REPORT 11
(1215/52/IM)

CLIMATE CHANGE AND GOVERNANCE CONFERENCE: 27 TO 29 MARCH 2006 - REPORT BACK ON CONFERENCE

1. Purpose of the Report

To report back to all Councillors on the Conference including the subjects covered and an opinion of the value of attendance by Elected Members.

2. Details on the Conference/Background

The Climate Change and Governance Conference was organised by Victoria University, with the support of the British High Commission and a number of high profile sponsors.

This was something of a milestone gathering on Climate Change. This level and breadth of participation does not seem to have been evident anywhere else to date and was paralleled by significant public and media interest.

The conference programme was largely dominated by scientific evidence on the first day, demonstrating compelling evidence that there is significant, indeed alarming, human generated impact on the environment. Future scenarios and risks were spelt out.

The second day was dominated by the question of how we can and should respond. The consequences of not responding, and doing so fast, are stark and potentially catastrophic. It was also clear that most of us will see the adverse impacts of climate change within our lifetimes.

The general message was that scientists in the 2001 IPCC report had been conservative in their estimates of the impact of climate change given emerging data and models.

A number of public events were built around the conference.

- CCP-NZ made awards to Councils that had achieved their goals. Councils representing about half of New Zealand's population are now signed up to this valuable programme fro action.
- The numbers overflowed the public forum on the Monday and the general conference and a video-show was made available outside the main theatre.
- The British Council hosted a film and talk event, Café Scientifique, on Wednesday night.

- The conference and surrounding events attracted a lot of media coverage, which was encouragingly issue-focussed and reflective of the seriousness of the issue. The Dompost op-ed pieces were generally a useful contribution.

Conference presentations are available at http://www.presentationcentral.co.nz/mediasite/viewer/?cid=a35a3cf5-3801-4352-aca3-ddfe7f575c0a which has both videos of speakers and copies of their slides.

Conference organisers are liaising with others to continue to bring the issues of Climate Change and appropriate public policy responses to the attention of stakeholders and the general public.

There is certainly an appropriate role for local government in both mitigation of green house gas emissions and adaptation of infrastructure, environment, social and economic models to the likely changes. The matter is urgent.

In case anyone doubts the seriousness of the issue, the sponsor list includes
Major Sponsors - IAG Insurance, British High Commission, British Council, Treasury, DoC, MAF, MED, MftE, MFAT, MRST, MoT,
Other sponsors – VUW, GWRC, Tindall Foundation, KCDC, NZ Business Council for Sustainable Development, Shell, Comalco, Honda, the Royal Society, WCC, French Embassy, Dutch Embassy,
Supporters of Associated Events – ICLEI, Genesis Energy, Stagecoach, NZ Institute of International Affairs, Paramount Theatre, TV3, University of Auckland, University of Canterbury, Wgtn Chamber of Commerce.

3. Recommendations

It is recommended that the Committee:

1. *Receive the information.*

2. *Note that the Resource Management (Energy and Climate Change) Amendment Act 2004 requires local authorities to plan for the effects of climate change, which includes land use planning, asset management planning and civil defence planning. The Act also requires the Council to have particular regard to the efficiency of end use of energy and the benefits of using renewable energy.*

3. *Note that officers ensure that the RMA requirements above are reflected in the business plans and Asset Management Plans of relevant Council business units.*

4. *Note that the draft LTCCP includes the development of an Energy Management Plan that will be implemented by an energy manager whose focus is initially corporate energy use.*

5. *Note that the Council is consulting on the Corporate CCP-NZ greenhouse gas reduction goal via the LTCCP and will be consulting on the*

Community CCP-NZ reduction goal during the Community Outcomes Measurement process.

6. *Note that District Plan Change 32 focussed strongly on renewable energy and that we await the Environment Court outcomes before Chapters 24 and 25 can become operative.*

7. *Agree that future reviews of Council's seven draft strategies include assessments of climate change impacts. Note these matters may arise earlier from public submissions in the LTCCP process.*

8. *Request that officers review the Council's policy responses to the threat of Climate Change and related energy issues.*

9. *Request the "supporting information template" be amended to include consideration of Climate Change issues.*

10. *Recommend to Council the establishment of a Councillor working party to consider and develop further policy response including a communications strategy regarding Climate Change and related energy issues.*

4. Key Messages

We summarise the points we learnt here. Copies of Councillor Foster and Wade-Brown's notes are attached as appendix one.

The Scientific Message

1. Scientific evidence is compelling that there is a significant and accelerating increase in Greenhouse Gases (GHGs) – especially CO_2 in the last 150 years. It has measurably accelerated since around 1970.
2. The clear and unambiguous view of the scientists is that we must not delay responding. The attendees seemed in no doubt that the threat was real – little time was wasted challenging the basic evidence.
3. We are clearly injecting far more GHGs into the atmosphere than allowable if we are to avoid breaching danger level emissions and consequent temperature changes. (e.g. Myles Allen advice that we are looking at C21 emissions that are more than enough for C21 and C22 if we are to keep under danger levels. Noting that danger levels mean danger, not merely discomfort of increasing bad weather scenarios)
4. The Climate Change roulette wheel (Prof Ron Prinn) demonstrated a range of modelled scenarios, with risks escalating as temperature rises. A "little bit more GHG" does not increase the risk "a little bit" – response is not linear.
5. Climate Tipping Point – where we enter a quite different and hostile climate – is likely at increases of more than 2° C average. This looks alarmingly possible.
6. Several speakers noted that there are dangerous and not fully known **positive feedback loops** e.g.
    a. permafrost melting and releasing CH_4,

b. warmer Arctic and Antarctic air melting snow/ice cover and therefore reducing reflection of solar energy, which continues warming, especially of polar regions.
c. Warmer air holding more moisture that in turn contributes to greenhouse effect.

7. Tony Blair said it is the 'Number 1 issue facing the world.' 'The science is sufficiently clear that not taking action would be deeply irresponsible.'
8. Northern Europe, especially UK, may suffer dramatic cooling since the **Gulf Stream** may cease flowing and warming the Antarctic coast from Cornwall up to Scotland.
9. The oceans are acidifying as CO_2 is absorbed. Coral is very vulnerable but so are all shellfish and possibly other marine life. Warming will also have physiological effects on fish.
10. Pre industrial CO_2 levels at 280 ppm, now at 380 ppm. Scenario modelling for 2100 is anything between 540 and 900 ppm depending on demographic, economic and technological changes and what responses we collectively make. CO_2 is currently higher than at any time over the last 20 million years. This compares to 10 000 years of human history.
11. Even if we stabilise emissions at a given level there will be ongoing residual impacts for several centuries. Every year we continue to increase GHG levels is likely to require 2 to 3 years to recover.
12. Natural CO_2 levels are already at the top of a cycle leading back to dinosaur days (when CO_2 was 3 to 8 times our pre-industrial, and temperatures 6-10 degrees higher – think that is an average includes what are now polar regions). That environment also had continents in completely different configurations thus hard to predict consequences.
13. Human activity is seeing CO_2 levels rise rapidly beyond the top of the natural cycle. Temperatures are up 0.7 degrees since 1870 and 0.5 degrees since 1970. Graphs repeatedly showed the last decade as an acceleration o the emissions and temperatures. The increased temperatures must be added to natural variability. Graphs showed how late C20 was moving well outside usual temperature ranges although the immediate perception is masked by variability.
14. An argument was advanced that it's the total amount of CO_2 and other GHGs in the atmosphere that matters rather than the rate so we can continue now and cut back more severely later. Given the current rate of increase and the short time before 2°C is reached, this doesn't seem palatable to put off solutions.
15. CO_2 levels are rising as a result of fossil fuel burning (transport, industry and electricity generation) and biomass burning (forest clearance) Fossil fuel use continues to accelerate. There remain easily sufficient fossil fuels that if consumed conventionally modelling suggests devastating results.
16. While there are considerable fossil fuel reserves considering coal, tar sands etc., which China and other countries will almost certainly use, the cost of conventional oil/petroleum will certainly rise considerably (Professor Sims and others). This "peak oil" is not a total solution for Climate Change but another problem – though the prescriptions for both are similar – reduce energy use rapidly especially Transport. The unrestricted, unsequestered use of coal worldwide could certainly still create the worst of scenarios.
17. New Zealand's GHGs are almost 50% from sheep and cattle (front rather than rear!) and we have responsibility and opportunity for research to lead agriculture here.

18. Fastest growing sector for GHGs is Transport. Lord Ron Oxburgh, ex Chairman of Shell, lauded role of biofuels, new technology vehicles AND bicycles, walking and public transport.
19. Nuclear energy has a lower Return on Investment than Energy Efficiency projects and the waste issues are absolutely not sorted. It is also the wrong scale for NZ as well as being publicly unacceptable.
20. Cities and states have an important role to play as well as countries, e.g. Melbourne is aiming to be Carbon Neutral by 2020. Several US States looking at carbon trading even if federal level not interested.

