Submission

By

To the

Finance & Expenditure Committee

On the

Climate Change (Emissions Trading and Renewable Preference) Bill

29 February 2008

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SUBMISSION BY BUSINESS NEW ZEALAND[1] ON THE CLIMATE CHANGE (EMISSIONS TRADING AND RENEWABLE PREFERENCE) BILL FEBRUARY 2008

1. INTRODUCTION

1.1. Business New Zealand welcomes the opportunity to comment on the Climate Change (Emissions Trading and Renewable Preference) Bill [hereafter referred to as 'the Bill']

1.2. This submission has been kept short and simple because Business NZ is deeply involved in the establishment of the emissions trading scheme and we are aware that many technical aspects of the bill are under discussion. For this reason our submission offers comment about the more general nature of the bill and some alternative options for the Select Committee to consider.

1.3. Last year, Business NZ sponsored a comprehensive study into an emissions trading scheme, which recommends an emission trading market covering all sectors and gasses– post 2012 - as the best way to minimise greenhouse gas emissions in the long term.[2] The report recommends emissions trading should not be introduced before New Zealand's major trading partners and competitors.

1.4. Climate change is recognised by governments in developed and developing nations as one of the most serious threats to future generations. However, the Kyoto Protocol CP1 only involves 30% of global emissions and the target is to reduce those emissions to 5% below 1990 levels. It appears that even if this target was met it would have very little impact on climate change.

1.5. Because climate change is a global issue, it requires a global solution. Isolated efforts by individual countries are unlikely to achieve the required levels of reduction in greenhouse gas emissions. Until the United States and developing countries make a commitment to reduce their emissions, there is little possibility of achieving the target set by the Intergovernmental Panel on Climate Change (IPCC). This does not mean New Zealand should do nothing, but that we should be aware our efforts alone will not achieve very much in the global context.

1.6. It is generally accepted that a major initiative to help reduce greenhouse gas emissions is to place a price on carbon. For this to operate effectively a common global price of carbon is needed,

[1] Background information about Business New Zealand is attached as Appendix 1
[2] NZIER report *'Emissions Trading Scheme for New Zealand'*, March 2007, attached as Appendix 2

however this is not currently achievable because all countries in the world are not prepared to accept the constraints of Kyoto.

1.7. For any emissions trading scheme to work we anticipate the international price for carbon would be slightly higher than the lowest cost to abate one tonne of greenhouse gas. At this time, there is no international price for carbon and the level of Clean Development Mechanism (CDM) credits is insufficient to meet the needs of Annex One countries.

1.8. The emissions trading scheme proposed for New Zealand is comprehensive and will include all greenhouse gases and all sectors of the economy within a five year timeframe, commencing January 1, 2008. There is no other country in the world attempting this level of coverage in this time frame.

1.9. Business New Zealand supports emissions trading as the most cost effective way of establishing an international price for carbon and thereby reducing emission levels. However, we believe that being the first to introduce a comprehensive emissions trading scheme will put our economy at significant risk and could result in the loss of tens of thousands of jobs.

1.10. When launching the framework document in September 2007 the Government assured consumers and businesses that the international price for carbon would be in the region of NZ$15/tonne and that the economic impact of introducing the scheme ahead of our trading partners would therefore be insignificant. The current EUETS price for carbon is N$39.99 and the current secondary market price for CER's is NZ$32.10. Government needs to reassess the economic cost of the emissions trading scheme in light of this real world price and inform the public accordingly.

1.11. Since the Bill was introduced into the House, a number of international studies have been carried out, indicating the cost to abate one tonne of greenhouse gas, between now and 2020, is likely to be between NZ$112 and NZ$170 if a 20% reduction in 1990 levels is to be achieved.[3]

1.12. It is noted that this level of reduction is at the low end of what scientists tell us is required to avoid serious harm to our global climate.

[3] 'Climate Change: Everyone's Business' A report from the CBI climate change task force, November 2007

1.13. Recent economic studies carried out in New Zealand confirm that even if carbon was priced at NZ$300/tonne, we would be unable to achieve the aspirational target proposed by our government for 2025. [4]

2. DESIGN OBJECTIVE

The Bill is intended to deliver on the following design objective:

That the New Zealand Emissions Trading Scheme support and encourage global efforts to reduce greenhouse gas emissions by:

- *reducing New Zealand's net emissions below business-as-usual levels; and*
- *complying with our international obligations, including our Kyoto Protocol obligations;*

While maintaining economic flexibility, equity and environmental integrity at least cost in the long term.

3. MAJOR DESIGN FEATURES

3.1. A number of world leading design features are included in the proposed emissions trading scheme. While Business NZ agrees that in a truly international trading scheme most of these features will deliver the desired results, there is serious concern that the economic cost of being a leader has not been properly analysed.

3.2. **Transfer of liability to consumers:** The Government's obligation in the Kyoto first commitment period is to reduce our internal emissions to our 1990 levels or to use the mechanisms available under Kyoto to secure carbon credits to offset the excess emissions quantity. On this basis, Treasury is charged with determining our level of liability by estimating the level of emissions each year from January 1, 2008 through to December 31, 2012 and comparing that with our 1990 levels. Based on an independent valuation of the cost of available carbon credits of NZ$21, the total liability is determined. In December 2007 Treasury estimated the liability at just under NZ$1 billion[5]. The

[4] New Zealand Business Roundtable and Petroleum Exploration and Production Association of NZ: *'Carbon Mitigation Scenarios'* – February 2008

[5] Calculation of the provision for the Kyoto liability

introduction of the proposed emissions trading scheme will progressively transfer this liability, and any future liability, to consumers. Initially due to the staged nature of the scheme, the taxpayer will be liable for some of the burden.

3.3. **Burden on liquid transport fuels sector:** The first sector to assume its share of the Kyoto liability will be the liquid transport fuels sector. Although the government liability under Kyoto is only for the difference between our current and our 1990 levels, the proposed emissions trading scheme makes the oil companies liable for the total emissions from every unit of liquid transport fuel. The burden for this sector is therefore far greater than that imposed by Kyoto. Other fuels will be placed in the same situation as they are progressively joined to the scheme. In addition, the Bill does not discriminate between liquid fuel used for transport and liquid fuel used as part of a process. This means industry will face the full cost of carbon with no protection, even if they can prove they have competitiveness at risk issues.

