



Energy Watch

The Newsletter of the Sustainable Energy Forum

Facilitating the use of energy for economic, environmental and social sustainability

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The Challenge of Urban Sustainability

An edited version of an address by Minister for the Environment Marian Hobbs, to the New Zealand Planning Institute Conference, 18 May 2000, Christchurch

The theme of your conference is *Welcome to the Future*. Before I discuss what I think this means in the urban context I would like to take you back 150 years to the scene that greeted the first European settlers to Christchurch. Little infrastructure existed. Roads were non-existent, little dry land was available and there were certainly no water or waste disposal systems in place. The settlers had to deviate from Wakefield's plan: they settled on the high ground—often close to the rivers that doubled as transport routes and waste disposal systems. Christchurch became one of the dysentery capitals of the world.

Today, many of the original environmental problems have been overcome. Our urban areas are generally pleasant and enjoyable places to live, and are home to 85% of New Zealanders. But the success of urban areas has led to new environmental problems, on scales unfamiliar to us. The perennial problem of Christchurch's winter air pollution comes to mind, as does Auckland's transport, and waste disposal everywhere. Our ways of dealing with these problems are no longer effective.

I believe we are now at a turning point. It is time we took stock of the urban problems we face and the ways we are dealing with them. What are the roles of the community and central and local government in addressing these issues? One thing that I am sure of is that a master plan will not solve the problems of urban sustainability unless everyone is brought on board. Imposing someone's view of utopia on others just does not work. All sectors of the community, including local, regional

and central government have a part to play in developing and implementing sustainable solutions. But no one group has an absolute mandate for urban sustainability, and neither should they; it is just too big and too complex. We need to work together, and speak the same language. The more concrete and grounded that language is the better everyone understands it.

We face complex urban problems. They do not fit nicely into one box, but merge seamlessly between environmental, social and economic realms. This was graphically illustrated in a recent hearing on the draft Christchurch Air Plan. The Committee found that it could not ignore the financial and health implications of banning open fires and coal. Some people feared worse health effects would result if residents could not afford to replace their open fire with alternative sources of heating. As a result the Committee recommended that a compulsory measure for people to replace open fires was only possible if accompanied by financial support for them to do so.

Urban sustainability is about making links. Agenda 21 offers a useful action plan to link the environment, economy and society together. We will be thinking hard about it at central government level, but we also need input from others at the grass roots, about how well New Zealand has done in making progress towards sustainable development. My view is that we have moved forward since Rio, but not far or fast enough. Some of our big environmental problems have if anything got bigger in recent years. The same has been true on the social front, which is

why we have launched such critical initiatives as *Closing the Gaps* to reduce the inequalities that exist between Maori and Pakeha in this country.

A key principle of Agenda 21 is community participation, in its widest sense, as the cornerstone of democracy. It is also a key ingredient in developing strategies to overcome urban problems. If the community does not have a common vision or buy into the strategies then urban problems will continue. The traffic will get worse, the waste volume will grow, energy use will increase and the levels of amenity we enjoy will decline. We need the community to help work up ideas and visions and to help turn visions and strategies into reality. But for people to have the energy to do this, they need to trust and understand the processes. I hear that only 45% of those polled by Environment Canterbury understood that council's decision-making role in water, air quality and urban issues.

Too often regulation has been used to force reluctant communities to change. Regulation has its place but co-operative approaches have to be given a shot first, such as the Christchurch subsidy scheme to encourage people to convert from polluting forms of home heating. I believe most decisions about urban management are best made at a local level, with community input. Local government is in a central position to respond to its local constituency. It has to weigh up competing interests. A range of environmental values has to be considered.

When making decisions about the form of a city, for example, a local authority has to recognise and provide for the matters of national importance set out in section 6 of the Resource Management Act (RMA). But it also has to balance matters such as protecting soils and related ecosystems, amenity values and the efficiency of transport networks. Environmental constraints such as the potential for flooding, land stability or erosion have to be considered. These are difficult judgments and sometimes tradeoffs have to be made. The competing problems need to be put before the community to involve them in reaching a decision that they all (or most) can live with.

The RMA has its place, but I think it has been somewhat overused. It has become the repository for all problems, whether it is a suitable means of addressing them or not. We sometimes need to look outside the strict boundaries of the RMA to more cross-sectoral approaches. The Auckland Growth Forum is the type of partnership model that I think has the potential to tackle the problems we face. The Forum has a long way to go but I

believe it is already a better way of conducting the strategic debate needed than relying on litigation to deal with differences.

Local government needs to communicate visions, goals and strategies that have evolved from communities—not impose strategies on them. Once local government has facilitated the development of a vision and strategies then they need to work with their community, infrastructure providers and private sector developers to make it happen. Here we reach the nitty-gritty. No matter what strategy, what vision, what goal — each decision on infrastructure will involve a number of choices. These choices and their consequences need to be articulated clearly and explored with the community. It is where planning has become undone. A council may think it has approval for a strategy until it develops concrete proposals—and discovers that the strategy may have been built on people's different interpretations of abstract language.

In Christchurch developers undertake over 80% of housing development. They are key players, and local government should be talking with them understand urban development and to make strategies work. The transport sector is another key group that has an enormous influence on the shape and direction of urban areas.

We need to extend this strategic planning approach so that it becomes the core function of every council's business. One of the key challenges I see for planners is to develop an ability to identify links and move out of the comfort zone of prescribed roles and responsibilities. Planners need to enhance the skills that assist communities to articulate their visions. You need to also venture out into unfamiliar territory if you want to understand what actually drives urban development. I urge you to explore transport planning, real estate, and health among other disciplines. On the other hand, don't be dismayed or threatened by others venturing into your territory. We each need to understand where others are coming from and how we can best coordinate our efforts.

Central government has an important part to play in complementing and supporting the efforts of local government and the community. The partnership between central and local government needs to be developed further, as a partnership between equals. Central government is able to shape institutional structures and systems, including regulatory frameworks such as the Local Government Act, Rating Powers Act and the RMA. It is better placed to address some common issues,

for example, emission standards and public transport subsidies. Central government can also shape pricing regimes and provide public goods such as research relevant to urban areas. We are serious about our role in urban sustainability and are taking action. The Prime Minister sent this message clearly when she appointed a Minister to advise her on Auckland Affairs.