- **Impacts**

21. Many temperature scenarios, depending on masking effects of industrial haze, circulation patterns etc. They range up to approximately 7 degrees at the higher end – by 2100, with potential for further rises.
22. Under more moderate and more likely scenarios NZ temperatures likely to rise ca 1.8 degrees by 2080, global by 2.5 degrees. Biggest temperature rises in the poles where temperature reflective ice is replaced by absorptive land or sea.
23. Likely to become wetter in the west of NZ by 20% plus, and drier in the already arid areas.
24. Greater proportion of rain likely to fall in extreme rain events (flooding more prevalent). More rain in atmosphere increases wind speeds – greater prevalence of extreme wind events. Warmer air holds more water that is then available for bigger rainfall in storms.
25. Insurance costs will rise. Likelihood of non-insurance in high risk situations. Note IAG is a large insurance group and was one of the sponsors.
26. Sea level rise ranges from approx 10 cm to 90cm in most scenarios. Possibility of dramatically higher levels (up to 6 metres) if Greenland or Antarctic ice shelves collapse – and this is possible much earlier than thought before. Instead of in two or three centuries' time it could be this one.
27. There will be changes in agriculture. This gives opportunities and risks/threats. The greater the level of climate change the greater the preponderance of risks over opportunities.
28. Biodiversity is particularly at risk as often it cannot adapt – nowhere to go to due to habitat fragmentation and time to colonise new areas – and is under multiple stresses already. This risk rises dramatically the greater the rise in global temperatures.
29. Significant likelihood of climate induced mass human migrations through displacement.
30. Interesting research on lack of correlation between income and satisfaction after a fairly basic level. Pattern was consistent across countries. Consuming more goods faster may hasten end of economy via catastrophic climate change and we might not even have enjoyed most of it!
31. Equity issues as developing countries want better living standards.
32. Addressing Climate Change is cheaper than the risk of inaction.

- **Actions**

33. Technological and lifestyle changes are required but don't wait for a technological "Holy Grail". Possibly not too significant an impact on GDP to reduce emissions given economic benefit of reduced waste/ energy. Challenge is behaviour change.

34. Sequestration an important technology given likelihood of China and India using coal.
35. Biofuels important for transport. Necessity not to destroy forests to plant palm oil plantations – some hope with recent "Heart of Borneo" agreements.
36. Critical to get international buy in especially for the big emitters like China, USA, India, Brazil, Indonesia etc.
37. NZ has a big opportunity in agricultural methane emission research.
38. NZ has an opportunity to work with other nations to model and advocate behaviours and policies. We cannot lead other countries or advocate their action unless we act decisively even though our emissions are a small proportion of the whole – but no country has the majority of emissions.
39. Effective and appropriate technology could be developed for export so NZ firms can still succeed if effort is re-focussed.
40. Establish and empower a standing Royal Commission on Climate Change.
41. National carbon pricing across a wide range of emitters – carbon tax (fiscally neutral) required to give right signals and business and consumer certainty. Repeatedly this was seen as an effective policy response. Pete Hodgson clearly implied that it was the numbers in Parliament that prevented its introduction rather than a deficiency in the concept.
42. National Energy and Conservation Strategy is to be redeveloped.
43. Most of Europe and many US states are ahead of NZ actions. We can learn from others, particularly Sweden, Netherlands and even some US cities and states.
44. An all party parliamentary accord on Climate Change Action is needed.

- **WCC Possible Actions**

45. Put into effect our Sustainability Framework.
46. Include a Climate Change filter in our policy template for all decisions.
47. Use advocacy opportunities locally (WRS), nationally, internationally (sister cities).
48. Consider increasing our Communities for Climate Protection Community & Council targets given the increasing urgency of our situation.
49. Get purchasing policy off the shelf and work with other local authorities and central government.
50. Transport policy is critical – Western Corridor and Ngauranga-Airport are both opportunities and threats.
51. Ensure urban form and planning policies support reduced use of energy.
52. Ensure building code and our own guidelines are up to the mark on solar orientation and insulation etc.
53. Lead by ensuring **Wellingtonians** know we are taking issue of Climate Change very seriously.
54. Ensure LTCCP includes costs of adaptation as well as mitigation e.g. stormwater for storms of 50 year return period now needs to consider same level of storms recurring much more frequently.
55. Be ready to react to the IPCC 2006 reports due in October.

The Earth's Climate is approaching a dangerous Tipping Point. We have a decade to stabilise and a decade to severely reduce emissions.

Report prepared by: *Councillor Celia Wade-Brown and Councillor Andy Foster*

Councillor notes from sessions
Climate Change Conference March 2006

Public Forum - Monday 27th
Dr Kevin Trenberth – Head Climate Analysis Section - US Centre for Atmospheric Research
"Observed Changes in the Climate and their Causes"

Visible pollution gets washed out in a week or so. Greenhouse gases are relatively long lived.

Since 1970 the human effect is noticeable – in CO2 and temperature. Average temp up 0.75 degrees since 1870. Up 0.5 degrees since 1970.

The extremes of temperature are also increasing. Example the European heat wave of 2003 – 30,000 deaths.
Land temperature rising about twice the rate of the sea surface.
Sea level up 37mm since 1993 – a satellite capable of measuring world sea levels was launched in 1992. (3mm pa) 60% is due to expansion of sea water, 40% to ice melt.

Heating Earth up – like the human body – the Earth sweats – ie evaporation increases. Moisture in the atmosphere rises approx 7% for every degree in temperature increase. Thus rainfall events tend to be more extreme, which is a management issue. Also results in changes in moisture intensified hurricane frequency and intensity. These cool the Earth by taking up moisture and then dump it.
Only raining over 1/16th of the globe at any one time.
Higher percentage of rain is falling in heavy rain events because of increased temp and increased water vapour in atmosphere.

Snow is more likely to fall as rain which means there is less snow to melt during spring and summer leading to more droughts in summer.
Losing Northern Hemisphere sea ice – may well become ice free in 50 years.
Arid areas tending to become drier, and wet ones wetter.

Showed graphs indicating the rapid rise in CO2 and methane in Antarctic ice over the last 150 years.
2100 – projection may be up to 700 ppm in atmosphere
The parable of the frog placed in a pot of hot water. Are we the frog ?

Jim Salinger – NIWA - Discussed projections looking towards 2080.
Predicted global mean temperature of +2.5 degrees. NZ approx +1.8 degrees (because we are surrounded by sea)
Rainfall in NZ – increase of 20% in West to reduction of 20% in East. Wellington expected not to change much. More water in the larger rivers.
Westerly winds likely to increase in intensity by 20%.
Sea levels likely to rise between 9cm and 88cm. Probably approx 0.5m.

Global insurance impact between 1950 and 2005 doubling every ten years.

In NZ there will be a range of economic gains and losses – esp in primary industries. Real risks to biodiversity especially in sub-alpine flora/fauna which has nowhere to go. New pests also likely.

USA emits 25% of global CO2. NZ, Canada, Australia are next worst as a group. China is 1/10th, and India 1/20th per person than the USA.

We'll double pre-industrial CO2 by 2060. Even with Kyoto implemented it will still happen about 2075.
Energy costs and demand will rise sharply driven by India and China.
China is well aware of this and in its centralised 5 year plan it is looking at less energy intensive ways of gaining wealth. The big question is how much the developed world will help China and India.

Kirsty Hamilton – UK Council for Sustainable Energy – International Policy Consultant
The business community debate about whether there is an issue is over.
Business is seeing insurance premiums rising significantly.
Business is looking at spending big money on solutions, like renewable energy. What they need is clear Government policy direction – long, loud, legal.
They are responding well to the development of carbon markets.
Kyoto is important as a base to creating a structure for international action.
In answering question she said that nuclear is not part of NZ's solution. It is too lumpy for a small market like ours. (ie scale of generation would crowd out existing generation/have large amount of its own capacity wasted) Big waste issues also.

Malcolm Alexander – Genesis Energy (sponsor) – GM Corporate Affairs
Genesis takes Climate Change very seriously, they care 'very deeply'. Released their climate change policy today. Discussed the challenges of keeping the lights on, and having legacy emissions (notably Huntly). Looking at windfarming and R and D into carbon sequestration. Also exploring for LNG and investigating importing LNG.
Answering questions he said that Genesis supports the RMA – 'democracy demands it' and it has not proved an insurmountable hurdle eg for wind farm at Raglan.

Wayne Wescott – ICLEI
Practical local actions can make a real difference. Use of purchasing power to buy/ develop energy efficient products and buildings. Melbourne has recently committed to zero net emissions by 2020 through more efficient energy use and sequestration.
ICLEI is working at a city level in China and India. They are enormously interested.
The conservative mayor of Seattle has pulled together 200 US cities to advocate for Kyoto ratification – driven in his case by advice that in the future Seattle would run out of water due to climate change impacts on the Rockies.

Conference – 28th and 29th March

The Hon.Pete Hodgson, acting minister for Climate Change, opened the conference.

He welcomed the views of the NZ Business Council for Sustainable Development and noted the paradox that in NZ the largest party supports Kyoto but many business organisations don't whereas in Australia it's the other way round.
He acknowledged the personal contribution o Jeanette Fitzsimons to the issues f Climate Change and welcomed a paper the Greens put out – see http://www.greens.org.nz/searchdocs/PR9693.html . While his view of the suggestions ranged from serious support to willingness to consider to disagreement on a few, he said the Greens were the only other party seriously thinking about Climate Change.