3.4. **Limited and partial protection for business:** Business NZ believes it is likely that all sectors of business will be adversely affected as carbon is priced into the New Zealand economy ahead of other countries, as every input into their business will be affected by increased energy costs. However, the methodology proposed to protect these businesses is limited and will provide partial protection only for a limited time as it is intended to phase out protection completely by 2025. As stated above, the Bill does not discriminate between liquid fossil fuels and similarly there is no protection offered for increases in the cost of liquid fossil fuels resulting from the introduction of a price for carbon. For example, this will impact on our largest fishing company, where 60% of their input costs are for diesel to power their fishing process. Similar impacts will be felt by other large companies with large energy costs.

3.5. **Narrow point of obligation:** On the basis of minimising administration costs to government and transaction costs to participants, it is proposed that the point of obligation for emissions will be as far upstream as possible. For example, in the liquid fuels sector, the five main oil companies will become the points of obligation with responsibility to surrender carbon credits for every tonne of greenhouse gases resulting from the use of liquid fuels. Currently there are few exceptions to this.

3.6. **International trade of credit units essential to maximise protection:** Unless there is significant advantage to becoming a point of obligation it is unlikely that even our large businesses will actively participate in the scheme, except for their industrial emissions.

However, most businesses that receive protection in the form of allocated New Zealand carbon credits will have to engage in carbon credit trading to ensure they maximise the level of financial protection on offer. To date, all credits issued by government under the now defunct Project to Reduce Emissions Scheme have been sold off-shore. For this to occur, New Zealand units are converted into Kyoto 'Assigned Amount Units' (AAU's) which can be traded internationally. This means a significant number of the AAU's issued to the government will find their way off-shore. We are already in a deficit position, given that our current emissions levels exceed our 1990 levels, and this will simply exacerbate the situation.

3.7. **Consumers will bear the ultimate cost of carbon as thermal generators pass on the increased costs resulting from their obligations:** Our electricity market is based on a generator pool where the marginal or last generator dispatched sets the spot price for electricity. The introduction of a price for carbon will see every unit of electricity attracting that spot price. It will not matter that a hydro generator is on the margin as they will have offered a price greater than the price of thermally generated electricity which will include a price for carbon. As hydro generators use the price of thermal generation to set their price for water, we are unlikely to see any reduction in thermal generation as a result of introducing a price for carbon. What we will see, however, is an additional cost to consumers of what we estimate to be about three times what it actually costs thermal generators to meet their obligations.

3.8. **Protection from international competitors likely to be inadequate:** Where companies are unable to pass on the increased costs resulting from the obligations of the NZETS, they will be exposed to unfair competition from similar businesses located in countries with no obligation or an internalised price for carbon. The Bill proposes to provide protection for these businesses by allocating carbon credits equivalent to 90% of their 2005 emissions, over a yet to be determined threshold level, phased out to zero between 2013 and 2025.

This level of protection is likely to prove inadequate for most businesses as it:

- excludes liquid fossil fuels used in manufacturing processes;
- will result in protection for less than 90% of 2005 levels for large businesses, dependant on the level of threshold adopted;
- will deny smaller businesses protection even if they are energy intensive and trade exposed;

- does not take account of the measures adopted by other countries when phasing out protection; and

- is likely to result in leakage as production is cut back in New Zealand and picked up in countries that have less stringent climate change policies.

3.9. **The lack of provision to protect new entrants and to protect growth in existing business will be detrimental to the New Zealand economy as a whole**. Trading schemes in other countries, in particular the EUETS, have new entrant allowances and accommodate growth in existing businesses. The aspirational goal of a low carbon economy (and in some cases carbon neutrality) for New Zealand will prove extremely difficult to achieve while retaining the government's target level of growth in GDP. In particular the fact that 50% of our greenhouse gas emissions are generated by the agricultural sector – a burgeoning export sector making a significant contribution to our GDP, with virtually no way to reduce its emissions levels in the medium term – will make it impossible to achieve a low carbon economy any time soon.

4. COMMENTS

4.1. **Proposed design falls short of objectives:** Comparing the design features with the design objective it would appear that the proposed design falls short in a number of important areas and significant change will be needed in order to deliver on the design objective. It is extremely unlikely that an emissions trading scheme that does not reflect a truly international price for the abatement of green house gases will deliver a reduction in net emissions below business as usual.

4.2. **The scheme appears to have been designed to minimise government's liability during Kyoto CP1 to the extent that it actually makes the government revenue.** In so doing, we calculate it will impose an additional cost of NZ$3.5 billion onto the economy while maintaining government's liability at NZ$1 billion during CP1. As the phase out of protection commences in 2013 it becomes a revenue gathering mechanism which, by 2020, will be delivering NZ$1 billion p.a. into the government coffers. There is no indication in the legislation of how this surplus will be recycled into the economy as was the case with the proposed carbon tax. It is hard to see under the circumstances how this will maintain economic flexibility, equity and environmental integrity at least cost in the long term in accordance with the design objective.

4.3. **Lack of long term economic flexibility:** Neither will the scheme, as designed, maintain economic flexibility at least cost in the long term when it adheres rigidly to 100% liability for all current and future emissions from fossil fuel, yet only offers protection to at risk businesses at somewhere less than 90% of their 2005 emission levels phasing out to zero by 2025. Energy intensive businesses would be much better protected by a scheme based on intensity measures.

4.4. **Insufficient analysis of economic costs:** To date the economic analysis undertaken by the designers of the scheme has failed to quantify the significant adjustment costs that will occur in specific sectors of the economy. Instead, equilibrium models have been relied on to demonstrate little economic impact to New Zealand over time. The latest modelling undertaken by Infometrics[6] confirmed a minimal impact on GDP but in so doing it assumed a 40% reduction in the level of our current dairy industry. It is difficult to comprehend that such a massive reduction in one of our fastest growing export sectors would not have significant economic impact in the long term. Infometrics are also predicting that with a NZ$25/tonne price on carbon, 52,000 jobs will be lost as a result of introducing the NZETS. The higher the price of carbon, the greater the number of job losses.

4.5. **Renewable preference requirement a sign of no confidence in the ETS:** The fact this Bill has tagged on to it a renewable preference requirement in the form of a ten-year moratorium on building thermal generation is an indication of how poorly government thinks the emissions trading scheme will deliver on its design objective. To introduce a high cost market mechanism designed to promote the use of renewable energy sources over traditional fossil fuels and, at the same time, to regulate to ensure that renewable generation is built before thermal, is a sign that the government has no confidence in their emissions trading system delivering the desired outcomes.