I would like to run through four current policy initiatives that will impact on urban areas:

Climate Change

The Government recently announced its intention to ratify the Kyoto Protocol on climate change by 2002—the time of the Rio +10 conference. This will have major implications for every sector of the economy; especially transport, which has increased emissions by 40% from the 1990 level. More public transport will be one means of reducing emissions. I intend to work with my colleague Mark Gosche, the Minister of Transport, to further investigate other means, such as the use of bus lanes, traffic calming measures and congestion pricing; and in the urban sprawl we achieve let's balance the cost of increased traffic and increased carbon dioxide emissions. Can the planet afford our lifestyle choices?

Energy Efficiency and Renewable Energy

Energy efficiency and renewable energy are an essential component of any sustainable development strategy. We are in the process of 're-energising' the Energy Efficiency and Conservation Authority. Together with the Ministry, it will be responsible for helping develop a national energy efficiency and conservation strategy. The Government intends to ensure this strategy is a fundamental part of its energy policy to deliver more sustainable, efficient energy outcomes.

Waste Management

Waste management is an area of major concern to me. The volume of waste is growing—up 82% in Auckland in the past eight years. The recently released National Landfill Census makes sober reading: landfills are not up to standard. It is time we made some hard decisions.

I will be working closely with local authorities to develop ways to reduce waste, phase in full cost recovery for waste management services, and improve landfill management. However, some communities are limited in their ability to pay for higher standards and I am therefore keen to investigate ways this burden can be lessened. One way is subsidies. The Government is about to

introduce a subsidy scheme to assist small to medium communities upgrade their sewage treatment systems.

Standards and Indicators

The Ministry for the Environment is working to develop indicators to measure and report on trends in the environment. I believe information is an essential tool for any management; otherwise we are wasting our time. The Ministry is presently working on indicators of urban amenity. I anticipate this set of indicators will make an important contribution to the management of urban areas. Work is also underway to develop some National Standards. I am looking at options to develop standards for marine bathing, and organo-chlorines. In addition, the Ambient Air Quality guidelines are being revised and I am discussing with officials the option of turning part of the guideline into a National Standard.

In conclusion I wish to leave you today with six main messages:

- Urban issues are complex. They involve all levels of government and the community.
- Our past approaches have been found wanting. It is time we looked at new approaches and new ways of working.
- We need to adopt a strategic approach supported by flexible, dynamic partnerships.
- We should be seeking agreed outcomes and we should use our energies to solve problems together to get lasting results.
- Regulation should be used to underpin and support agreed outcomes, not to decide them—especially if such decisions can only be made through protracted litigation.
- Strategic planning is an essential component of urban sustainability and is a core component of local democracy. But it is the way we plan that produces the communities our children and we will want to live in.

EnergyWise Awards 2000 New Renewable Energy Awards

In the April edition of EnergyWatch we gave details of the EECA's EnergyWise Awards 2000, but managed to leave out what are perhaps the most important: the awards for non-renewable energy. Below this brief grovel we present the winners and outline details of their projects.

Winner:

Tararua Wind Farm

Tararua Wind Power Ltd

The 31 mW Tararua Wind Farm near Palmerston North is the largest in the southern hemisphere. It produces enough energy to supply 25 000 homes and saves 30 000 tonnes of carbon dioxide each year, with an expected annual output of 137 GWh. It has received no government subsidies or environmental credits. Of the 103 approved turbines, 48 Vestas 660 kW machines have been installed in the first stage.

Tararua Wind Power was the outstanding winner of the award. Achieved with strong community endorsement, the project gained international recognition of what can be achieved without government support. Energy is generated at a cost competitive with fossil fuel, and avoids greenhouse gas emissions at low cost. A third of the cost was spend in New Zealand.

Highly commended

Electronic load governor

Powerflow Technologies Ltd

An electronic load governor for small micro-hydro systems (up to 100 kW), developed by Powerflow and Prof John Boys at Auckland University. The unit increases power output from new or existing systems, and protects supplied equipment by improving the power quality.

Solar electric research vessel

Central Institute of Technology

An unmanned vessel used to carry out robotic meteorological and oceanographic research. It can leave its home port and go to a predetermined location in the ocean.

Grid inter-tied house

Sunpower Co

A suburban house in Auckland which was 100% electrically self-sufficient for 5 years, when it was grid connected and began to sell surplus energy. All inefficient appliances have been replaced with alternative or a very energy-

efficient models. Power comes from solar voltaic and solar hot water panels.

Solar water heating financing project

Synergex Systems New Zealand Ltd

A system developed and funded by Synergex, the Prometheus Foundation, Greenpeace and the Energy Saver fund. Seventy five systems were sold on interest-free terms, but the publicity generated at least four times as much business for NZ system suppliers.

Biomass-fired boiler

Easteel Industries Ltd

Development and installation by Easteel of an 8 MW biomass-fired high-pressure hot water boiler for Tachikawa Forest Products. The fuel used is sawdust, which would otherwise have to be disposed of.

The SEF Conference will be S—o—o—n

...at the University of Otago on the 8th and 9th of July, as part of the University's International Science Festival.

A registration form is enclosed with this issue. For further information

On the web:

www.physics.otago.ac.nz/sef2000

Or write to:

SEF 2000
c/o Energy Management Programme
Otago university
P O Box 56
Dunedin

Or phone the Science Festival: 0800 724 3378

The SEF theme is *Integrating Energy Systems*.

The timing looks good because the "Enquiry into the Electricity Industry" team, headed by David Caygill, will have reported about three weeks earlier, and the Energy Efficiency and Conservation Authority will have metamorphosed into a statutory body just ten days earlier.

New Zealand Wind Energy Association Annual Conference

Another indication that times are changing is the political input to the NZWEA conference on 25th May: Minister of Energy Pete Hodgson; Minister of the Environment Marion Hobbs; and The Greens co-leader Jeanette Fitzsimons. As Jeanette put it:

Clearly the political context in which this conference takes place has changed significantly from that of last year's conference. NZ has been sorely lacking any substantive environmental leadership for too long.

