will simply be swept aside. The question for NZ is: do we want to become a long term economic colony of the oil companies? Or do we want to use our marginal land to develop economic sovereignty into something meaningful? Something that puts economic control into NZ hands? Something that assures young new Zealanders of full employment? Something that extends the farming role of food providers to include the provision of mobile energy?

### Economics

There is a special economic benefit accruing to NZ if it elects to site a major processing plant at Gisborne. When biomass is used as feedstock for the production of methanol, Gisborne is a logical site for the construction of a major processing plant. It could feed on wood stock growing on some 40% of EP sites within convenient trucking distance of the city. The two processes needed to convert wood chips into methanol are its gasification and the liquefaction of the resultant syngas. The whole process involves a substantial investment of capital. If built large enough, it could serve the whole country for processing.

That option could have another benefit pointing to a major advantage in energy efficiency. Syngas is basically methane. Marine hydrates are methane volumes stored in sea ice. If the ice is melted, methane emerges as a gas. Hence, if ice-binding hydrates can be landed at Gisborne intact, all that would be necessary for processing would be to deposit them within easy distance of the second stage of processing so that they could be readily melted, processed to liquefaction, and so emerge as methanol. Thus a single capital investment could be used to produce both fuels derived from biomass, and fuels derived from fossils.

Methane hydrates pose a danger to humans. At present, an environmental temperature of 2°C only provides the safety margin between the normal melting point of ice and the lower level of surrounding water temperature. Theoretically, a global rise in sea temperature of that magnitude could rapidly release the whole of the methane stored throughout the world to the atmosphere and so threaten life as we know it. There is some evidence that methane hydrates do not exactly follow the ordinary rules for ice melting, but not enough is known about the issue to be dogmatic. Currently, we know that human intervention threatens methane stability in subsurface conditions and that 2°C is an inadequate cushion. The path of responsible government must be to protect humans against global release by



mining the resource to extinction while such action is possible. There is not a single piece of evidence suggesting that voluntary restraint in fossil fuel usage will defer climate warming to the extent needed for safety.

The world is now at a crunch point. If action is now taken to shift methane hydrates to the top priority for mining, we may survive and, just incidentally, prosper. If we do nothing (the preferred path for world governments) humans seem destined to destroy themselves and a raft of animal species currently living on land and in water. Government preferences lead inevitably to the mining of bound oil and the continuance of burning carbon as the driving force for mobile energy. New Zealand's biomass pathway (only one of many) leads to plantation management of biomass and the burning of hydrogen as the driving force for mobile energy. Such a pathway enables carbon to be extracted during the growth phase and released to the atmosphere during the processing phase. If it becomes desirable to reduce atmospheric concentrations of carbon, that can be done at the processing stage by capturing CO<sub>2</sub> from smokestacks and sequestering it in secure locations.

A New Zealand policy of mining methane hydrates and producing biomass fuels sustainably (and therefore indefinitely) would effect a major change in the economy. Its base would change from carbon to hydrogen. Its products would shift from atmospheric pollution to small amounts of water, yielding energy available for mobile and other uses in the process. That the shift could be used to regulate atmospheric concentration of carbon is a by-product and a bonus. From the perspective of global employment, losses in the mining sector would be more than made good by gains in the cultivation of marginal soils on steep country for afforestation.

In the short term, a shift of this magnitude must involve Government, heavily. However, the shift need not become more than a move to effect a transition from land and sea mining of unbound oil to land cultivation of vegetation and its processing. When achieved, the whole process would be self-funding and profitable. Two forms of capital investment would surface: plantation cultivation and industrial processing. They must involve farmers, but would offer farmers a new source of income: energy production from biomass. Fonterra thus provides a useful model for organisation purposes. Whether ownership of the processing plant should be offered to farmer members of a co-operative company remains an issue for them and Government to consider. In the first instance, major stakeholders in a biomass-energy pathway for NZ would involve scientists, Federated Farmers, Government, motorists and transport operators.

### Recommendations

There is nothing in the Constitution Act 1986 prescribing the duties of members of Parliament. There ought to be. Take energy. It forms the basis of the national economy. In



static form it provides the base of national supplies of electricity. Moves are well under way to put the supply on a fully sustainable basis. Not so with the mobile form. As fuel for transport vehicles, it is in the hands of the world's big oil companies. As bound oil supplies begin to be exploited, New Zealand finds itself in danger of being severely damaged in the integrity and functionality of its land, buildings, agriculture, horticulture, and systems serving communications, transport and government roles through man-made releases of carbon to the atmosphere. This must stop. Government has an inherent duty to protect the people of NZ against such hazards.

Action needed by the NZ Government is as follows:

1. Urgent research is needed: a) to establish the relative transport and operating costs of establishing one or several plants for processing raw material into liquid fuels, b) to establish commercial methods of harvesting and releasing methane from leaves, grasses and other green material, and c) to examine sour felling methods in order to ascertain the optimum yield of energy from wood and leaves in short rotation plantations and of material and energy from long rotation plantations.
2. Raw materials should include waste wood (around 5 million m<sup>3</sup>/annum – Penniall & Williamson, NZJFor., August 2011, 9-14) from existing plantations, dedicated wood from short term EP plantations, residual wood from long term plantations, leaves and grasses, natural gas from marine methane hydrates, sawmill residues, and green material from land clearance and park operations.
3. Negotiations should be undertaken with Federated Farmers and NZ Farm Forestry Association to establish collaborative principles for converting EP land into energy (short term) and high quality material (long term) plantations and for the harvesting and conversion of wood and soft material into timber and liquid fuel.
4. A processing plant or plants should be established to convert raw material into methanol, diesel and aircraft and ship fuels on a progressive basis and a system established to distribute and, if appropriate, to export the products.
5. Decisions need to be taken on the most appropriate methods for supplying New Zealand's needs for fuel cell vehicles of all types, including consideration of domestic manufacture.
6. The Constitution Act 1986 should be amended to include provisions defining the duties of members of Parliament.
7. Members of Parliament in general and Government Ministers in particular should be obliged by the Constitution to protect the national energy base and the economy against: a) the creation of man-made damage to the environment, if necessary by initiating new enterprises designed to exploit New Zealand's natural resources and b) the immigration to NZ of people in numbers threatening a population density above a level supportive of self-sufficiency in mobile and static energy.
8. In collaboration with Christchurch City Council, Government should investigate the water-table problem in an attempt to find an optimum solution to the potable



water/liquefaction issue and so redesign urban building to achieve an optimum fit with more expensive energy.

9. Government should consult with Universities on the best way to structure a Mobile Energy Authority charged with responsibility to implement a sustainable national takeover of the production of transport fuels within the time now available.