4.6. **Short timeframe poses risk to economy:** As stated in the introduction, Business New Zealand supports the use of market mechanisms and believes that a properly designed emissions trading scheme would deliver on the design objective. However, we have continually expressed concern that Government is attempting to introduce a highly complex and as yet untested scheme in an extremely short timeframe. We believe this is being dictated more by politics than sound economics. Another point is that our major industrial companies have international owners and the opportunities they are being offered by our competitor nations to invest internationally and to relocate and grow offshore are such that we are

[6] *'General Equilibrium Analysis of Options for Meeting New Zealand's International Emissions Obligations'* Report prepared by Infometrics for 'Emissions Trading Group', October 2007

likely to see no further investment in New Zealand. This would be of major consequence to the health of the NZ economy and our communities. If the real outcome of the NZETS is to reduce our dairy industry by 40% and force large manufacturers to move the bulk of their production off-shore, we will be failing to deliver on our international obligations and in particular our Kyoto obligations.

4.7. **Land use issues:**

The current problems with deforestation of post 1989 forests and the slow down in planting of new forests result from the government's decision to use carbon absorption in trees to shelter emitting activities without compensating forest owners. This approach conflicted with what the industry understood to be government plans when they originally ratified the Kyoto Protocol. This change of position reduced the incentive to invest in forests and the problem was further exacerbated when the government indicated their intention to stop foresters from converting land to dairying or other uses by imposing a cost of carbon on deforestation during the first commitment period. This action infringed property rights and was the main cause of the large-scale deforestation of recent years.

The Bill goes some way to rectifying the problem for post-1989 forests. However, there is still a real problem with proposals in respect of other forests. The owners of the land on which pre-1990 forests stand who opt not to replant following harvest, but instead switch to another land use such as dairying, will be liable for the full cost of the emissions involved. This is a substantial penalty and reduces land use flexibility. Land-based industries are an extremely important part of the New Zealand economy. It is vital that they are able to continue to respond flexibly to changes in world prices, technological developments and competition for resources. Any attempt to erect a barrier to exit from forestry will deter people getting into it in the first place, which is also undesirable on environmental grounds. Moreover, what are in effect retrospective tax changes are bad policy, affecting domestic and international investors in New Zealand and Maori forest owners, and would send poor signals about New Zealand's investment climate.

The proposal to allocate 55 million tonnes of free carbon credits to be distributed among the pre 1990 forest owners is fraught with problems and would only be a partial solution. The optimal policy would be for agricultural emissions to face the full cost of carbon subject of course to any competitiveness at risk issues and to not impose any land use restrictions on land currently in forest. Any conversions of forest land to dairying or other uses would then be economically sensible as long as the cost of carbon was factored in.

The proposal to delay entry of the agricultural sector into the NZETS until 2013 will create issues with land availability for forestry as the land will retain its higher value while its cost of emissions is subsidised by the tax payer. This in effect will continue to constrain the level of new forest planting until post 2013. It would have been more sensible to have forestry and agriculture enter the NZETS at the same time.

5. RECOMMENDATIONS

Summary of Business NZ's recommendations:

- Ensure sufficient carbon credits are allocated to ensure 100 per cent protection in initial years.
- Introduction of the NZETS should not impose any more cost on the economy than that estimated by Treasury.
- Use a progressive obligation methodology in the liquid fossil fuel sector to ensure sectoral liability matches the government's Kyoto liability.
- Separate identification and protection for liquid fossil fuels used for heat generation and propelling machinery.
- Point of obligation selected to deliver emission reductions
- Introduce a one-way trade system with a safety valve to minimise overall cost to the economy.
- Revert back to the dispatch system used by ECNZ to minimise fuel burn in electricity generation.
- Allow technical groups to complete their analysis and report back through the leadership forum.
- Slow the passage of this legislation to allow more detail to be incorporated before it is reported back to the House.

5.1. **Ensure sufficient carbon credits are allocated to ensure 100 per cent protection in initial years.**

While it is important for New Zealand to position itself alongside its main trading partners, there is no justification for imposing costs on our manufacturing and production sectors when no other country is imposing such costs on theirs. This issue can be handled by ensuring that sufficient carbon credits are allocated to ensure 100% protection in the initial years. To achieve the proposed allocation of credits up to 90% of 2005 emission levels would require to be amended to provide full protection against all increased costs including liquid fossil fuels.

5.2. **Introduction of the NZETS should not impose any more cost on the economy than that estimated by Treasury.**

The cost to the economy is calculated regularly by Treasury and currently sits at around NZ$1 billion. The introduction of the NZETS

should not impose any more cost on the economy than that estimated by Treasury. To achieve that the proposed NZETS should initially only allow credits to be purchased off-shore and there should be a safety valve capping the cost of credits at the price calculated by Treasury. This could change as we reached bilateral agreements with other countries to link our trading system.

5.3. **Use a progressive obligation methodology in the liquid fossil fuel sector to ensure the sectoral liability matched the government's Kyoto liability.**

While it is understood that where a supplier can pass on costs to consumers there is no justification for allocating carbon credits, the cost difference between the government's Kyoto liability and the cost to consumers in the liquid fossil fuel sector will be disproportionate. It would seem appropriate in the liquid fossil fuel sector to use a progressive obligation methodology to ensure the sectoral liability matched the government's Kyoto liability.

5.4. **Separate identification and protection for liquid fossil fuels used for heat generation and propelling machinery.**

It has been assumed that all liquid fossil fuels are used for transport. Liquid fossil fuels used for heat generation or for propelling machinery as part of a process should be identified separately and protection provided where required.

5.5. **Point of obligation selected to deliver emission reductions.**

Administration costs for the NZETS should be minimal as it is a self reporting electronic system. It has been proposed however, that to minimise administrative costs for government, the point of obligation should be as far up the supply chain as possible. The only exception in the liquid fossil fuel sector is airlines that may opt to become the point of obligation rather than an oil company. This ignores the other very large users of liquid fossil fuels like fishing and mining companies and it is difficult to see why they should not be allowed to opt in should they choose to. It really depends on what the NZETS is designed to achieve. If it is intended to result in a reduction in emissions then the point of obligation should be the party with the greatest incentive to reduce consumption. It is unlikely that the fuel supply company would meet those criteria.

5.6. **Introduce a one-way trade system with a safety valve to minimise overall cost to the economy**.

The proposed method of protection offered to businesses who are trade exposed as a result of the introduction of a price for carbon is to issue them with carbon credits equivalent to 90% of their 2005 emission levels for all industrial process emissions, electricity and

direct fuel use with the exception of liquid fossil fuels. These companies will need to engage traders to operate on their behalf or establish in-house trading expertise in order to maximise the value of the carbon credits that are issued. As outlined earlier, if the NZETS was a one way trade system with a safety valve the process would be greatly simplified and overall cost to the economy would be minimised.