The main points of their speeches are summarised here:

Pete Hodgson

- New Zealand has one of the best wind resources in the world, yet has many barriers to greater uptake of wind energy.
- The Tararua Wind Farm produces enough energy to supply 25 000 homes, is popular in the community and spent 30% of its development costs within New Zealand—and won the inaugural EECA 'New Renewable Energy' Award.
- The Electricity Inquiry's terms of reference (*see EnergyWatch 13*) specifically refer to fixed charges, both for distribution companies and Transpower. Fixed charges disadvantage embedded generation and wind energy projects are generally embedded.
- The NZWEA's submissions emphasised the issues of fixed or variable transmission charges, and the threshold on lines companies owing electricity generation. Both disadvantage new renewables.
- The Inquiry will report by 12 June. Any necessary new legislation will be introduced later this year.
- Wind Energy, and new renewables, must be seen in the context of climate change. To ratify the Kyoto accord by 2002 is a significant challenge and raises issues for every sector of the economy. I want the WEA to weigh into the debate with a clear focus on solutions and the respective roles of government and the industry.
- EECA will now have a statutory role within the

state sector and can make an important contribution to climate change issues.

- The taxation review will be an important forum for discussion of a carbon charge. The Government will take the decision on a carbon charge to the electorate in 2002. But the review, covering all taxation, is in the work programme for this term.

Marian Hobbs

- No government can ignore climate change. A ministerial group will oversee the development of a climate change action programme, convened by Pete Hodgson.
- The Kyoto Protocol is only a partial response. Eventually all major emitting nations must be involved and the international process will need to find a way to develop a fully global response.
- It is vital that there is greater awareness of the threat of climate change and the impact, here and abroad.
- Many district plans classify wind energy as a discretionary activity in rural zones. In the Wellington region alone, South Wairarapa, Porirua City, Lower Hutt and Wellington City all indirectly make provision for wind generation.
- We cannot underestimate the importance of building public support for wind generation. As the need for renewable energy sources grows and is understood by communities, then the weighing up of alternatives becomes easier.

Jeanette Fitzsimons

- We should take some hope, though not necessarily optimism, from the Electricity Inquiry; the Energy Efficiency and Conservation Act, Kyoto, and carbon charges.
- Oil depletion is coming. Discovery peaked 30 years ago and world-wide we now discover only one barrel of oil for each four barrels we use. The inevitable production peak and developing scarcity will probably happen in this decade.
- The responses to both oil depletion and climate change must be the same—more energy efficiency and more renewables.
- The Energy Efficiency and Conservation Act

gives the Minister of Energy a duty to promote renewables, monitor them, report on them, provide information on them.

- EECA now has a mandate to pursue renewables. The National Energy Efficiency and Conservation Strategy, which is to be prepared by April 2001, must state targets for renewables and means to achieve them.

- Obstacles to wind energy and their solutions:

Fossil fuels and carbon charges

Fossil fuels maintain their dominance by being subsidised for the resulting environmental, health, and social disruption. Use taxation and the polluter pays principle.

Grid connection

Energy efficiency, distributed renewables and fuel cell technology all have the potential to reduce demand on the grid. Current pricing charges for 'maximum pipe size' and gives no credit for embedded generation.

Lines/energy ownership split

Lines companies are the ideal entity to build wind generation for reasons of capital backing and scale.

Wholesale market

Market reforms have eliminated long-term planning, created more barriers for energy efficiency and led to fossil fuels being burned while water spills. We need a fundamental rethink about how to design electricity industry institutions.

NIMBYs

There are some who see wind farms as blots on the landscape. The answer is not to remove public participation for wind farms, but to get the public consultation right at the start.

No long term thinking in government

There is a desperate need for government leadership, perhaps through a purchasing policy favouring sustainably produced goods and services throughout the public sector.

Public perceptions

We need greater recognition of the potential for renewables to provide greater independence from oil and multinationals, greater understanding that renewables are greenhouse-friendly, greater pride in new technology to benefit from NZ's natural advantage.

What is happening to oil prices?

Kerry Wood

Everybody knows that oil prices have been on the move—down 2 cents as this was written—but in New Zealand most commentary has been about non-competitive behavior by the oil companies. There is more to it than that.

In March 1999, the bulk, tax-free price of 95 octane petrol in Singapore was about 17 cents/litre (Data kindly provided by BP: all prices are New Zealand dollars or cents unless otherwise stated). It then rose fairly steadily to about 32 c/l by mid-August, held at roughly that price until early October, then rose more rapidly to a brief peak of 51 c/l in early March 2000. It then fell steeply to 32 c/l again in early April, before going back up to 45 c/l in early May. The price of diesel followed a similar but rather more stable pattern, with a March peak of 37 c/l. (51 c/l is about the same as US\$ 55 / barrel: higher than the maximum crude price because of refinery costs)

All this was caused by the OPEC nations reducing production by 1.6 million barrels/day —about 2% of world production—in March 1999, then increasing it again a year later. Seasonal demand in the northern winter, declining stocks and growing total demand did the rest, but note the long delay between cause and effect. There was a little cheating, for example an 'unauthorised' OPEC production increase of 630 000 barrels/day (0.8%) in January, but also a worldwide demand increase of 2.4% in twelve months. Expectations are that prices will climb again later this year, because stocks will not be replenished before the northern winter and demand will remain strong. However, some OPEC countries may produce more than their quota, which would help to keep prices down.

OPEC policy seems to be to keep the price at about \$US 25/barrel: high enough to be a nice little earner, but not high enough to provoke anything nasty, such as a rush to sustainable alternatives or another oil war. On this view, the recent production changes brought prices into the target area, overshot a little and have now applied a correction.

So are we going to see a repeat of the 1970s oil shocks? The answer seems to be a definite maybe:

- OPEC does not control a majority of production, but demand is increasing and non-OPEC production is declining.

- Three OPEC countries—Saudi Arabia, Kuwait and Abu Dhabi—control 70% of excess capacity.
- China is the fifth-largest oil producer but a net importer of oil: 650 000 barrels/day last year, and increasing.
- The rate of new oil discovery peaked in the 1960s and is now well below demand. Some very large increases in published reserves are 'political oil,' not backed by exploration.
- An increasing proportion of non-OPEC reserves are in tar sands or shale oil, which have to be mined or flooded with steam to get the oil out. Producing this oil is expensive, and uses a significant proportion of the energy produced. This effectively increases the carbon dioxide emissions from each litre of oil delivered to consumers.
(This is why Greenpeace has complained to the Australian Stock Exchange about a prospectus for development of the Stuart Oil Shale in Queensland: the prospectus is misleading because it ignores the risk of unusually high carbon taxes.)
Waste disposal is another problem: crushed rock will not fit back into the hole it came from, and contains oil traces which will leach out.