Pete Hodgson clearly accepted that it was the numbers in Parliament rather than a deficiency in the concept that meant the carbon tax was currently abandoned. He believed it would have set a solid framework for a seamless transition into emissions trading. The government's intentions remain assertive about Climate Change.

NZ ratified Kyoto because
1) NZ is a good international citizen
2) NZ is more dependent on a reliable climate than any other Western country due to our primary producer status.
3) Technology matters – e.g. USA lags in hybrid design because the govt lacks commitment and leadership re Climate Change. Given our agricultural background, our technological improvement could be ruminant physiology, which was one reason the "fart tax" was important.
4) Our "clean & green" reputation was at stake – would European consumers buy from a non-Kyoto nation?
5) NZ stood to make a small amount of money from being in a surplus position – this was where there was an error in the calculations. The other reasons stand.
Kyoto Protocol has enabled our wind energy expansion, retrofitting houses which brings health gains to and supports Walking School Buses. All these changes contribute to a better Quality of Life.
In conclusion he believes the Kyoto Protocol will survive, be strengthened by the Fourth IPCC report and that States of both Australia and US will join in as trading partners.

Prof Peter Barrett – Director Antarctic Research Centre – VUW
"The Geological Record" (Greenhouse History)

65 million years ago – temps 6-10 degrees C above pre 1900 levels, with CO2 levels x 3 -8 higher than pre 1900 at 280 ppm. Meteorite – 60% species extinction
4 periods:

I. Greenhouse period (dinosaurs)
II. Cooling transition period
III. Ice-sheet age
IV. Current period

Antarctic ice sheet stable below x2 CO2 levels, disappearing above x3.

CO2 levels and temperatures from Antarctic ice core sampling. Most likely temp rise 3 degrees by 2100. Could be higher – up to 7 degrees, which would be back to greenhouse dinosaur times.
CO2 levels higher now than any time in last 800,000 years and probably the last 20 million years.
Temperature rises likely for next 1 to 3 centuries.

Dr David Lowe – NIWA Principal Scientist.
"Measuring Atmospheric Gases"
Data subject to very close scientific scrutiny. Very public information.
Recent measurements of the main long lived greenhouse gases – CO2, NO2, CH4.

Charles Keeling - measured CO2 in atmosphere from Mauna Loa in late 1950s early 1960s. noted seasonal cycle, and ongoing increase year on year. David Lowe's measurements from Baring Head from 1970s slightly lower than Mauna Loa, very little seasonal variation, but continual growth mirrors Mauna Loa.

2005 – 380ppm about 100 ppm higher than pre industrial level.
Rapidly accelerating accumulation

Excess CO2 comes from:
combusting fossil fuel, 7.2 GT per year
from making cement, 0.2 GT per year
and from biomass burning.2.0 GT per year (3 main sources)
Graphs show exact correlation between CO2 and the above three causes.

Measuring atmospheric O2 levels. They are falling as CO2 rises. Also on seasonal cycle.

Plus 4 GtC per annum to atmosphere, which then goes about 2 GtC each to biosphere and oceans. About 40% goes to those reservoirs, the other 60% stays in the atmosphere since measurements began in 1950s.

Atmospheric methane – about 10 years in atmosphere. Unlike CO2 it changes the chemical nature of the atmosphere. Reduces ability for the atmosphere to clean out pollution and deal with infrared radiation.

Over the last few years methane growth rate has flattened out to approx zero.

Rain forests are high producers of methane. Recent discovery that living plants produce methane. This was not expected. Could be as high as 20% of global methane budget.

CO2, NO2, CH4 all absorb incoming infrared

Earths natural greenhouse affect
Without it temp w/b -18 degrees average, with it is average +15 degrees.

Also increases radiation by 2.6W sqm to base of 155.

Good news – oceans and biosphere are soaking up 40% of emissions, this could be increased if we reduced emissions.
Bad news – fossil fuel emissions increasing at over 2% pa.

Professor David Vaughan – British Antarctic Survey
"The Recent Record at Higher Latitudes"
Antarctica – de-glaciation and the Earth's climate system
Need to get past discussion of whether it is our fault – **it is** – and onto what we do about it.

Is climate changing in Antarctica ?
Arctic is warming faster than other parts of the world.
No evidence of magnified warming on east Antarctic coast. However also warming some part near the Antarctic Peninsula at 5 times the global mean. 2.5 degrees over just 50 years. Causes ? Peninsula area losing sea ice where other parts of Antarctic coast have increasing amounts of sea ice. 87% of Peninsula glaciers have retreated since 1950, 13% have stayed the same or increased.
Reduction of 14000 sq kms of ice shelf (equates to Wellington and Taranaki provinces) Those ice shelves have been there at least 10,000 years, more evidence that it is human activity.
Impacting plant life and wildlife.

In the last century sea level up 8 -18 cm, next century expected between 50-100cm. After that sea level rise may accelerate.

Causes of sea level rise - thermal expansion of oceans, draining lakes, ground water extraction, Antarctica and Greenland ice shelves melting etc.

Impacts of sea level rise include more frequent New Orleans type events.
Thames Barrier closed about 50 times since built. With 1 metre sea rise would be closed 300 times – (check) a year.

West Antarctica the big unknown. It rests on rock that is below sea level – therefore likely to float free in time, and more unstable.

Conclusions for Governance
Dramatic patchiness in how climate change is affecting different parts of Antarctica. Data is improving all the time. Some changes may be natural, some are Climate Change related.

There is significant variation in how global warming will impact different areas – eg Siberia will be able to grow new crops, reach oil currently under sea ice.

Multiple stresses on wildlife eg Antarctica – so we will also need to manage the other stresses – eg tourism pressures.

Even once we have stabilised greenhouse gases we will see years of legacy as sea levels will continue to rise.

There are still major uncertainties in the science, but we know enough to know that humans are having an impact and we have to deal with it. Cannot delay political decisions until certainty is achieved.

Dr Myles Allen – University of Oxford (video link)
"Climate Change Modelling and Perspectives – How much carbon can we emit?"
2100 – various estimates 1.8 degrees to 3.2 degrees temperature increase.
(see Climateprediction.net)

CO2 levels of 550ppm if that is the stabilisation level are unprecedented with the current configuration of continents
If temps rise 4 degrees or more then models struggle to determine what will happen.
Myles warned to be really beware of those who were sceptical of the models – the same people who are now putting complete faith in the most optimistic scenarios are those who denigrated the original models or that there was a human component to climate change.

Said there is 10-20% chance of a warming greater than 2 degrees if stabilise at no more than 400 ppm.
Uncertainty about the sensitivity of the climate
Uncertainty about what the impacts will be of increases in CO2.
Range of temp responses to 550ppm limit. (what if 550 is exceeded ?) Graphs of peaking in 2080, and of continued high levels.

We cannot observe what we need to know to determine what is sustainable – i.e. we don't have a spare planet to act as a 'control.'
Estimates one Trillion Tonnes maximum into atmosphere if want to keep below 2 degree increase. We are predicting to inject in 21st century what should suffice for 21st and 22nd century combined.

Suggestions – retain natural gas, and burn coal and sequester.

Showed a graph indicating where one trillion tonnes is in terms of rate of current emissions.
20% risk of 2 degrees – could keep emitting till 2030 - 2050 at latest but would then need to shut the world economy down in a decade. 50% risk if keep going to 2070, 80% if keep going till 2080/90.

If we know the target, then it provides a good focus for policy. If we thought that fossil fuel was going to run out in 2050 then it would be priced accordingly along the way. That is what we should do for climate target – i.e. not allow any more fuel to be consumed beyond one trillion tonnes .
Total amount of cheaply accessible fossil fuel exceeds that trillion tonnes, therefore we need to sequester some of that CO2. That is critical. Could we achieve 100% sequestration to avoid that trillionth tonne ? Very expensive.

Professor Ron Prinn – Co-Director - MIT Joint Programme on the Science and Policy of Global Change
"Integration of the Science and Economics of Climate Change"
rprinn@mit.edu – check website.

Energy production drives economies.
What will it cost us to do something about Climate Change ? Everyone must walk out of this room aware that there is a risk and with their eyes open about the size of this risk.
MIT programme founded in 1991.

We must face the fact there are big uncertainties but that does not stop us needing to act to do something about it.

Climate is interconnected with air pollution too. Many third world cities will want to do something about local pollution – that pollution also contributes to climate change.

Integrated Global System Modal (IGSM)
Earth System models and Human economy models.

How accurate are climate models ? Uncertainties are clouds, ocean mixing, and aerosol forcing. These uncertainties can be constrained by observations. Huge number of computer runs required to test outcomes.

Global CO2 emissions/ NO /SO2 emissions graphs.
1990 approx level of 8
95% confidence that level will rise to 7 – 35
68% confidence will rise to 10 - 22

Graph of probability of difference temp changes, and sea level rise with and without policy at 2050 and 2100. Policy reduces significantly the chances of the more dangerous outcomes.