5.7. **Revert back to the dispatch system used by ECNZ to minimise fuel burn.**

Our electricity market presents specific problems for New Zealand and without reform it will be unlikely to deliver the desired change in balance between renewable and thermal generation. Given that, in the main, thermal generators provide base load and hydro generators provide peaking, there is little or no discrimination on price and very little possibility of thermal generation being displaced in the merit order. One option would be to revert back to the dispatch system used by ECNZ to minimise fuel burn. This would see a significant change in the way the electricity market operated by ensuring the lowest fuel/operating cost generators were dispatched first and should produce a greater level of emission reductions.

5.8. **Allow technical groups to complete their analysis and report back through the leadership forum.**

Business New Zealand recognises the vast opportunities for business as the international market moves to tackle the global issue of climate change. However, it also recognises that without a strong economy it will be difficult for a country the size of New Zealand to capitalise on these opportunities. If New Zealand extends too far in its desire to be a world leader we will fail to gain any advantage from the vast array of opportunities. We recommend caution when considering the technical details of this Bill and suggest that the various technical groups already established be allowed to complete their analysis and report back through the leadership forum, who in turn will inform the Minister, before this Bill is reported back to the House.

5.9. **Slow the passage of this legislation to allow more detail to be incorporated before it is reported back to the House.**

There is concern at the extent to which regulation will be required to enable this legislation. The Legislation Advisory Committee recommend that as much detail as possible is included in the legislation and as little as possible in regulation. The haste with which this legislation is being introduced will preclude this approach being adopted and we therefore recommend that the passage of this legislation be slowed to allow more detail to be incorporated before it is reported back to the House

6. ALTERNATIVE APPROACHES

6.1. The NZETS is not a cap and trade scheme in the true sense as it relies on a global cap under which it can trade. This allows a country and a business, which is increasing its levels of emissions, to meet its obligations by purchasing carbon credits from a country or a business that has reduced its emissions below the level of its assigned amount. The assigned amounts set the global cap and it is that cap which must be reduced if the most serious consequences of climate change are to be avoided. It is inappropriate therefore to consider that in some way the scheme will cap our emissions. It will not, it will simply cost more to maintain business as usual levels of emissions over time. There is no reason not to adopt an intensity based measure for energy intensive businesses as this clearly defines the most efficient producers. If the global cap is to be achieved, production should be moved to the most efficient plant and although the emissions for that plant increase, closure of a less efficient installation reduces global emissions.

6.2. The intent of the Bill is to offer protection to a business that meets a threshold limit of emissions but which does not have to become the point of obligation. Removing the need for a threshold to determine who is eligible for protection would not create the administrative problems envisaged, as long as a business receiving protection also had to become the point of obligation, as a company would only be interested in opting in if it made economic sense to do so.

APPENDIX 1

BACKGROUND INFORMATION ON BUSINESS NEW ZEALAND

Business New Zealand is New Zealand's largest business advocacy organisation.

Through its four founding member organisations – EMA Northern, EMA Central, Canterbury Employers' Chamber of Commerce and the Otago-Southland Employers' Association – and 70 affiliated trade and industry associations, Business NZ represents the views of over 76,000 employers and businesses, ranging from the smallest to the largest and reflecting the make-up of the New Zealand economy.

In addition to advocacy on behalf of enterprise, Business NZ contributes to Governmental and tripartite working parties and international bodies including the International Labour Organisation, the International Organisation of Employers and the Business and Industry Advisory Council to the Organisation for Economic Cooperation and Development.

APPENDIX 2

nzier

authoritative analysis

Emissions Trading Scheme for New Zealand

Report to Business New Zealand

26 March 2007

Preface

The New Zealand Institute of Economic Research (NZIER) is a specialist consulting firm that uses applied economic research and analysis to provide a wide range of strategic advice to clients in the public and private sectors, throughout New Zealand and Australia and further afield.

NZIER is also known for its long-established *Quarterly Survey of Business Opinion* and *Quarterly Predictions*.

NZIER was established in 1958.

Authorship

This report has been prepared at NZIER by Johannah Branson, Peter Clough, Vhari McWha, Brent Layton and John Stephenson and reviewed by Jean-Pierre de Raad. The assistance of Sarah Spring, Jessica Matthewson and Simona Vita is gratefully acknowledged.

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George Riddell and his colleagues at Business New Zealand had the foresight to see the need for this report at this time.

Responsibility for the contents of the report rests with NZIER alone.

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Executive Summary

The problem facing New Zealand

It is generally recognised that current rates of international greenhouse gas emission are harming the environment. This is a global issue since the location of the emissions is not relevant to the effect that results in terms of global climate change.

Global climate change policy is focused on reducing the level of emissions caused by human action. The Kyoto Protocol counts six types of greenhouse gases in assessing the impact of humans on the atmosphere: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), two groups of synthetic gases known as hydro fluorocarbons (HFCs) and per fluorocarbons (PFCs), and sulphur hexafluoride (SF_6).

Within the context of this global problem, New Zealand politicians have accepted (at least implicitly) that they have a responsibility to ensure that the social cost of pollution is recognised by those undertaking pollution-causing activities in New Zealand.

A policy objective has been accepted (implicitly) then:

> *To commit to a climate change target or mitigation mechanism that yields a net benefit to New Zealanders.*

This recognises both the scientific reality that the atmosphere is a global resource with a finite capacity to absorb greenhouse gases without detriment and the economic reality that New Zealanders should not be expected to accept more of the cost of climate change mitigation policy than the benefit they collectively capture. The wording used here draws on the experience of the Commerce Commission, which considers only benefits to the public of New Zealand when making decisions and does not consider the distribution of those benefits (the argument being that any preference over the distribution is subjective and that the final distribution of benefits can be difficult to determine anyway).

The New Zealand economy presents some peculiar challenges in terms of the sources of greenhouse gas emissions. Specifically:

- New Zealand is a small economy (accounting for only 0.4% of total emissions from OECD and ex-Eastern Block countries).
- A disproportionately large proportion of New Zealand's emissions relate to agriculture (50% compared to 7% on average internationally).
- The corollary to the previous point is that a disproportionately small amount of emissions come from energy (23% relative to 63% internationally).

- New Zealand has a relatively high proportion of renewable electricity generation (at around two-thirds), when compared to other countries.