Some authorities predict developing shortages before the end of the decade, others say we have plenty until 2030 or even beyond. Price increases may be here to stay, give or take the odd remission.

In New Zealand, with a weak dollar, balance of payment problems and very high transport energy use, the picture is less than rosy. Our situation was described as, "champagne energy use tastes on a beer income," by Dr Lee Schipper, a senior scientist with the International Energy Agency, who has studied our energy intensity trends in a contract for EECA. We have the energy use habits of an affluent highly developed economy, but the GDP of a less successful one. "For example, New Zealanders have relatively large poorly heated homes and very high car ownership." As their wealth grows they will heat their houses more and drive their cars further.

Power competition killing green energy

Last year's opening up of the European Union's electricity market has been a disaster for less polluting energies, say environmental and industry lobbies. "Since February last year when the EU electricity directive came into force, electricity liberalisation has proved to be bad for the environment and for industrial competitiveness," the World Wide Fund for Nature (WWF) and Cogen Europe said in a joint statement. Cogen represents the interests of the cogeneration industry, which combines heat and power production, reducing greenhouse gas emissions.

WWF and Cogen said that in the Netherlands 40% of electricity comes from cogeneration and that a third of the installed capacity is under "serious threat of closure." In Germany, which has Europe's greatest amount of cogeneration, 9% of plants have closed down, 6% are partly shut down, 18% are thinking about stopping their generators and 27% suffer economic problems, the groups said. "This is the result of a decline in power prices of about 30% in Germany for large power consumers," the statement said. The European Union's electricity market was partially liberalised in February 1999, unleashing fierce competition for large business consumers, the only ones able to shop around the block for cheaper prices.

New and clean producers were also having problems getting their electricity to the market, as former monopolistic utilities set prohibitive prices for access to the power grid, which they still control, the statement said. The European Commission, the European Union's competition watchdog, has expressed reservations about a German plan to divide the country into two zones for the transmission of electricity, saying it would give an unfair advantage to established big firms.

Cogen and WWF said that development of new cogeneration supply schemes had decreased by 25-50% in the EU and that the trend would continue. "Liberalisation...has resulted in cogeneration being squeezed out by more polluting electricity supply options," they said. Reuters

Monitor

Transport fuel use in NZ: a summary and guide to statistics

Kerry Wood

Transport is the largest and fastest-growing energy-using sector in the NZ economy. In the March 1998 year, domestic transport accounted for 45.5% of energy-derived CO₂ emissions. This is already the highest proportion in the OECD (the average is about 30%). On present trends transport energy use will be about 80% higher by 2020 and will then account for some 52% of energy use.

The true situation is even worse. Other energy uses that could reasonably be ascribed to transport include emissions from construction and maintenance of roads, runways, railways and vehicles. Energy use and evaporation losses in petroleum production and distribution could also be included. These losses are very largely accounted for by gasoline production, which is almost entirely for transport. They include refinery cracking, synthetic petrol production at Motunui (at a thermal efficiency of about 50%), and evaporation losses in storage and distribution.

Transport, energy use and energy intensity figures are summarised in Table 1. Passenger transport (private and public) accounts for some two thirds of transport energy use. Of this, nearly 90% is by cars, with domestic air travel taking most of the remainder. The remaining third of energy use is for freight, 91% of it by road vehicles.

Table 1 shows the increasing dominance of car and truck use for passengers and freight, as well as the better energy intensity of other modes. It also gives the minimum age of the oldest quarter of vehicles. The fuel efficiency of most modes is improving (the exceptions are passenger rail and coastal freight), but the increase is not enough to offset growth. Coastal shipping seems to be an exception, but this is uncertain: annual variations in energy intensity are greater than the variation over a

decade. The minimum age of the oldest quarter of cars is 13 years—higher for buses and trucks—showing that new technology will take many years to be fully effective.

Measurement units

The units used to measure transport fuel use can be messy, even in a nominally metric country. In New Zealand they include:

Imperial Gallon gal = 4.55 ℓ
 Still used for most motor vehicle fuel consumption figures. Multiply by 0.354 to convert miles per gallon to kilometres per litre, then take the reciprocal and multiply by 100 to get litres per 100 km.
 (you can see why getting used to 1/100 km is taking some time)

Joule J
 The metric unit of energy:
 one Joule/second = one Watt
 The usual practical units are Megajoule (MJ = 10⁶J) and Petajoule (PJ = 10¹⁵J).

The Joule and its derivatives are difficult to conceptualise but are theoretically the best units because they directly measure the energy in the fuel, and also because they are unique units.
 (The gallon, barrel and ton/tonne all come in two or more versions: fortunes have been made by buying one and selling another)

Litre ℓ = 1/1000 m³
 (A special typeface is sometimes used, as here, to clearly distinguish 'ell' from 'one')

Table 1: Passenger km and freight tonne km, energy use, energy intensity and vehicle age

	Passenger- or tonne-km		Energy use		Energy intensity		Age of oldest 1/4 of road vehicles years (min)
	1998 pass-km or t-km, millions	Growth %	1998 PJ	Growth %	1998 MJ/km	Change %	
Cars	51 858	3.6	98.7	2.9	1.90	-0.8	13
Buses	4414	1.8	3.3	1.6	0.75	-0.3	14
Passenger rail	212	-0.6	0.3	0.0	1.44	1.4	-
Domestic air	2778	3.2	8.2	3.3	2.75	-0.6	-
Road freight	17 361	4.0	53.8	3.0	3.10	-1.0	17
Rail freight	3547	3.0	2.2	1.0	0.61	-2.0	-
Coastal shipping	7278	0.06	2.8	-4.7	0.38	-	-

Growth or change is the average for 1989 - 1998, expressed as percent per year

Tonne t = 1000 kg
 Sometimes used for international oil statistics, but conversion is messy because the varying specific gravities of refined products. Unrefined crude is even more variable.
 Sometimes spelt ton, but tonne is safer because it differentiates the metric unit from the Imperial (long) and US (short) tons, with values of 1.016 and 0.907 tonnes respectively.