Significant increase in warming is much greater in the higher latitudes, rather than equatorial areas. Most sensitive areas are the polar reasons. Why should we care about them given few people live there ? Depleting summer sea ice – means ocean absorbs ice previously reflected by ice. One of the dangerous feedback loops. Permafrost will move north and will release CO2 and methane – up to 50 years of human use could be released. Irreversible.
The ocean as a carbon sink. Only in high latitudes is the sea water cold and dense enough to sink and pull carbon down into the deep water.

Running computer models of ocean with increases in CO2 at current rates for 100 years and then stabilise at constant level for 900 years.
In one model the system recovered, but in the other model it kept getting worse for 900 years – ie the ocean was collapsing.

MIT Emissions Prediction and Policy Analysis (EPPA) model. Very complex. Welfare (consumption) change under Kyoto with Australia and USA not in it. No emission trading. Losses for economies especially for the oil producers Canada and Middle East. Europe, Japan also lose. Eastern Europe the one gainer.

With emission trading Former Soviet Union sells permits to Europe and both gain. Point is to lower global emissions, not emissions in individual countries.

In lay terms what happens when there is no policy = the Greenhouse Gamble – like a roulette wheel. Probabilities approx ¼ of wheel is dangerous territory of 3 degrees plus.
If we stabilised at 550 ppm then we should be under 3 degrees at worst.

Questions
Q - How do we stop the possibility of reaching the trillionth tonne ?
A - Ron Prinn – the big increases are coming from Indonesia, China, India, not the OECD. Must work with these emerging countries so that they adopt efficient uses of energy. We need to develop lower energy level lifestyles. We are setting ourselves up as a civilisation for a calamity.
A - Kevin Trenberth – main payoff for taking action is beyond 2050, so in the meantime we are going to have to adapt to change that will occur regardless.
A - Peter Barrett – He says we need to reduce our emissions.

Q -What about the level of risk ?
A - Ron Prinn – risk – a bit like changing diet when you have high cholesterol. Doctor cannot tell you that you will live 10 years longer, but we still change diet, because we'd expect on average to live longer. So too do we need to change lifestyle to reduce likelihood of real climatic catastrophe. Scientists cannot give an exact answer on when the world would have a coronary.

Q - Transportation sector – do higher oil prices affect the modelling ?
A - Ron Prinn – biofuels an option for low population countries.

Q - Could Climate Science be better reported in the general media ?
A – need to understand that scientists are inherently conservative. Things are moving faster than predicted, so we should sit up and take notice.

After lunch session
The role of Forests – Dr David Whitehead – Landcare Research
"The role of forests in climate change mitigation."
1992 Pinatubo – reduced solar radiation by 3% and increased diffuse fraction by 9%, increased C uptake by 2.5Gt year for 10 years.
NZ post Kyoto between 1990 – 2001 CO_2 +37.1%, CH_4 +5.4%, N_2O + 29.8%
Drivers are transport, urea, fewer farm animals, less forestry planting.

Described the amount of new CO_2 taken up by various different land uses.
Dryland pine forest +6.1 Mg of Carbon per year
Dry tussock -0.09 to + 0.4

Mature rimu +1.3
Mature shrubland – 0.5 to + 0.6

Carbon Storage
Fst indigenous - 48
Fst exotic -16
Scrubland - 36
Grassland improved - 59
Grassland unimproved - 19
Tussock - 13

NOTE AN ISSUE FOR NZ IS THAT WE DO NOT GET CARBON CREDIT FOR EXISTING BUSH/FOREST BEING IMPROVED – eg scrub becoming mature forest. We are almost the only country for which this is a significant issue because of our unique biodiversity history.

Research method involved measuring carbon held in various areas of vegetation. Plot assessment just like animal plot lines.
Also said that **soil** is losing carbon through erosion ?

Potential for forest sinks on marginal farmland. Predominantly natural reversion through manuka and kanuka. Leaf litter accumulation would offset soil erosion.

1.5 m ha of marginal land which could be allowed to revert – carbon farming may be more economic than agriculture on these lands. If a $50 tonne CO2 equivalent applied after 2012 would impact land use esp in eastern North Island.

1990 Kyoto Target graph – with projected emissions reductions through efficiency and existing 'Kyoto sinks' will get us close to 1990, shrublands may make that even better.

Multiple benefits through soil recovery, reduced erosion, reduced flooding, water quality, biodiversity, recreation and tourism etc. (eg Cyclone Bola and Manawatu floods – esp relevant for east coast North Island)

Methane emissions from forests ? Discussed Keppler's recent paper arguing that 11-46% of annual global methane emissions from plants. David said that even with suggested overstatement of the issue the beneficial impacts of reforestation by less than 5%.

Uptake of methane in soil – CHECK MEASUREMENTS
Beech forest - 10.5
Pine forest 4.2 – 14
Arable land 0.95
Dairy pasture 0.5 to 0.6
Sheep pasture 0.3 to 0.55
Ungrazed pasture 0.7

Carbon Zero marketing
Models being developed for carbon accounting
Renewable energies for bio fuels

Dr Mark Howden – CSIRO Sustainable Ecosystems – Canberra. Senior Principal Research Scientist
"Climate Change and Australian Agriculture"
Noted the huge diversity of Australian agriculture.
Focussed on wheat by way of example. Output has significantly increased. Within growth trend there are huge differences between good and bad years (good year output approx double bad year)
Wheat can only grow in a particular band of land – other areas are too hot, too dry, too wet.
i.e. Climate matters !
There are huge uncertainties in predicting future climate, especially at a regional level. (What will emissions be, how will global climate change, how will regional climates change. Then there are the probabilities. (uncertainty analysis) For example 10% chance of wetter, 60% of wetter in the same region).
His work involves modelling predicted temperature and rainfall changes in 2070, and then modelling the probabilities of yield changes, for any given area. Shows some regions benefit, some lose.
Showed that can adapt practices to reduce or even eliminate some of the negative impacts of climate change on the industry:

- need to recognise there is an issue,
- be motivated to act,
- use technical options available, new techniques and learning to deal with changing and uncertain environment
- support translocations to new locations and landuses,
- new storage and transport policies,
- monitoring to see what works and what does not.

Action is not about a precise answer, but confidence that the direction is correct.

Need
Informed community with capacity to change behaviour
Capacity to learn to change

Conclusions

- Climate Changes appear very likely and probably very significant
- Adaptation could be very important in reducing vulnerability
- Adaptive governance is useful – sharing knowledge etc
- Open question as to how well set up our existing institutions are for this

400ppm – about 10 years off
550ppm – about 50 years off

Prof Blair Fitzharris – Dept Geography – University of Otago
"How vulnerable is New Zealand to the impacts of global warming."
Graph of risks from different levels of temp increase – get this 6 bar graph into report
GRAPH TO INCLUDE

Agriculture used to a stable climate with year by year variations. With climate change the climate is no longer stable and this takes agriculture out of the **coping zone** more frequently - GRAPH.
How can we adapt to respond ?
Critical negatives - water, coasts, alpine tourism, health, infrastructure
Natural systems most vulnerable

Adaptation – NZ has relatively high adaptive capacity.
Projected climate change will put extra stresses on economy and environment.
Because of our increasing water and energy demand, coastal living demand, and increase in extreme events – we are increasing our exposure.

Building Capacity – mostly knowledge
Weaknesses include –

- We aren't integrating our thinking between sectors
- Climate uncertainty not treated in the same way as economic uncertainty.
- Dependency on current regulatory codes
- Lack of leadership and champions
- Finite scope for adaptation especially in natural ecosystems.
- Limited affordability of adaptation – insurance
- Limited take up of technology
- Limited land use suitability – eg climate suitable but Gore doesn't have suitable soils for kiwifruit.

New commercial opportunities
More hydro capacity, growing new crops, climate proofing such as installing storage in dry areas.

Risk – Faded rainbow diagrams
Coping range (up to 1.5 degrees) ----- Adaptive Capacity to approx 2.5 degrees ------ then Residual Risk

Biodiversity coping range is much lower (prob under 1 degree), adaptive 1 ½ degrees.
Human economy in NZ copes up to 3 degrees.

NZ vulnerability
Water security – especially in the east away from main rivers
Ecosystems likely to change and ecosystem services likely to reduce – 1 degree warming pushes snowline up 100 metres. More snow at high levels, less at low levels.
Coastal settlements likely to be highly vulnerable as investment there has increased and
Risks to critical infrastructure
Biosecurity risks likely to increase
Shifts in agriculture and forestry

Increase in extreme events
By 2100 climate change impacts will be substantially greater under high emission scenarios than low ones.

Hotspot residual risks
Ecosystems with low adaptive capacity under multiple stresses – esp alpine areas, eastern forests
Coastal Communities – esp Bay of Plenty type areas
Areas affected by water shortages – esp in the east

Adaptation reduces impacts now – much cheaper than mitigation later.
Adaptation probably will not cope if temp changes exceed about 2 degrees.