The implication of this is that in order to achieve the same proportionate reduction in greenhouse gases the composition of the reduction will have to be quite different to most other countries. It is also likely that direct emissions reductions will be relatively expensive in New Zealand:

- It is expensive to increase our reliance on renewable generation, since
  - Being weather dependent, it is less reliable (firm) than thermal generation and, therefore, a larger installed capacity is required to achieve the same level of generation output;
  - Our high existing level of renewable generation means that thermal generation is currently relied on for system security during adverse weather events; to replace this capability new renewable generation would be required in different locations (in terms of weather patterns) to existing renewable generation;
  - It is not geographically possible to link our electricity system with another country's system to take advantage of differences in weather patterns (and hence renewable generation potential); and
  - The small scale of our market makes nuclear generation infeasible (notwithstanding political considerations).
- There are few existing public transport networks for people to use to replace private transport, and low population density makes building these relatively expensive (and therefore potentially not cost-effective relative to the social cost of pollution).
- Although there is some evidence that it is possible to lower emission rates from agricultural activity (for example by use of nitrogen inhibitors in fertiliser application, or by feed management in growing cattle) measurement of emissions from a specific agricultural activity (for example by individual stock) is currently not achievable. Applying average emission rates means that reductions in emissions are not rewarded, and therefore no incentive to reduce emissions at farm level is created by pricing emissions. The only reward would be from reducing stock numbers, and therefore production which has a clear negative economic effect.

Given this background it is apparent that under the first objective, relating to international policy agreement sits a second objective relating more explicitly to domestic policy decisions:

> *To minimise the total long-run cost of meeting New Zealand's climate change commitments in a global context, including the cost of fulfilling any obligations arising from failure to meet these commitments.*

This objective captures the relatively simple point that the lowest cost means of meeting the climate change target should be adopted. Although this is a simple point, as we have outlined above it is not necessarily one that is easy to achieve. The reality is that it may prove cheaper to pay emitters in another country to reduce emissions rather than to achieve any reduction within New Zealand. This is not a failure of policy since the first objective is still achieved (provided the emissions reductions are only counted once, which should be easily achieved if an international body is monitoring all countries).

All costs should be taken into account when designing policy to achieve the first objective, for example, a balance should be sought between the benefit of including all emitters in any scheme, and the cost of monitoring individuals who have only a small effect on overall emissions.

Like the benefits, it is important to consider the initial distribution of costs only to identify whether they remain within New Zealand. In most cases, the initial party on whom the costs fall will not be the party who eventually pays as the costs are diffused through the economy. The exception is where firms are exposed to international competition. In this case, they are unlikely to be able to increase prices to reflect the cost of climate change mitigation policy (unless the policy is international). This means that the party that receives the benefit of the emission (the consumer) does not also bear the cost of the emission. This will affect the achievement of the first objective (a net benefit to New Zealanders) and may mean that these firms should be treated differently to those without international competitors.

Options for a solution

Market instruments are generally the preferred solution to managing stresses on natural resources (e.g. fish stocks, local air quality, water) because they provide flexibility in terms of either paying the cost of using the resource or changing activities to avoid the cost, they also provide a continuous incentive for improvement (by valuing each additional abatement) contributing to dynamic efficiency. Other options are:

- Technology-push, usually by subsidising research into reducing the undesirable effect. These are generally justified by arguing that there is some market failure preventing developers receiving sufficient return on their research. These policies face a high risk of failure (i.e. not discovering any new technology) and even if successful may not reduce overall levels of emissions.
- Moral suasion, through educating people to change their ‘bad’ habits. This is generally unsuccessful in the long-run partly because the individual does not capture the benefit of their self-restraint. The main use of moral suasion is to make unpalatable policies more agreeable to voters.
- Regulatory prescription, such as banning particular technologies or prescribing rates of emission. These generally work most effectively where activities are homogenous and costs are well-known. Where regulated activities are more

diverse and parties face different costs of compliance, the outcome is unlikely to be optimal and innovation will not be encouraged, as there is little incentive to reduce emissions below the prescribed rate.

There are two main approaches to market instruments:

- Market adjustment instruments which change the price of an activity (through subsidy or tax).
- Market creation instruments which create a property right in the resource which can then be traded to encourage the rights to be put to their highest value use.

In the context of a policy where international linkages are desirable, a market creation instrument such as emissions permits that can be traded across borders in a similar way to other goods and services is more likely to be successful than attempting to harmonise tax laws, with the associated ceding of sovereignty.

International experience of emissions trading

Emissions trading is not a new idea and there are a number of international examples of schemes that have been established to allow trading. Initial schemes were limited to local air quality and had low levels of trading as there were few participants. More recently schemes have become more ambitious in scope, covering larger geographic areas, different types of gas, and more industries.

Notwithstanding the increased scope in international schemes the lessons available to New Zealand are relatively limited due to our particular economic structure and emission patterns as outlined above.

Key lessons are:

- Schemes to date have had limited effectiveness in terms of achieving environmental targets principally because of over-allocation of permits and to some extent because of uncertainty over longer-term policy intentions.
- Consideration of transaction costs is important in determining the scope of the scheme, but within this constraint the widest scope in terms of industry and gas coverage should be sought to ensure liquidity.
- Different allocation methods are able to be adopted for different sectors within a single scheme. Associated with this, consideration needs to be given at industry level of how increases in production will be dealt with so as not to prohibit internationally efficient (including in emissions terms) growth.
- Allocation methods are often chosen to ease acceptance of new policy; some level of gratis allocation can also ease the adjustment cost of moving to a world where emissions incur a cost; it can also be used to protect the profitability of trade exposed firms (who are emissions-efficient in production technology).
- Design of a local scheme should consider whether attributes will limit international trade (little experience exists to date). Examples would include

limits on prices, exchange between gas types or exclusion of a particular industry.

- Annual targets are not vital given the long-term stock nature of the atmosphere. Banking and borrowing can be used to mitigate against this concern. There are no reported adverse effects of banking; borrowing is not common probably reflecting concerns about managing credit risk.
- Lack of information about demand is often problematic in the short term leading to price volatility until market participants become aware of the supply-demand balance.
- Although New Zealand has a successful track record with low cost privately run registry and exchange systems, consideration should be given to whether this will limit international trading opportunities.

Market design

In order to have an emissions trading scheme we need to:

- Define the right to pollute, specifying what exactly the permit allows the party to do.
- Determine how the rights are initially allocated.
- Enable trading, fundamentally by determining a mechanism for transferring the right to someone else.
- Ensure that the right can be enforced, i.e. that those who pollute without a permit are sanctioned and that transfers between parties are enforceable.

If transaction costs are sufficiently low and there is competition for the permits then a market will evolve and an efficient outcome will result. If transaction costs associated with searching for buyers or sellers, negotiating a contract, or enforcing the contract are high then limited trading will occur. This will limit the efficiency of the final outcome (depending on the efficiency of the initial allocation) and may mean that the market would benefit from intervention to lower transaction costs.

If one firm has market power then the initial allocation of rights becomes important for the efficiency of the final outcome. In order to achieve the most efficient outcome the dominant firm should either be allocated exactly the amount of permits it will finally use (so it is not in the market, distorting the price). If this is not possible it is generally more efficient for the dominant firm to be a buyer of resource rights rather than a seller (as long as they are not the sole buyer).