US Barrel bbl = 159 ℓ
 Thoroughly non-metric but the most usual measure for international oil statistics.

	SG (kg/l)	Calorific value higher lower* (MJ/l) (MJ/l)		CO ₂ equivalent (kg/l)
LPG	0.510	25.5	23.5	1.39
Premium gasoline	0.733	34.6	32.3	2.10
Unleaded gasoline	0.753	35.3	33.0	2.16
Auto diesel	0.822	37.8	35.4	2.36
Marine diesel	0.846	38.6	36.2	2.43
Aviation gasoline	0.794	37.6	35.3	2.25
Aviation kerosene	0.795	36.9	34.5	2.31
Other fuel oil (mean)	0.928	41.1	38.8	2.93

*Corrected for the energy lost by condensation of produced water

Liquid fuel characteristics

Characteristic values for liquid fuels used in NZ transport are given in Table 2. The data for unleaded gasoline is used in the sample calculations below:

Volume equivalent of one Petajoule

$$= \frac{10^{15}}{35.3 \times 10^6} \frac{\text{J} \times \ell}{\text{J}} = 28.3 \times 10^6 \ell$$

$$= \frac{28.3 \times 10^6}{159} \frac{\ell \times \text{bbl}}{\ell} = 178\,000 \text{ barrels}$$

Volume equivalent of one tonne

$$= \frac{1000}{0.753} \frac{\text{kg} \times \ell}{\text{kg}} = 1330 \text{ litres}$$

$$= \frac{1330}{159} \frac{\ell \times \text{bbl}}{\ell} = 8.35 \text{ barrels}$$

CO₂ generated by burning 1 tonne

$$= \frac{1330 \times 2.16}{1000} \frac{\ell \times \text{kg} \times \text{t}}{\ell \text{ kg}} = 2.87 \text{ tonne}$$

All liquid fuels produce roughly 3 times their own weight in carbon dioxide: 2.7 times for LPG, 2.9 times for unleaded gasoline or diesel, 3.1 times for heavy fuel oil. (Coal is up to 3.7 times)

Price increase due to a retail carbon tax of \$ 30/t

$$= \frac{30 \times 2.87 \times 100}{1330} \frac{\$ \times \text{t} \times \text{c}}{\text{t} \ell \$} = 6.5 \text{ c/}\ell$$

The equivalent carbon tax for diesel is 7.1 c/l. Both figures would be higher if the tax were applied at the point of production or importing; the petrol tax might be higher than for diesel because of energy losses in production and distribution.

Table 3: Use of transport fuels, 1992

	Road transport		Other domestic transport*		Non-transport		Total	
	PJ	%	PJ	%	PJ	%	PJ	%
CNG	2.4	2.0	-	-	-	-	2.4	1.3
LPG	4.0	3.3	-	-	-	-	4.0	2.1
Gasoline	89.0	74.5	3.1	5.0	0.7	7.2	92.8	48.5
Auto diesel	24.1	20.2	22.6	36.3	9.0	92.8	55.7	29.1
Marine diesel	-	-	5.4	8.7	-	-	5.4	2.8
Aviation gasoline	-	-	0.7	1.1	-	-	0.7	0.4
Aviation kerosene	-	-	27.2	43.7	-	-	27.2	14.2
Other fuel oil (mean)	-	-	3.2	5.1	-	-	3.2	1.7
	119.5	100.0	62.2	100.0	9.7	100.0	191.4	100.0
	62.4%		32.5%		5.1%		100%	

* Includes off-road use of road vehicles, rail, domestic air and marine uses

Information from:

- Greenhouse gas emissions from NZ transport. Ministry of Transport 1993.

- Energy-Wise monitoring quarterly. EECA, December 1999.

Stabilising the global climate

Lester Brown

President of the Worldwatch Institute

Aside from stabilizing population, the overriding challenge facing our global civilization as the new century begins is to stabilize the world's climate. The exciting thing about the climate challenge is that we already have the technologies needed. Restructuring the energy economy to stabilize the climate requires investment in climate-benign energy sources. It is the greatest investment opportunity in history.

Stabilizing the climate means shifting from a fossil-fuel or carbon-based energy economy to alternative sources of energy. Nuclear power, once seen as an alternative to fossil fuels, has failed on several fronts. Within a few years, the closing of aging nuclear power plants is expected to eclipse the new plants still coming online, setting the stage for the phase-out of nuclear power. Electricity from the power source that was once described as "too cheap to meter" now has become too costly to use. The issue is no longer whether it is economical to build nuclear power plants but—given the high operating costs—whether it even makes economic sense in many situations to continue using those already built.

The only feasible alternative is a solar-hydrogen based economy, one that utilizes sources of energy such as wind power, solar cells, hydropower, wood, and direct sunlight. The transition has already begun, as can be seen in energy-use trends from 1990 to 1998. Coal burning, for example, did not increase at all during this period. Meanwhile, wind power and photovoltaic cells—two climate-benign energy sources—were expanding at 22% and 16% a year respectively. But the transition is not moving fast enough to avoid potentially disruptive climate change.

Wind farms on the rise

Wind and solar cells are emerging as the cornerstones of the new energy economy. Already Denmark gets 8% of its electricity from wind. For Schleswig-Holstein, the northernmost state in Germany, the figure is 11%. Navarra, a northern industrial state in Spain, gets 20% of its electricity from wind. In the United States, wind-generating capacity is moving beyond its early stronghold in California as new wind farms come online in Minnesota, Iowa, Texas, Wyoming, and Oregon, dramatically broadening the industry's geographic base.

Within the developing world, India, with 900 MW of generating capacity, is the unquestioned leader. China, with the help of the Dutch, began operation in 1998 of its first commercial wind farm—a 24 MW project in Inner Mongolia, itself a region of vast wind wealth. The world's wind energy potential can only be described as enormous. Today the world gets over one-fifth of all its electricity from hydropower, but this is dwarfed by the wind-power potential. For example, China is richly endowed with wind energy and could double its national electricity generation from wind alone.

With the costs of wind electric generation dropping from US\$ 2600/kW in 1981 to \$ 800/kW in 1998, wind power is fast becoming one of the world's cheapest sources of electricity—in some locations undercutting coal, traditionally the cheapest source. Once cheap electricity is available from solar sources, it can be used to electrolyze water, producing hydrogen—an ideal means of both storing and transporting solar energy.