Dr David Wratt – Leader National Climate Change Centre – NIWA
"NZ Climate Change: Water and adaptation"
Water – too little or too much is a key issue for NZ in the next century.
Treasury report said that the drought of 1998 was principle reason for the recession at that time. NZIER report costed the drought at est 1% of GDP ($618m) 1997/8 and $539m the following year.
Insurance payouts of $1.5b 1968-2004 – 75% was weather related. Others inc Earthquakes, Wahine Storm and ship. No clear trend in New Zealand as is too small a sample size.

What affects NZ rainfall ?

- Weather noise – general variations.
- La Nina/El Nino
- The inter-decadal Pacific oscillation
- Increasing greenhouse gas concentrations

Overall pattern is more days of extreme rainfall above 25mm per day on the west coast and fewer on the east coast.

Cannot predict exact rainfall levels, but scenarios – giving a range of numbers. More confidence in the direction than the magnitude.
Frequency of heavy rainfall events likely to double by 2030, multiply fourfold by 2070.
What are currently 20 year droughts likely to be 5 year occurrences by 2080 under average global predictions.

Even if we can hold CO2 in atmosphere at current levels we'd be talking about an increase in temps of 1 degree, thus need to adapt.

Local Government – should include a climate change filter in our decision making framework. RECOMMENDATION at Councillor and officer level.

NIWA working with agriculture sector – providing information to allow farmers to adapt.

Dr Harry Clark – Rumen and Welfare, Ag Research NZ
"Emissions from Animals"
Methane emissions from ruminant animals
Worldwide about 25% of methane anthropogenic emissions of CH4 come from domestic ruminants.
Typically 5-8% of energy lost as entric methane from grazing ruminants.
98% is lost from the mouth – fart tax ill named !
Rumen microbes digesting the food. Gives off H and CO2. Other archaea microbes use H and CO2 and byproduct is methane.
Breeding ewe produces 11kg, and milking dairy cow 85 kg of methane a year.

NZ's estimated CH4 emissions
1990 - 2005 – enteric CH4 up 9.6 %, total CO2 equivalent emissions up 22.5%, so CH4 dropped from 35 to 31 % of total CO2 equivalent emissions.

NZ and Australia are unusual in having large proportion of CO2 equivalent emissions coming from CH4. Europe only has about 3.4%. So we are on our own with research on this.

Mitigation
Improve efficiency of animal production system – more meat, wool, milk per unit of feed ingested. 1990 – 2002 drop in sheep numbers from 58 million to 40 million, but they are individually bigger. Dairy population up from 3.3m to 5 m so emissions have gone up despite increased efficiency per animal.
Improve quality of diet – effects are not very large in practice. Effect less than 20% at 100% of the diet.
Manipulate rumen microbial system - multitude of suggestions, injections etc.
Exploit animal to animal variation through breeding system choosing lowest emitters – this has real potential - measuring 302 Jersey cows found a three fold variation between individual animals.

Dr Carol Turley (Plymouth Marine Laboratory – UK)

The earth is our life support system.

50% of anthropogenic CO_2 is absorbed by the oceans. The level and rate of carbonic acid production has been very constant for the last 20m years. We are already at the edge of natural variation and will be well out of the range by 2050 and dropping rapidly.

Coral formation becomes more and more difficult because the organisms need less acidic environment and may even begin to dissolve. Although the reefs are a small proportion of the ocean in area, they are home to up to 9 million marine species. There are also cold water corals which are under great threat.

100 million people directly depend on healthy reefs.

Plankton, the basis of the food chain of higher sea life, are vulnerable at the pH level likely by 2050. Pteropods are an integral part of polar and subpolar food web and also vulnerable – their shells begin to dissolve. For zooplankton there is a combination of higher mortality and less successful fertilisation. Growth rates of mussels and sea urchins will be affected too.

Marine scientists are not at all confident about the future of coral reefs in the second half of this century.
The reaction between water and carbon dioxide is a simple one so the predictions of pH changes are very certain. The total effect on ecosystems is less clear, particularly on the seabed organisms which are critical to the marine habitat.

Summary Panel Session on Day One
Malkovich The natural temperature cycle - +/- 3 degrees, and CO2 variations – we are at the top of one of these multimillion year cycles – and should now be heading down – but we are heading up. This is compelling.
The **known unknowns** are scary. The **unknown unknowns** keep emerging and they are equally worrying.

Day Two

Professor Will Steffen Director, Centre for Resource & Environmental Studies, Australian National University)

"Sleeping Giants – surprises in the climate and Earth system"

Three areas of science that have developed since the 3rd IPCC assessment indicate the risks of ending up at the higher end of the IPCC range are greater than expected due to positive feedback loops.

Climate Sensitivity – how strongly does the global system react to CO_2 forcing? Internal feedback systems could mean increases lead to further increases. Forests could burn more often and more severely with wildfires and increase CO_2 due to higher temperatures and drier in certain parts. We also have the warming effects of CO_2 masked by particulate matter that have shorter lifespan than Greenhouse gases. The Carbon cycle has some strongly non-linear processes. Soil carbon outgasses a lot more as temperature rises. Thus the terrestrial biosphere adds to the anthropogenic burden of CO_2.

Cryogenic instability – this describes the icesheet changes such as the prediction that the Arctic could become ice free in the summer. Although the ice is floating so the sea level would not change much, the loss of reflective cover (albedo) means the darker water will absorb the solar energy and increase warming. Another positive feedback. Previous estimates suggested the Greenland and Antarctic ice sheet would take millennia to melt and possibly add 6m to global sea level. Recent analysis published in the last six months of instabilities and satellite photos of changes suggest there is a

threshold at about 2 – 3degrees above which the ice sheets will melt much more rapidly. They disappeared at the last interglacial period some 120 000 years ago.

If the West Antarctic ice sheet melts, that is about 6m of sea rise.

Will mentioned the ocean acidification issie. Are there other climate related issue sthat have not emerged yet?

There don't appear to be dampening systems to offset the positive feedback loops. Palnet Earth, during the time H. sapiens has been here, has show strong self-regulating mechanisms regarding atmospheric gases, temperature and ocean acidity. Are we risking going past a tipping point into a different and much less hospitable climate system?

Dr Steve Hatfield – Dodds (Research Director, Social and Economic Integration, CSIRO) (Steve.Hatfielddodds@csiro.au)
"Interpreting the economic impacts of reducing greenhouse emissions."
Changes in lifestyle – if we took productivity gains in increased leisure rather than output, we'd improve climate change outcome and be happier too.

Collective action most effective when

- Understand cause and effect relationships
- Humans can do something about it
- Can develop agreements

Economic modelling – all focuses on cost of reducing emissions. We can't cope with the costs of not reducing emissions (eg greater hurricane frequency)
His estimate is that implementing Kyoto would cause a 1 to 3% gap in GDP though dumb policies would cost more.

Will deep cuts in emissions involve radical changes in our lifestyle ?
Graph showing 85% increase in emissions vs 60% reduction – shows just a 1-3% reduction in GDP. Technology and changing the way we do things is key.
Social impact relatively small – eg energy becomes relatively cheaper to buy the same amount because we'd be consuming less.

Discussed the benefits of increasing wealth.
Wealth and health/life expectancy – health and life expectancy improves steadily and steeply up to $5000-15,000 US – then curves flatten off to almost level.
Thus increases in economic wealth aren't critical to basic material needs.
For higher income nations issues more significant issues for health, happiness and life expectancy are employment (worth 4 times income to compensate for unemployment on a satisfaction level – UK research), health, relationships and social standing.

Happiness income paradox. Unclear/no relationship between average income and satisfaction over time. Relative income to other people seems more important.
Gains from rising income may be offset by welfare losses in non traded domains.
Different types of needs may be subject to diminishing returns low marginal benefits

Relative income and status may be more important than specific income level.

Secure employment, good health, good relationships and having some social standing were all more important than income for happiness.

Genuine Progress Indicators measure different types of need.

People are systematically averse to loss. Our subjective valuation of a loss is greater than a gain. A lot of data showing we tend to value giving up twice as highly as we value the gain of getting something. True of Council decision making. We are dramatically loss averse for catastrophic losses.
Significance for Climate Change ?
No radical lifestyle changes are required. Significant reductions in emissions involve only minor reductions in economic growth.
A forgone gain is not felt as strongly as a cost borne. We are still likely to be much wealthier in the future, all we will have done is reduce the growth trend line slightly.
How we frame the questions we ask a person affects their response dramatically.

Q – What differences to life satisfaction between those with/without children ?
A - There's a large cohort who think life was better in the past anyway.
Do children make you happy ? Unclear !!!!

Q - What if there are multiple stresses – over and above climate change ?
A - Clearly harder to determine difference between BAU and alternative approach.
Real issue is getting a handle on the developing countries.

Q – (from Nick Smith) Why if costs are small are countries so unwilling to make changes ?
A – This is the most significant policy decision we can make. However it is less significant than not making emission reductions. We aren't used to getting our head around the lead time of 50-100 years. Part of the issue is it has been mis-framed. When we agreed Kyoto there was nothing like the urgency and solidity of the information. We have 1 or 2 political cycles to get the architecture right. It will involve doing things differently, and even though there will be little impact on GDP people are often resistant to change.