Emission trading scheme choices

The international experience shows there are many variants in design around the broad requirements for emissions trading. This creates a number of choices for consideration in designing a scheme for New Zealand's circumstances. The key choices relate to:

- Defining the unit of trade.
- Deciding the time period for which emission entitlements will be valid.
- Specifying the points of obligation or the entity with responsibility to report emissions and demonstrate it holds sufficient entitlement against those emissions.
- Determining whether the entitlements will be relative to output or set at an absolute level irrespective of output.
- Deciding on the registry and market arrangements for trading.
- Deciding how the initial allocations of entitlements will be made.
- Deciding how to deal with any windfall gains.
- Deciding whether and how to incentivise firms to seek efficient reduction in emissions before any scheme gets under way.
- Deciding the appropriate transition path from a position where there is no emission trading scheme to one where there is a scheme.

The unit of trade has generally been defined in terms of emission of tonnes of CO_2, or its equivalent for the other gases, with equivalence based on the Global Warming Potential factors of the other greenhouse gases relative to CO_2.

The key factors relating to the term for which emission entitlements are specified is the impact on investment incentives it can have and the flexibility it provides the regulator to subsequently adjust entitlements should circumstances alter. If the term is fixed and short and there is no clear understanding of how any entitlement will be determined in the next period this is not conducive to investment decisions. On the other hand, if the term is perpetual and not open to adjustment then there is no flexibility for the regulator to correct errors or adjust to changed circumstances. We have suggested an evergreen rolling entitlements for 10 years as a compromise between investment and regulatory flexibility.

The usual options in relation to the point of obligation are either upstream (where the source of the input that causes the emission comes from) or downstream (at the place where the emission occurs). The choice between the options is usually driven by the location that minimises the transaction costs of monitoring and reporting emissions obligations and entitlements. The decision can vary from sector to sector and within a sector according to the nature of the emission. We have suggested that parties should be able to voluntarily agree to transfer the point of obligation. They will only do this when they see advantage in doing so.

If an emission entitlement is fixed at some specified level of emissions irrespective of the volume of output there is no opportunity for growth in output without purchasing additional emission entitlements. If, however, emission entitlements are set relative to the level of output then as output grows the entitlement also grows.

The basic requirements of a trading scheme are:

- A registry to record ownership of entitlements and transactions that result in change in ownership.
- An inventory of recorded emissions from each obligation point, with which to match individual entitlements held, and to assess aggregate achievement against the emission reduction target.
- A trading arena in which offers can be made and accepted, with changes of ownership reported to the registry.

Compatibility with, and linkage to, other trading arenas at the international level, to increase the opportunities of establishing worthwhile trades are desirable, but not vital to the establishment of a scheme.

There are two basic ways in which initial allocations of emission entitlements can take place:

- Sale of emission units by government or system regulator.
- Gratis allocation of emission units.

Gratis allocations may be made:

- 'Grandfathering' on the basis of historical emission levels.
- 'Performance' based on the emissions which would occur with international 'best practice' operation in terms of emissions.
- Grants based on an emitter's expected future emission levels.
- Grants based on some other basis (e.g. balloting).

Gratis allocations have been a common feature of most international schemes, but are generally contentious because it is argued that gratis allocations remove the incentive for emissions constraints. This is erroneous as it fails to recognise that even if a firm gets an allocation free it incurs an opportunity cost when it decides to use it rather than trade it in the market place.

Another objection to gratis allocations is that with sale of entitlements the government raises revenue that allows it to invest in research and other schemes to deal with emissions. This objection assumes that such expenditure will be an efficient use of resources, and this is by no means certain.

A further objection is that gratis allocation gives a valuable asset to those most responsible for the 'problem' of pollution. However, an alternative way to view the initial allocation of rights as removing the current rights of those emitting and replacing them with alternative rights that are easier to adjust in future and take a form that incentivises them to seek ways to reduce their emissions in a way their current rights do not.

Windfall gains arise where there are two different technologies with different emissions levels that produce the same good and the price is set by the more emission-intensive producers. The most commonly cited example is electricity

generation where hydro and wind generators benefit from higher prices when the marginal cost of thermal generation increases. The windfall gains issue is essentially a political economy issue and its resolution will be in the political arena.

Companies that have already invested in reducing emissions may argue that it is 'unfair' if they receive fewer grandfathered allowances than companies that have not. Political economy considerations will make recognition of early action unavoidable.

From a longer-term perspective there is also an economic case for recognising early action if doing so accelerates the participation of firms into the scheme, thus achieving wider coverage earlier, or if firms are holding off investments now in the expectation of getting better allocations in future. Investment is less likely to be postponed if allocation procedures are clearly announced in advance, and allocations are based on some international 'best practice' standard or, if that is not possible, on historical emissions from a period that means they are not open to manipulation.

Embarking on establishing a comprehensive domestic emissions trading scheme before there is a clear indication of what the successor agreement to Kyoto will look like and there is wider coverage of emissions restraint at the international level would almost certainly entail increased costs for New Zealand, for questionable benefit.

The costs arise because of the difficulties of setting domestic policy in an international vacuum and through higher competitiveness impacts that would be incurred in New Zealand, necessitating additional transaction costs in arranging allocations and other compensatory measures. These costs would be much reduced or eliminated if the future scheme was reasonably well understood and every country was facing the same emission restraints and implied cost of emissions.

The benefits of too early action are negligible because any emission reduction achieved in New Zealand will be eclipsed by increased emissions in countries without emissions restraint and some of that extra emissions would be due to production relocating from New Zealand to countries without constraints. Indeed, too early action by New Zealand may result in activities shifting from New Zealand to countries with lower environmental standards than New Zealand to the overall detriment of the world's environment, including the level of greenhouse gases in the atmosphere.

The transition path towards an emission trading scheme New Zealand adopts should be guided by careful cost benefit analysis. The emissions trading scheme should be expanded to cover new sectors and emissions when the benefits from doing so outweigh the transaction and other costs that will be incurred.