Solar-powered buildings

In 1998, sales of solar cells jumped 21%, reaching a potential of 152 MW. In Japan, the development of a solar-cell roofing material has set the stage for even more rapid future growth in solar-cell use. With this technology, a building's roof becomes its power plant. During 1998, nearly 7000 rooftop solar systems were installed in Japan.

The German government announced in late 1998 the goal of 100 000 solar roofs in that country. In response, Royal Dutch Shell and Pilkington Solar International are jointly building the world's largest solar-cell manufacturing facility in Germany. Italy has set a goal for 10 000 solar rooftops. While wind and solar-cell use are soaring, the worldwide growth of oil use has slowed to less than 2% a year and may peak and turn downward as early as 2005. The burning of natural gas, the cleanest of the three fossil fuels, is growing by 2% per year. It is increasingly seen as a transition fuel, part of the bridge from the fossil-fuel-based energy economy to the solar / hydrogen energy economy.

The goal is to convert small positive growth rates for fossil fuels into negative rates and to boost dramatically the growth in wind power and solar cells. Because wind energy is starting from such a small base, and because the urgency of stabilizing the climate is mounting, it should perhaps be growing at triple-digit annual rates, not just in the double digits. If coral reefs are dying and if the Antarctic ice cap is beginning to break up because

the Earth's temperature is rising, maybe wind-generating capacity should be doubling each year, much as the number of host computers linked to the Internet did each year from 1980 to 1995.

One way of dramatically boosting the growth in wind power would be to reduce income taxes and offset them with a carbon tax on fossil fuels, one that would reflect the costs associated with air pollution, acid rain, and climate disruption. Such a move would raise investment not only in wind power, but also in solar cells and energy efficiency. It could push wind power growth far above the current rates, greatly accelerating the shift to a solar-hydrogen energy economy.

Bold German initiative

Sharply accelerating the wind power growth rate depends on restructuring tax systems to reduce taxes on income and wages while increasing those on environmentally destructive activities, such as carbon emissions from fossil-fuel burning. Some countries have already begun to do this, including Denmark, Finland, the Netherlands, Spain, Sweden, and the United Kingdom. And in late 1998, the new coalition government in Germany announced the first step in a massive restructuring of the tax system, one that would simultaneously reduce taxes on wages and raise them on energy use. In April 1999, the first of four annual tax shifts was implemented. This ecological tax shift of some US\$ 14 billion—the largest yet contemplated by any government—was taken unilaterally, not bogged down in the politics of the global climate treaty or contingent on steps taken elsewhere. The framers of this bold German initiative justified it primarily on economic grounds, mainly the creation of additional jobs. It would also help reduce carbon emissions.

*This may be the closest thing
to a free lunch that
economics has to offer*

In an article in Fortune magazine, which argued for a 10% reduction in US income taxes and a 50 cent-per-gallon (\$NZ 0.25/litre) hike in the tax on gasoline, Prof. N. Gregory Mankiw of Harvard University noted, "Cutting income taxes while increasing gasoline taxes would lead to more rapid economic growth, less traffic congestion, safer roads, and reduced risk of global warming—all without jeopardizing long-term fiscal solvency. This may be the closest thing to a free lunch that economics has to offer."

In stabilizing climate, there is no substitute for leadership. Examples abound. Denmark, for instance, has simply banned the construction of coal-fired power plants. Meanwhile, it has adopted a series of economic incentives for investment in wind power that has fostered the development of the world's largest wind-turbine manufacturing industry. As a result, in 1998 wind turbines of Danish design accounted for half of all turbines installed worldwide. Though scarcely a major industrial power, Denmark has a commanding position in this fast-expanding new industry.

Leadership and time are the scarce resources. The world desperately needs more of both. Saving the planet, including the stabilization of climate, is a massive undertaking by any historical yardstick. This is not a spectator sport. It is something everyone can participate in. Few activities offer more satisfaction. There is no middle path. The challenge is either to build an economy that is sustainable or to stay with our unsustainable economy until it declines. It is not a goal that can be compromised. One way or another, the choice will be made by our generation, but it will affect life on Earth for all generations to come.

Daily Yomiuri

Carbon dioxide driving motor industry policy

Carbon dioxide is fueling the new alliance between Daimler Chrysler AG and Mitsubishi Motors. The combined organisation will be the world's third largest car-maker.

Daimler Chrysler sees Mitsubishi as a way to crack the Asian market. But the German auto maker also needs the deal to help it solve a more immediate problem in its own backyard. As part of an effort to curb global warming, Europe's auto industry faces a 2008 deadline to cut by 25% the amount of carbon dioxide their new cars belch out. For Daimler Chrysler, whose Mercedes-Benz luxury cars are as thirsty as they are profitable, that will mean diversifying its product mix by adding smaller, more fuel-efficient cars.

Wall Street Journal
Japan Times

New support for the global warming loonies

A new source of global warming has been found: the moon. It triggered the Little Ice Age 500 years ago and now looks set to warm the planet for the next 500 years. This cycle was discovered by researchers at Columbia University, New York, studying Atlantic sediment cores. They traced the cycle over 10 000 years but had no explanation. Now Charles Keeling at the Scripps Institute has one. The slowly changing alignment of the earth, moon and sun changes the strength of the tides. Higher tides promote more vertical mixing of ocean water, drawing up cold ocean water which cools the atmosphere. The last tidal/cooling maximum was in about 1425 and the next will be in about 3100, so 'lunar warming' can be expected to peak in about 2260. This effect does not contradict greenhouse gas warming: it is additional, making efforts to control greenhouse gas warming all the more important.

Another team, at the National Oceanographic Data Center in Maryland, have analysed 5.1 million temperature measurements in the top 3-4 kilometres of ocean waters from the mid-1950s to the mid-1990s. They show that the average warming of the seas over the 40-year study period was about 0.05 °C for the top 3.6 km of ocean water as a whole, and nearly 0.3 °C in the top 300 m. This seems to be roughly equivalent to the amount of heat stored by the oceans as a result of seasonal heating in a typical year. "That makes it a big number," said Dr Peter Rhines, an oceanographer and atmospheric scientist at the University of Washington in Seattle.

New Scientist, CNN/Science

Countering the contrarians

Before seizing on the views of the small band of (global warming) skeptics to justify complacency, politicians would do well to consider two questions.