Q – Is the decision making architecture right for making policy decisions ?
A – Every Government knows the issue and is well advised because science is well communicated internationally.

We need to understand lowish probability but high impact events. We do that kind of thing already.

Rt Hon Tony Blair – Prime Minister
Climate change is the most important issue we face. We have to go far further than Kyoto. We can't afford to wait another 5 years.
At heart a new agreement must look to emissions stabilisation and include all countries.
Opportunities coming up with G8 and G8+5 meetings.
Set very bold ambition to stabilise climate change with all major economies esp US, China, India.
Urgent and latest science confirms this.

UK target – UK will be one of the few countries to meet and exceed the targets. 23-25% greenhouse gas emissions. Aim 20% CO2 reduction – UK will miss this with econ growth and only meet 15%.

Q – Jim Bolger – EU subsidised agriculture – where does that fit – what about shifting to biofuel.
A – Would like to encourage shift into biofuels. Key is developing a framework including all major countries so that everyone knows that the direction is towards stabilising climate change. Gives certainty to Governments and business.
Q – Is the world going to move fast enough ?
A – That is undoubtedly the risk. However a genuinely inclusive framework might surprise with rapidity of take up and behaviour change.

Q – Youth rep - Nathan Little – what plan to enforce action ?
A – Keep up the pressure from the people on our Governments. Eg things are happening in USA at grassroots level despite not being a signatory. Governments need to know they are supported.

Q – Is there a particular role for smaller countries like NZ to play ?
A – Yes as a proselytiser for change. Also demonstrate what we are doing – to demonstrate that we can grow sustainably. This is the largest of potential clashes between short term pain and long term gain. It is not NZ or UK that is going to make the difference alone but it is important to show what can be done. Would give business and industry some advantages in competing internationally.

Q – Steve Tindall – World Business Council for Sustainable Development. He says that there is willingness to act but business needs Government direction/certainty.
A – It is important to show how individual people can make a contribution. Eg microgeneration programme. Eg new building standards. Eg biofuels. Governments must show that economic growth is not antithetical to emission reduction. Retail sector can assist with this enormously.
Internationally we must demonstrate that everyone is in on this.
Emissions trading must be set up.
Show ordinary consumers that there are ways we can consume in a more responsible way.
Good things are being done – need to be able to bring the best practice together.

Q – Cath Wallace – what is the UK doing to get the price signals right for true cost of carbon emissions and encourage the uptake of renewable energy ?

A - Working out a carbon budget to measure cost of inaction. Hope to be able to say more in a few months time. Have set a UK target for renewables of 10% with aim to increase that later. Target for transport. Target 40% increase in energy efficiency for buildings.
Framework incentivising renewables.
Part of European emission trading system. Working on agreement to take that beyond 2012.
Climate change levy goes on business – worth several billion Euros in the European systems. All air travel by Government will be offset.
Not there yet but have made good progress.

Q – John Campbell – the wider population still struggling with a distant abstract concept. Why address seriously and immediately ?
A – people do understand it is happening and serious. People are seeing evidence now, whether they can relate weather events to climate change. Precautionary principle – science is sufficiently clear that **not taking action would be deeply irresponsible.**
UK about 2% of emissions now and declining. China in 10 months will increase their emissions as much as the entire emissions from Australia. We can only make it work if includes US, China, India, Brazil and others, and set a clear direction
Energy security and supply is also pushing us in the same direction. That may help pull US in. Can bring these two issues together into an international framework.
Alarmed at scale of problem but optimistic about the way the world is looking at the problem. Cannot let this opportunity slip. That would be disastrous.

Jim Bolger – also be honest with people and tell them what they have to give up.

Murray Ward – Principal, Global Change Consultancy
"Framing Policy Action in the Short Term and Long Term"
Sense of urgency has ramped up enormously in public mind with discussion of 'tipping points'
The Political Challenge
Urgent. Some say we need targets, some say we don't. Some developing countries say they can't afford it with problems of poverty etc – they are asking for help.
Governments seem to be 'stuck' – long term failure to provide clear consistent messages. Failing to deal with perception that climate change is burdensome. Take the carbon charge – it became unpopular and got dropped. We should think about revenue recycling. Auckland example of congestion charges being recycled.

EU Environment Council goal to keep increase less than 2 degree requires
15-30% reduction by 2020 and 60-80% by 2050 on Kyoto baseline.

If we use the best of technologies available we are still going in the wrong direction.

Science supports EU rather than US position on Climate Change.

Leaves the public stuck with unknown or overwhelming challenge.

Result we see the costs as large, now and personal – and the gains as ethereal and long term.

Massive reductions in emissions can be attained and econ growth maintained
New transformation innovation in C21 business challenge for C21
There are huge reductions in cost available through economies of scale.
He compared the challenge with the Space Race to get a Man on the Moon – which had a massive tax cost but was strongly supported.

- Inform, Invigorate, Invest

- Excite & Embark

Get hope into discussion rather than gloom.

Need for economic emissions trading framework.

Rt Hon Simon Upton – Chair OECD Roundtable on Sustainable Development
"What sort of credible contribution can a small country make ?"
Simon spoke on likely course of events – not what he would like to see
There are clear risks.
Kyoto was never intended to be the answer but a first step.
Because the atmosphere is a commons we must have a genuine international agreement on managing it.
NZ cannot park its engagement and wait until others front up. Even Australia recognises its credibility relies on making efforts.
Failure of US and China to engage raises the cost to economies of nations that did sign.
NZ will not be alone in missing its target.
Implementing workable long term policies to increase the cost of carbon is more useful than targets.
Makes more sense to reduce emissions abroad where they have poor current technologies but it is risky to assume that is the whole answer.
Clear there will be massive ongoing consumption of fossil fuels in next half century. They are extraordinarily cheap and accessible. There are alternatives but it is a question of price. Price solar 20-30 cents kwh, 3 cents from coal. Energy needs from China and India are enormous. Now developed world uses 60% of energy, mid century it'll be just over 1/3.
Governments are betting on technologies not treaties for a solution.

The trouble with a treaty based approach is it is built on nation state basis – but the economy is global as is the CO2 footprint. Treaties tend to only deliver the do-able (so it is relatively easy for Europe). US signed to -7% knowing it could not deliver.

Only 3 big options globally

- Solar
- Nuclear
- Carbon capture and storage

Renewables are insufficient for our energy intensive world. Solar needs expensive R and D. There will be expansion of expensive fission and new fusion. That leaves capture and storage.

There are no precedents in human history for radically changing lifestyle. Simon argues it will be impossible for a Government whether democratic or totalitarian to impose except when disaster is clearly evident.

Technological changes required to achieve this.
NZ could divert diplomatic resources into urging the big countries to apply efforts to transformation without delay. We will need to show we are prepared to act too.
We can demonstrate leadership on our emissions from enteric methane. That is half of our emissions. Technological fixes for transport emissions will come from elsewhere. We could then add value to the debate and add value to our own production and build on our knowledge base.
We are spending $4 million on this. Is that sufficient ? Simon asked scientists what their wish list was. The whole shopping list was only $7 million. Added improving methane measurements – they have huge variability – 1100 m tonnes +/- 500 million. NZ needs to make a long term public good investment.

That is not all – solid grounds for sensible energy emissions policy – also about energy security.
Greenhouse gases should become more expensive over time. Well designed carbon tax would be the way to go. Pretty easy to apply given the changes in market price. Would need broad level of sign up at Government level. All main parties. Currently sufficient incoherencies to make for reasonably even servings of humble pie.
There are no costless interventions.

We should focus our research on pastoral gas which would be advantageous to NZ and allow us to capitalise on our existing knowledge base.

New Zealand will only be listened to when we argue for other countries to cut emissions if we also “walk the talk”.

The Swiss session chair noted that small countries can build bridges

Jood Oude Lohuis – Netherlands Environmental Assessment Agency – Team Manager – Climate and Global Sustainability Unit
“The logic of European action on Climate Change”
EU countries have widely ranging emission targets agreed. From +25% to – 20%. New member states are already well below 1990 levels having got rid of old factories. Some countries are ahead of target, like UK (coal replaced by natural gas), Germany (advantage of reunification and recession in Eastern Germany), Sweden, others are well behind like Port, Aust, Fin, Spain. EU as a whole 1.9% behind target.
With current policies would be 98% of 1990, target is 92% of 1990. New policies will get EU closer. Will need to buy some credits. Netherlands has already started buying emission credits outside EU. 70% of those contracts have already been fulfilled.

EU Climate Policy
Extensive European Climate Change Programme – deciding on what policies to adopt working with NGOs.
EU emission trading system
Allowing trading outside EU
Full implementation of monitoring scheme – not easy
Promotion and targets for renewable energy
Special stimuli for co-generation – accounts for 48% of Netherlands generation
Directive on biofuels – target of ---%
Standards on energy performance for buildings
Eco-efficiency standards for products

National Policy – eg Netherlands
Covenants with industry set up in 1992 – subsequently changed to emission trading
Fiscal incentives for buying efficient cars
High energy standards for new buildings – triple glazing/insulation – not all economic in short term
1996 energy tax for non industrial users
Subsidy for energy savings in existing buildings

Across EU
Look at all current environmental policies – so far delivered 5% reduction in emissions. Transport sector is one that is not helping. Very few easy ways to reduce emissions in transport

Emission trading system was implemented in 2003 among 25 member states
Installation specific caps cover 11,400 installations and 4000 companies. Review July 2006. Covers 2.1Gtonne CO2
May link to US states, Japan, Russia, Norway.
By far the biggest system.