Proposed design of a New Zealand ETS

In relation to units of trade and period of entitlements we propose:

- Annual emission entitlements be issued on an evergreen rolling basis for ten years or so with entitlements for the next three years issued after three, six and so on years. We believe this is a reasonable compromise between the needs of regulators to be able to adjust entitlements as circumstances change and new information becomes known and the needs of investors for certainty.
- Emission entitlements that are auctioned should be initially offered for a range of years. In subsequent auctions forward entitlements that allow parties to extend their existing entitlements should also be auctioned. For example, in the third year of auctions an entitlement for 8-10 years forward should be offered to allow those that initially bought a 10 year entitlement to 'top up' the term back to 10 years.
- Entitlements should specify the units of CO_2 equivalent the holder can emit in each calendar year period. Firms with obligations will be required to do annual reconciliations of their obligations and entitlements.
- Banking of unused entitlements for an indefinite period should be permitted.
- Borrowing of up to 10% of any year's obligation from future year's entitlements should be permitted but any borrowings would be 'repayable' at a rate of 1.15 units per unit borrowed per year.
- Failure to hold the correct level of emission entitlements within three months of the end of the calendar year for which they are required will incur a monetary penalty and an obligation to obtain in addition to the calendar year's obligations 1.15 times the emission units not delivered. The level of the monetary penalty could act as a short-term cap on price, but the repayment obligation means this cannot be a long-term solution. The 1.15 times requirement ties in with the proposed 'borrowing' cost. The cap on borrowing will constrain firms from borrowing indefinitely.
- Entitlements relating to all internationally recognised greenhouse gases should be fully fungible and convert to their CO_2 equivalent at the international Global Warming Potential (GWP) factor in force at the time of the annual reconciliation at which the entitlement is submitted in fulfilment of an obligation.
- Carbon sinks from forestry and other sequestration activities should give rise to fully fungible emission entitlements. Again, from a New Zealand perspective this is critical due to the likely efficiency of sinks relative to direct abatement, even if it is of limited importance in other countries.
- Any party, whether New Zealand based or not, should be able to buy and hold emission entitlements. This is irrespective of whether they are holding the entitlements as a hedge or for speculative purposes.
- Emission entitlements from other countries that are recognised by the party to which New Zealand is responsible for meeting its international obligations should be able to be traded in New Zealand, and used to meet local and international obligations.

The proposed allocation procedures which include evergreen entitlements and forward auctions will allow the government to alter the overall availability of entitlements in response to the country's commitments in an orderly manner. Holders of entitlements will get clear messages in advance of changes.

In relation to the registry and market platform we propose:

- The registry functions should be delivered through electronic and internet based recording processes. International compatibility would be an advantage and adopting an existing system should lower costs.
- The registry should be capable of communicating with national registries in other countries, and with international transaction logs.
- The trading forum should be simple, low cost and internet-based.
- The development of a market should be left to private initiatives to determine who develops the most successful forum and the registry should be contracted out to the private sector.

In relation to firms at risk from international competitors which face no or limited effective emissions charges we propose:

- New Zealand firms subject to international competition from producers likely to be facing no or limited effective emissions charges should receive a gratis allocation of emission entitlements.
- To incentivise the firm receiving the entitlement to reduce its emissions, but not constrain efficient growth in output, the level of gratis allocation should, if practicable, be based on an international 'best practice' standard per unit of output.
- The 'best practice' standard could be set at the world best standard or at some point, such as, the upper quartile or top decile level for plants in an international peer group for which data are available.
- For smaller entities, the information costs of finding and checking peer group data may be too great, and their gratis allocation could be based on some percentage less than 100% of their historical emissions per unit of output. They should have the option of having their allocation determined on the basis of the emissions of an international peer group if they wish, however.

We are aware that some international commentators have argued that a firm does not need anywhere near a 100% gratis allocation to protect its profitability. The analysis behind this argument depends on the firm facing a demand curve that is price responsive and the competitors of the firm also facing emission constraints that are roughly similar.

The New Zealand firms in the position of being vulnerable to competition from other firms that are not subject to constraint tend to be commodity producers (timber, aluminium, iron and steel, cement, pulp and paper, meat processors, etc) and typically face demand that is relatively responsive to price. Moreover, the

commodities these firms produce are also produced in significant quantities in countries that are unlikely to be early adopters of emissions constraints.

The consequences of under-allocating to firms with competitiveness at risk will be that they will reduce investment and, over a period of time, either move overseas or have their output replaced by overseas production. Under-allocation, unless corrected, will therefore lead to inefficient resource allocation and a loss of public benefit to New Zealand. On the other hand, the consequence of over-allocation is some wealth transfer to the owners of the firms, but no adverse impact on economic efficiency, in New Zealand or elsewhere. Given the overall objective of dealing with climate change in an efficient manner, running the risk of over-allocation to firms with competitiveness at risk is preferable to running the risk of under-allocation.

A potential criticism of our proposal is that it will allow emissions to grow because the allocations for firms with competitiveness at risk will be on a relative basis per unit of output. Because the allocations for the significant firms in the category will be on the basis of an international 'best practice' standard, New Zealand's emissions from a firm in this category are likely to initially drop. Emissions will only grow subsequently if the firm is efficient in both economic terms and efficient in terms of emissions relative to its international peer group. Its increase in output is likely to be displacing less economically and efficient production elsewhere.

Moreover, our overall proposal includes a reassessment of targets on a rolling three-year basis and if the overall level of emissions is not coming down as needed this provides an opportunity to impose tighter constraints on all firms and sectors with allocations. The firm will have seven years to adjust to this change.

The rolling three-year reviews of the 10-year evergreen contracts will also allow the level of any competitiveness at risk allocations to be adjusted with an adequate lead time to any changes in world best practice or the spread of obligations to competitors to New Zealand firms. Indeed, when all countries have imposed similar restrictions on firms in an industry, there will be no need for a competitiveness at risk allocation at all, and our proposal easily handles the complete phasing out of gratis allocations should this happen.

We propose that emission obligations be placed on thermal and geothermal electricity generators. This will raise the price of electricity when the marginal plant is a thermal or geothermal by approximately the amount of the emission charge per unit of electricity generated by the marginal plant.

Firms that are heavy users of electricity may have their competitiveness placed at risk through the increase in electricity prices. To deal with this we propose they be provided gratis allocations of emission entitlements per unit of output sufficient to cover what the impact on their profitability would be if they be using electricity in line with international best practice standards.

In relation to firms that can pass the costs of emission entitlements through to customers we propose:

- Firms in this situation should not receive any gratis allocations.
- They should be required to purchase their entitlements in auctions or from those with surplus entitlements or sink credits.

In relation to the point of obligation we propose:

- The point of obligation for emissions in the supply chain vary by sector and within sectors by the type of emission.
- Firms that are downstream in situations where the point of obligation is defined to be upstream may voluntarily assume emission obligations and in return receive any emission entitlements.
- Firms will need to negotiate any such arrangements with their upstream supplier and bear the administrative costs of these arrangements. Assistance with the negotiations may be necessary if the upstream supplier has market power in the negotiations.