First, why do the global warming contrarians always reach the same conclusion, even with shifting arguments? A few years ago contrarians argued that satellite measurements showed that warming was not occurring. More recently they acknowledged that warming might be occurring, but that the rate in recent decades had been slower than expected. Now that the National Academy of

Sciences has concluded that the observed surface warming is "undoubtedly real" and that it has accelerated in recent years, the contrarians have shifted to arguing that the discrepancy between the surface and satellite measurements shows that climate models are inadequate.

Second, if climate models are so inadequate, how can the contrarians be so sure that global warming will be mild? Contrarians confidently predict that warming will be at or below the low end of the range considered likely by the Inter-governmental Panel on Climate Change. Given that many of the same people have argued that we don't know enough to make valid global warming forecasts, it's very difficult to understand how the contrarians can rule out the possibility that warming could be as severe as mainstream forecasts suggest.

Science thrives on contrarians' challenges to conventional wisdom, but when it comes to global warming policy we shouldn't bet the planet that the contrarians are right.

Dr Daniel Lashov
letter to New York Times

Renewable Energy Research Laboratory

A Renewable Energy Research Laboratory was opened in April, by Christchurch Polytechnic

This full-time research laboratory will be lead by Dr Fouad Abdalla who has extensive inter-national expertise in the renewable energies area. His specialist areas are solar energy and wind power but he also has interests in the fuel cells and biogas areas. The area of renewable energy will become increasingly important as the worlds reserves of petroleum products start to run out over the next few decades - Maui gas field is predicted to run out in less than a decade.

Aviation fuel tax 'good for the environment'

The taxation of aviation fuel should be closely aligned to the environmental costs of air travel, says the European Union. These costs include air pollution, acid rain, climate change, high altitude water emissions and ozone depletion. The Commission urges the EU member states to adopt a 1997 proposal to extend energy taxes as soon as possible. The Commission's paper says that, under the proposed tax, the net reduction of carbon dioxide emissions in 2005 would be 55 000 tonnes if a tax rate of Euro 10/1000 litres (NZ\$ 0.18 /l) were applied. But the beneficial effect would be negligible unless it is applied globally. The commission says that European countries should intensify efforts to see a general aviation fuel tax introduced at world level, particularly in the run-up to the 33rd International Civil Aviation Organisation assembly in the autumn of 2001.

Financial Times

Plant now, pollute later

Japanese companies in 'dirty industries' such as power generation and steel-making are being invited to invest in planting trees in NSW, to earn credits to offset their greenhouse gas emission reduction targets. From July, the Sydney Futures Exchange will offer the world's first exchange-based trade of carbon emission instruments.

Australia has already secured such a deal with the Tokyo Electrical Power Company, which has signed a contract for a A\$M 2.6 plantation investment project with State Forests. The deal establishes 1000 ha of plantation land to be extended, over 10 years, possibly to 40 000 ha. Such deals give heavily industrialised nations such as Japan more flexibility in meeting tougher curbs on greenhouse gas emissions proposed under the 1997 Kyoto Protocol. The protocol has not been ratified by either Australia or Japan, so there is no legal obligation on companies to comply.

Other Japanese companies are moving independently on the same front. In 1998 Toyota and Mitsui set up a firm in Melbourne with a capitalisation of \$250 000 to cultivate eucalypts. Another consortium will plant 100 000 ha of trees in China.

Reuters

Coal-fired electricity generation

Modelling by the Ministry of Economic Development (MED, previously the Ministry of Commerce) suggests that by 2020 a ban on all coal-fired generation would have reduced New Zealand's carbon dioxide emissions by 13%. But while electricity prices in 2020 could be similar to today's (in real terms) on current policy settings, a ban on coal-fired generation could raise them by 26%. The full report is available on the MED website: <http://www.moc.govt.nz>.

Minister of Energy Pete Hodgson said the report was another indicator of the size of the challenge involved in reducing greenhouse gas emissions. "There are no easy or cheap answers to global warming," he said. "There is no free lunch."

(Perhaps the Minister should read pp 10-11 E/W)

New Zealand Wind Energy Association (NZWEA) Chairman Paul van Lieshout, says that the "policy direction message from the Minister is still not getting through to Government officials." He finds it amazing that the supplementary report produced by MED only replaces the coal with gas fueled generation and not wind power. Van Lieshout argues that, "if the MED had replaced the 13% of coal based electricity in their model with wind energy, then the electricity cost would not be dearer than today's commercially viable Tararua Wind Power project. And the added benefit would be no emissions of damaging pollutants and greenhouse gasses". Ignoring wind power also bypasses wind energy technology employment opportunities for New Zealand, says van Lieshout. Throughout the world, wind energy generation is now growing at more than 25% per year, and the cost of wind turbines continues to drop. New Zealand's abundant wind resource could supply at least 20% of New Zealand's electricity needs. Wind power is a perfect 'companion' energy source to our existing large hydro-power systems—water can be conserved when the wind is blowing.

Van Lieshout says, "NZWEA calls on the Minister to establish a target for renewable energy power generation that restores it to more than 85% of the total by 2012 (the end of the first Kyoto Protocol commitment period). There should be no additional fossil-fuelled power stations installed during this period."

Newsroom: Press releases by
NZ Government and NZWEA

Soot and global warming

Coal-burning power plants. Diesel-burning cars and buses. Dung burnt for heating and cooking. All are sources of soot, and all combine to create a hazy concoction that reduces cloud cover and enhances global warming, according to a report in today's issue of *Science*. "There is one huge soup of pollution coming off the Indian subcontinent," said Andy Ackerman, a scientist at NASA's Ames Research Center in Moffett Field, California. "The sun comes up, black particles absorb sunlight, and when they heat up they warm the air and evaporate clouds." With less cloud cover reflecting sunlight back to space, increased solar energy reaches Earth's surface and the lower atmosphere, causing a warming of the atmosphere and oceans. In fact, this mechanism amounts to a warming that is three to five times greater than that of the greenhouse effect attributed to carbon dioxide emissions since the Industrial Revolution of the 1800s, said Ackerman, lead author of the study.

Ackerman and colleagues collected their data in the tropical Indian Ocean during the dry monsoon months of February and March in 1998 and 1999. The research is part of the Indian Ocean Experiment, an international project to quantify the indirect effect of aerosols on climate through their effects on clouds.