Carbon market stabilising around 20-30 Euros per tonne. Government actions impact the market significantly. Links with energy prices.
Costs till now very low.

Post 2012 from EU perspective
Build on Kyoto
Broaden participation
European Trading System - Include more sectors (eg aviation) and all gases (not just CO2)
Develop new technologies
Adaptation to the effects of residual climate change

Kirsty Hamilton – Climate and Business Consultant – UK
"Climate Policy and Business Investment"
Debate on science is over
Head of investment Schroders discussing the insurance costs, costs rising to $150 billion per annum in next ten years. ABN Amro. Warren Buffet – won't insure without substantial premium increases.
Scale
Timing – the next ten years is key. The systems in place by 2050 will largely depend on the investments made from 2005 to 2050. Otherwise there will be need to retire infrastructure early which is wasteful. How do we direct capital properly.

Mobilising investment – business is becoming much more interested and involved. Seeing business opportunity. Lining up to put more money into renewables in particular.
Policy framework is key – energy security and climate change are rising up the agenda. Businesses want to know with greater precision what the policy environment is going to be.
Policy should be loud – (clearly designed to impact/incentivise returns), Long (stable), Legal, to give investors confidence.
How well prepared are NZ businesses ?

Local Government – important role in procurement and strategic direction.

Elayne Grace – Actuary IAG Sydney
Insurance Sector lessons
Climate change a serious issue
NZ – weather events. Thames-Coromandel has had more than 10 floods since 1981.
How can we reduce the risks ?
Costs of global disasters are increasing dramatically – doubling every 10 years – increasing wealth, more coastal development, climate change are the three reasons.
5 of the biggest 10 insurance events **ever** (in real dollars?) have occurred in 2004 and 2005 – and they are all weather related. 2005 Atlantic hurricane season the worst on record for number of hurricanes, their scale. Katrina $US125 billion economic loss, $45 billion insured. At least 1200 lives lost. Also impacted fuel costs through 10 refinery closures, plus lost taxes, jobs, global impact on re-insurance costs.
US Army Corps requested money to study raising the levees, with est cost of $1 billion in 2004 – that adaptation was not undertaken.

Queensland cyclone risk expected to intensify and move south – currently Brisbane not associated with cyclone risk – but probably will be. Adaptation includes building codes so new buildings can stand up to cyclone events.

"As an insurance company we believe that historical data is not relevant going forward." Needing to undertake sophisticated modelling of climate change risks.

Insurers want to make sure insurance remains available and affordable. Therefore they are concerned that climate change is putting pressure on premiums. Need to work with Governments and local governments to become insurers of last resort.

Under high emissions scenarios the costs of damage are likely to increase massively.

Recommendations:
Adopt clear precautionary long term reduction target and pathway
A vision beyond 2012
Appropriate framework for carbon trading

Insurance challenges – claim patterns changing, managing risks (eg building codes change), investment returns, reputation.
Insurance opportunities – managing risk, driving prevention measures, help customers understand risks, reduce our (IAG's) own footprint (saves opex $)

Small changes can increase damages dramatically
2.2 degrees means 5 -10 % in cyclone wind speeds. 25% increase in peak gusts – 650% increase in building damages.
1 degree temperature increase raises bushfires by over 20%

Example of Thames – Coromandel
Insurance was considering pulling out insurance – so collaborative effort. Insurers provided info on future climate change so community could put in engineering solutions to reduce the risk.

Business case for dealing with Climate Change
1300 experts in 95 countries – UN Millennium Ecological Assessment noted 2/3rd of ecosystems are being degraded or used unsustainably (eg - in air) The Earth is being treated as a business in liquidation – not on anyone's balance sheet.

Q – are premiums reflecting risk – eg earthquake risk is priced in the same basket as weather. The former is a constant risk, the latter an evolving one through climate change.
A – yes, but may not be at the level of detail. Probably not strong enough price signals.

Lord Ron Oxburgh (UK Geologist and ex Chairman of Shell Oil)
"After oil, shaping the energy transition"
Infrastructure has a long timescale – we've got till maybe 2050 to get Climate Change under control, which means acting now on the infrastructure which will still be around then.
Three main sources of CO_2 emissions
1. Agriculture and biomass – the least well understood
2. Transport – internal combustion engine incredibly inefficient <20%. Engine plus fuel needs to be light and compact. Alternatives – natural gas and coal both have high CO_2 costs. Hydrogen currently high CO_2 costs. Biomass – by far lowest cost in CO_2.

Internal Combustion Engine ----- fuel cell/hybrid/batteries/much reduced vehicle weights with more advanced materials/bio-fuels.

Big challenge is aviation fuel – likely to be the last to change – possibly synthetic bio-fuels.

Timescale of capital investment must be considered e.g. 10 – 15 year for car replacement but 40+ for power plants , 70+ for houses and 100 for some stormwater infrastructure.

Traditional biomass – rape seed, linseed etc bio diesel, or ethanol from sugar cane.
Ethanol – 15% mix in unmodified and 85% in new modified engines (cost $50 or less to build into new engines – just requires modifying seals)
Problems with ethanol – energy units to produce ethanol - cultivation, fertiliser, etc is almost as much, or even more than you get out of it. Energy in – energy out ratio 1.2
Shell developed enzyme to break down straw. In – out ratio 10, cost per barrel $20-30. Used in Ottawa Government vehicles.

CO_2 emissions – straw ethanol 0.01, US corn 0.07, diesel and petrol up at 0.08/9 CO2 kg per MJ.

Future biomass – anything produced by photosynthesis is a potential source of energy, organic garbage, forestry slash – for vehicle bio-fuel, power generation.

Transitional energy – nuclear, renewables,
Fuel reserves – the energy hungry countries – China, India, USA have huge reserves of coal. They will use it so the key is preventing it getting into the atmosphere – most usefully by re-injecting into the ground.

The world scene
Graph showing all nations show strong correlation between energy use and GDP per capita.
When plot energy use against emissions the same trend is apparent – direct correlation. The one nation that sits outside that is Iceland. Sweden, Norway and NZ are also well below the line (hydro and geothermal and nuclear)

To keep at less than 550 ppm CO_2 we have to significantly reduce emissions per energy unit consumed. China will need to be allowed to go way over the limit before coming back into line.

He showed a brilliant block graph of people and emissions – developed/emerging/developing/poor nations – population and emissions. As population rises from current 6.5 billion to about 9.5 billion, and nations move up the wealth categories the energy use grows dramatically. This underlines the need to do things differently – decouple energy emissions from GDP growth.

Agriculture – we should minimise fertiliser use.

Finished with the warning ‘time is not on our side. If we take action now we may be able to save our children and grandchildren from the worst excesses. Every year of delay is 2 or 3 more until things might get better.’

Ralph Sims – Massey University – R.E.Sims@massey.ac.nz

"The Transport Fuels of Tomorrow"

IPCC is concerned about equity issues as integral part of addressing global warming.
1 – The world will not run out of fossil fuels for centuries. Using Myles Allen's 1 trillion tonne maximum – he demonstrated that known reserves will take us to that trillionth tonne. Add unknown reserves and then massive quantities of other fuel sources (oil shales etc) and the potential fossil fuel reservoir is many many times the trillion tonnes. (e.g. Canada already extensively uses shales and tar sands – 15% of their oil)
2 – We shouldn't plan for 'peak oil' but plan for the end of cheap oil. We don't know when the 'peak' will be. Currently the world historical consumption is about 900 – 1100 billion barrels, and using about 30 billion barrels a year. We're consuming 2 barrels for every one discovered. Major concern in climate change terms is that other forms of fossil fuel may emit even more than existing fossil fuels.
3 – Bio-fuels have a major role to play – big opportunity for NZ. Ethanol already is 44% of Brazil's total gasoline, and is blended into 30% of US fuel. NZ residues from forest slash is worth 50PJ per annum – equates to a medium sized gas field. Could also use animal fat. Bio-diesel could provide 7% of NZ diesel needs, and would be competitive at $US 50 per barrel.
4 – Paradigm shift.
Moving to carbon capture – physical and biological storage. This is being driven by the coal industries which need to sequester emissions.
Hydrogen fuels – may be years away and are currently only an inefficient carrier of energy.
More nuclear power – this is on too big a scale for NZ's energy demand.
Micro-generation – at a household level – also avoids transmission losses. Net metering is available now.
5 – R and D. NZ Government R and D doesn't match the enormity of the challenge. We invest less now on energy than in the late 70s and 80s. (oil shock)
6 – Land use management should integrate food and fibre production. Gave example of emissions used to produce 1 kg butter (7.03 CO2 kgs) to 1 kg margarine (1.65 CO2 kgs)

The IPCC 4th Assessment Draft is under development.
1 – since the 3rd Assessment in 2001, despite technological and policy advances CO2 outputs are still increasing, especially in transport.
2 – We've developed on cheap energy.
3 – Existing system is not capable of continuing without severe environmental effects.