"This (soot) effect definitely kills clouds," said Ackerman, "but it is not the only effect." Daniel Rosenfeld, a scientist at Hebrew University of Jerusalem in Israel, reported in the March 10 issue of *Science* that aerosols such as sulfates and sulfuric acid from lead smelters and oil refineries increase the number of tiny water droplets in clouds to the extent that the droplets can no longer coalesce to form rain. Owen Toon, an atmospheric scientist at the University of Colorado at Boulder, points out that aerosol pollutants also reflect sunlight back to space, rendering a cooling effect on Earth that may cancel out the warming effect of greenhouse gases.

"These recent studies demonstrate both the importance of aerosol effects on climate and the complexity of aerosol-cloud interactions," write Stephen Schwartz of the Brookhaven National Laboratory in Upton, New York, and Peter Buseck of Arizona State University in Tempe, in an accompanying *Science* article.

Science, The Hindu

A series of record world temperatures may indicate a speedup of global warming. For 16 consecutive months—May 1997 to September 1998—each month broke the previous monthly world average temperature record. Scientists from the US National Climatic Data Center calculate that there is only a 5% chance that the string of record high temperatures was a coincidence. A change to faster warming is more likely.

Team leader Thomas Karl said, "It raises a flag because it was such an unusual event that we need to watch very carefully in the next several years, because it could be a signal of an increased rate of temperature increase." The team found that 1999 was the fifth warmest year on record. It would have been expected to be cooler because of La Nina, a cooling of the waters of the central Pacific Ocean.

New York Times

Norwegian Government falls on global warming issue

Norwegian Prime Minister Kjell Magne Bondevik announced the resignation of his government after losing a vote of confidence in parliament. This is the first government in the world to fall as a result of issues related to global warming, after calling a vote of confidence which it had no chance of winning. The issue was the building of several natural gas fired power stations.

During a day-long debate in the Storting (parliament) Bondevik, a Christian Democrat, had made it clear he would resign if he lost the vote. The minority three-party coalition government, with just 42 seats in the 165-member parliament, was bitterly at odds with the parliamentary majority over whether to build the gas fired power plants to burn some of Norway's large stocks of natural gas. The government argued that the plants would release far too much carbon dioxide. The government wanted to put the gas power plants on hold until more efficient, cleaner technology is developed to make natural gas fired power plants pollution free.

The new Prime Minister, the Labour party's Jens Stoltenberg pledged that, "Norway shall be a leading country in environmental policy."

ENS, Reuters

Global warming may be speeding up

A pay rise for not driving to work

The US State of Maryland has introduced a law giving employers a strong incentive to pay their employees more if the employee agrees to give up their parking spot at work. It is also the first law in the nation to extend tax credits to not-for-profit organizations, such as schools and medical centers, if they pay for employee transit benefits or other 'pay-me-not-to-drive' incentives. The tax credit is valued at half of whatever an employer pays towards an employee's transit or van-pool commuting costs, up to US\$ 30 per employee each month. Employers can also take the tax credit if they boost the pay of employees by the fair value or cost of a parking space that employees pledge not to use, typically \$3 or more a day.

Sustrans

Mini-Whats

SEF Conference

Have you forgotten the SEF Conference in Dunedin? See page 4.

How not to do it

On 4 April the Times of India reported the withdrawal of 1750 diesel buses in Delhi on environmental grounds, following a Supreme Court order. The bus company's 750 long-distance buses did their best but turned out to be grossly inadequate, with some commuters waiting for several hours. Two days later the Times reported the issue of temporary permits for 1500 buses. There were hopes that buses could be converted to CNG, but by the deadline there was only one filling station, which took 40 minutes to fill each of the 21 converted buses. There has since been at least one CNG enquiry to New Zealand.

Spanish renewables

Energia Hidroelectrica de Navarra (EHN) has placed an order with Spanish manufacturer Gamesa Eolica for 1800 wind turbines, with a combined capacity of 1.4 GW. Delivery will be by the end of 2002. This is the largest order yet placed, equivalent to 15% of European capacity in 1999.
Renewable Energy World

German renewables

The German government passed a new renewables law on 25 February, guaranteeing prices for

generation from a wider range of renewable energy technologies than before. Purchase prices per kilowatt from 1 April are (in DM, = NZ\$ 1.04):

New wind power, first 5 years	DM 0.178
After 5 years, good sites	DM 0.121
After 5 years, worst sites	DM 0.135

Renewable Energy World

Kids Corner

Two versions of the logo used by the School Energy Forum in Europe:



Perched



Flying
Sustainable Energy News

New gas regulations

New Zealand's gas company disclosure regulations are being tightened from next year, under regulations introduced in May. "The information disclosed under the regulations is designed to help gas users monitor and negotiate with pipeline owners," Mr Hodgson said. "It should also promote access to Commerce Act remedies by private parties or the Commerce Commission."

"The regulations are focused on gas transmission and distribution pipeline businesses that have the potential to exercise market power. The purpose is to promote transparency of conduct and performance of pipeline owners.

The amendments to the regulations tighten rules for accounting and for calculating performance measures, require the use of a mandatory optimised deprival valuation methodology for valuing pipeline fixed assets, require pipeline owners to disclose asset management planning information, introduce new measures of reliability performance and provide for most disclosed information to be made available on the Internet.
Newsroom

EECA Bill passed

The Energy Efficiency Act was passed on 10 May, and comes into force on 1 July 2000. On that date EECA will become an independent crown owned entity reporting to the Minister of Energy and monitored by the Ministry for the Environment. Green Party co-leader Jeanette Fitzsimons described the Act as giving the Minister, for the first time, power to set energy efficiency standards to protect consumers from expensive and wasteful household appliances, vehicles and buildings. "We now have legislation that brings New Zealand into line with other OECD countries," she said. All parties except ACT supported the bill.

Climate neutral network

An article in Christian Science Monitor describes the US Climate Neutral Network, a voluntary certification organisation for 'climate neutral' businesses: those emitting no net greenhouse emissions. Certification requires companies to reduce their own emissions as much as possible and offset the rest with innovative programs that help reduce the burning of fossil fuels elsewhere.

SEF Conference

Have you forgotten the SEF Conference in Dunedin? See page 4.



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