Panel Session featuring:
Lord Ron Oxburgh, Rt Hon Simon Upton, Professor Ralph Sims, Howard Bamsey (CEO Australian Greenhouse Office), Jeff Fiedler (Natural Resources Defence Council, Washington DC), Kirsty Hamilton, and Joop Oude Lohuis.
Q – Do we have the capacity to scale back our consumer society ?
A – Ralph Sims – more public transport use would be good.

Q – from Jeanette Fitzsimons – what assumptions about land currently used for food or natural ecosystems being needed to generate bio-fuels.
A – This is about using existing land better. We can produce sufficient food, fibre and fuel for this century, if we do it right – this assumes very serious vehicle efficiency. Marginal farmland is one area in New Zealand.

Q – Why aren't bio-fuels being produced given the oil price ?
A – Lord Oxburgh – it is, but it's early stages. Would be surprised if bio-fuels are widespread within 5 years. Governments have to look at taxation policies – eg bio-fuel incentives. (like in Europe)

Q – Why isn't population part of the discussion ?
A – Lord Oxburgh – as standards of living rise family sizes tend to reduce.
A – Joop Oude Lohuis – politicians are reluctant to address this.

Q – Bio-fuels – what is the role of GE in generating them ?
A – Lord Oxburgh – real money is in using by-products like wood slash, straw residue.
A – Jeff Fiedler - There is a huge potential for intelligent breeding selection before worrying about alien genes.

Q – What can we do to change our lifestyles/consumption ?
A – Lord Oxburgh – envies where make proper provision for bikes on our road layouts. Dutch, Danes do well. Decent Public Transport is also really important.
A – Ralph Sims – solar orientation of new houses is an obvious thing to do. Household wind turbines.
A - Joop Oude Lohuis – stressed the importance of infrastructure

Q – What is the role of purchasing policy ?
A – Jeff Fiedler - Informing consumers is important. Especially need certainty in carbon pricing, and maintaining that certainty for a long time (eg 30 years).
A - Simon Upton – simple carbon tax advocated with few exceptions. It is much simpler than a tradable emissions basis.

Q – Cath Wallace – how does NZ tackle the politics/sociology of the sacred cows especially the conversion from forestry to dairy.
A – Simon Upton – real issue is about water quality which is the way to tackle it.

A – Jeff Fiedler – must offer a viable business model to go forward or have the political strength to roll them over. Eg in USA failed to do this with coal and electricity.

Q – The likely movement of people by virtue of policy (competition for labour in the West) or individual choice is likely to see large numbers of people move from lower emissions countries to more developed.
A – Lord Oxburgh – this is a big issue. Movement of people is likely to exacerbate the problem. He predicts mass migrations and potential resource conflicts on a scale we have not seen previously.

All panellists were asked for one top of mind thing they would advocate being done now.

- Kirsty – courageous decision making by policy makers
- Ron – private individuals writing regularly to MPs saying that the issue is at the top of their agenda
- Ralph – vehicle emissions labelling and wof testing including emissions
- Simon – carbon tax (getting price signals right), global sequestration and NZ methane reduction research.
- Joop – emissions trading system and regulating building standards.

Last Session – New Zealand the Way Forward
Associate Professor Ralph Chapman – Victoria University School of Earth Sciences
"Policy options for New Zealand in the absence of a carbon tax"
"This is the critical issue of our time."
Misleading stories we tell ourselves –

1. NZ is stuck in a policy hiatus - Domestically abandonment of carbon tax, big energy and transport issues, climate change report back from officials in the next 18 months. Need to build a broad, informed constituency.

2. Information overload – scepticism – natural to wait for clinching evidence. Responsibility on media to raise better coverage. We do have sufficient information to act.

3. Competing priorities – 'other issues are more important right now'. The World Economic Forum in 2001 described as the greatest issue we face.

4. Others should act – we can buy emissions from others, rather than at home. That would expose our economy to potentially high price of emission reductions. Need to be seen to do our bit. Carbon tax would have provided some foundation for a trading environment.

5. Technology will save us. E.g. wind-power which has fallen from 1978 price of $1 per kwh to 5 cents now. Useful but can't solely rely on it nor wait for silver bullet.

6. We can rely on the private sector – but businesses need the right framework. We don't currently price for externalities.

7. Action just too costly – perhaps the most seductive story. Emissions in NZ have continued to grow – there's no chance we'll be out in front – we are among the slow movers.

Critical policy framework elements

- Set challenging targets – allows us to be seen to be doing something that allows us to advocate for others.
- Protect reputation as responsible clean, green nation. For example 100% renewable electricity is within reach.

- Scope for biofuels to provide substantial (20%) of transport energy within 20 years.
- Sweden seeking to be no longer dependent on fossil fuels by 2020. Other nations offer opportunities for learning too.

Favour broad based action over narrow measures

- A carbon tax would have been best
- More equitable and efficient and non distorting to be broad.
- Idea – a domestic emissions credit trading scheme ? Need some means of signalling clearly that investors must consider carbon cost.
- Need a consistent framework. A problem is that Government has taken all the forestry credits. Avoid unnecessary policy switches.

Governance

- Requires strategic governance – are our institutions up to it.
- Are central and local governments engaging in joined up thinking ? Climate change must be central to urban design, transport, land use, building code,

Transport – more rapid acceleration of PT and end to new motorway development. Reallocate TG money into other areas. TDM

Doubts the current structural arrangements are strong enough to withstand lobby groups – eg MfE.

Building a constituency important – urgency awareness, building motivation.
NZ Government haven't built the constituency.
We're in the right window time-wise, where sufficient and compelling evidence is available.

Insufficient Evidence	Enough Evidence	Evidence completely clear
Can't achieve action	Ability to take action	To late to take action
	Hope	Desparation

We have been complacent for the last two decades. Need now to learn from other countries and act.

Alan Milne – Mayor Kapiti District
We've accepted that Climate Change is a fact. Many people remain ignorant or in denial. His own Council only voted 7 : 3 recently to adopt level 3 of CCCP.
Most residents and ratepayers don't show much concern. Great publicity from this conference – congratulations to the media. Challenge to scientists to share the information among the wider community, and for councillors and staff to provoke discussion and debate.

Molly Melhuish – Advocate and Energy Analyst
Noted the conference has largely addressed the supply side, and not managing demand, which is also important.

Peter Neilson – Business Consultant for Sustainable Development
We've abandoned the carbon tax for now, but not the Kyoto target. That is an opportunity. He's very encouraged by the size and quality of the conference audience. Potential to spread the message and empower politicians.
We need a price on carbon for businesses to make decisions.
After the parties of the right forced abandonment of the carbon tax Nick Smith signalled willingness to discuss cross party policy. This is grounds for hope also.
Need to get New Zealanders enthused – suggests subsidies for efficient homes and vehicles.
Opportunity for 2012 (trading emissions credits) to get businesses with ideas or wanting grand-parenting to talk to Government – opportunity to reduce tax liabilities.
Businesses need to collect data.
Suggest talking to Australia about addressing the transition process.

David Brash – Ministry for the Environment
Leading the issue across Government
Government is taking Climate Change seriously.
Need to build public awareness.
'We don't know how lucky we are.' Agrees with Simon Upton that we should focus on areas where we can lead (agriculture and forestry) and be a 'fast follower' of others research in other areas (eg transport) . Too easy to say "We're buggered and the only good news is we're not as buggered as the Australians!"

Q and A session
Q – Is this the right time for a mass social marketing campaign – A – yes.
Peter Neilson noted that the Business Council has done research that suggested most people weren't into 'saving the planet' (too big/abstract) but very committed to saving their neighbourhood.
Q – Why doesn't our PM show the same leadership as Tony Blair ?
Q – What should happen in the next six months ?
A - Alan Milne said that TLAs have to get their response right. Example coastal developments will have to accept that TLAs will not accept responsibility for protecting them.
A - Ralph Chapman and David Brash say that LG should not wait for Government direction. Need to keep going now. RMA needs amending to give more strength in energy and urban design – eg building act.
A – Molly Melhuish – establish a Parliamentary Commission or similar body focussed on the issue. There are so many opportunities for win-wins – just need to get the message across.
A – Peter Neilson – build the constituency. Write to MPs. From his experience 'your pressure will make a difference.'
A – Ralph Chapman – we are on a wave, starting to change hearts and minds.

Jonathan Boston – Victoria University
The Way Forward
Conference material will be on Institute of Policy Studies website soon, and a book of material produced.

Jonathan noted that resource conflicts are likely to increase (eg Dafur) over water and agriculture. (referred to Lord Oxburgh's comment on mass migration. An example of stress is Uganda's reducing outflow of water into the Nile, because of drought in Uganda – which then has a dramatic impact downstream.
Strong desire that we should take a lead, not be a laggard. Need broad agreement from all political parties.
IPS planning to hold discussions soon on our energy future.
Noted Sweden's aim is to be largely independent of fossil fuels by 2025.