The two tables that follow summarise how it is proposed that the New Zealand ETS should deal with individual emissions and an evaluation of the proposal against a standard set of criteria used in the early stages of policy development.

Outline of emissions trading in New Zealand by emissions source

	Share of total emissions	Gases	Point of obligation	Emissions constraint	Competitive-ness impact	Gratis permit allocation
Oil and oil products						
Transport	19.1%	CO_2 & CH_4	Upstream on oil product importers & wholesalers	Acquire entitlements & trade	Negligible	None
Other	2.8%	CO_2 & CH_4	Upstream on oil product importers & wholesalers	Acquire entitlements & trade	Negligible	None
Fugitive		CH_4	Upstream on well-operator, if efficient to do so	Facility baseline based on 'best practice' & trade	Yes	Yes
Natural gas						
Non-combustion (petro-chemicals)	3.2%	CO_2 & CH_4	Downstream on facilities	Facility baseline based on 'best practice' or % historical emissions (small operators only) & trade	Yes	Yes
Combustion	6.5%	CO_2 & CH_4	Upstream on distributors and downstream for 'major users'	Distributors acquire entitlements & trade Major users facility baseline based on 'best practice' & trade	No for distributors Yes for major users	No for distributors Yes for major users
Fugitive	0.8%	CH_4	Upstream on well & pipeline operators, if efficient to do so	Acquire entitlements & trade	Negligible	None
Coal						
Combustion	8.6%	CO_2 & CH_4	Downstream on facilities for major users Minor users upstream or exempt if not efficient	Facility baseline based on 'best practice' or % historical emissions (small operators only) & trade	Yes	Yes
Industrial processes	5.6%	CO_2	Downstream on facilities	Facility baseline based on 'best practice' or % historical emissions (small operators only) & trade	Yes	Yes
Cement & lime	0.8%	CO_2	Downstream on facilities	Facility baseline based on 'best practice' & trade	Yes	Yes

Fugitive		CH_4	Upstream on mine owner if efficient to do so	Facility baseline where efficient & trade	Yes	Yes
Non-energy sources						
Wastes - Landfills	2.1%	CH_4 & N_20	Downstream on landfill facilities	Acquire entitlements & trade	Negligible	None
Wastes - Wastewater treatment	0.5%	CH_4 & N_20	Downstream on larger treatment plants Small plants exempt	Larger plants acquire entitlements & trade Small plants none	Negligible	None
Agriculture	50.0%	CH_4 & N_20	Determine whether upstream on farms of downstream on process facilities – dairy factories and slaughterhouses – if and when measurement issues resolved	Cap & trade with cap related to units of output	Yes	Yes
Fertiliser		N_20	Upstream on distributors of fertiliser	Acquire entitlements & trade	No	Suppliers of nitrification inhibitors receive emission entitlements
Forestry	-33.0%	CO_2	Upstream on landowners or assignees	Carbon credits accrue while growing. Small negative debit to reflect carbon emission from harvest debris 2-3 years after harvest. If land replanted harvest debit can be offset overtime against carbon credits from the growing new trees	Minimal and offset by sink credits	Retain sink credits
Bush regeneration & clearance	??%	CO_2	Upstream on landowners or assignees	Carbon credits accrue while bush regenerating. Destruction by crushing or burning leads to emissions that need to be covered by entitlements	Negligible	Retain sink credits for regenerating bush
Solvents & refrigerants	0.1%	HFCs	Upstream on importers/ suppliers	Acquire entitlements & trade	Negligible	None
Aluminum	<0.1%	PFCs	Downstream on facilities	Facility baseline based on 'best practice' & trade	Yes	Yes
Electricity transmission	<0.1%	SF_6	Downstream on network operators	Acquire entitlements & trade	Negligible	None

End use energy						
Electricity generation	8.1%	CO_2	Downstream on thermal and geothermal plant	Acquire entitlements for all emissions & trade	Yes - boon to non-thermal generation	None
Oil Refining	1.1%	CO_2	Downstream on refinery	Facility baseline based on 'best practice' & trade	Yes	Yes
Other industry & commerce	1.6%	CO_2, CH_4 & N_2O indirectly	Upstream in electricity & fuel suppliers with downstream optional based on agreement Downstream for emissions not covered upstream	Facility baseline based on 'best practice' or % historical emissions (small operators only) if needed for competition	Maybe	Yes for trade-exposed energy intensive and tax relief from revenue from electricity and auction receipts
Households	1.2%	CO_2, CH_4 & N_2O indirectly	Upstream in electricity & fuel suppliers	None	No but bear cost impact	None but tax relief from revenue from electricity and auction receipts

Note: The end use energy shares of emissions are subsumed within the source sector emissions and are not additional to them.

Source: NZIER

Assessment of proposal against evaluation criteria

Criterion	Comments
Efficiency: Productive efficiency – the extent to which production occurs at minimum cost, i.e. resources are not wasted. Allocative efficiency – the extent to which resources are allocated to their most valuable use. Dynamic efficiency – the extent to which investment and innovation occurs efficiently over time.	Design is intended to minimise the cost of reducing emissions The use of international best practice standards will encourage New Zealand businesses with allocations because of competitiveness at risk towards low emission production processes Clear signals about the regime and the use of 10-year evergreen rolling entitlements will aid dynamic efficiency The highly open nature of the proposal in terms of gas coverage, sectors, who can trade , what can trade will promote allocative efficiency
Effectiveness: To what extent does the policy under consideration achieve the stated objective?	The proposal should contribute to the climate change objective distilled from the New Zealand Energy Strategy by capping allowable emissions and seeking to minimise cost across a broad range of sectors: To commit to a climate change target or mitigation mechanism, that yields a net benefit to New Zealanders; and to minimise the total long-run cost of meeting New Zealand's climate change commitments in a global context, including the cost of fulfilling any obligations arising from failure to meet these commitments
Administrative and compliance cost: The extent to which a proposed approach imposes such costs should be considered a relevant evaluation criterion.	The proposal is intended to keep compliance costs low, by identifying the party in the supply chain where transaction costs would be lowest. The area where there will be some effort required will be in setting the international best practice standards. However, a lot of work has already been done negotiating NGAs with most of the firms that will seek 'best practice' baselines, which should reduce this cost
Information availability: The extent to which the proposed approach ensures high quality accurate information is available to participants in a timely manner	The proposal should generate good quality and timely information for market participants and policy makers through monitoring of emissions and market activity

Contract availability: The effect of market design on liquidity	The broadness of the market in terms of sectors, gases, types and countries of origin of entitlements that will qualify, range of permitted participants and allowing borrowing and banking should all aid liquidity. New Zealand has good expertise in getting low liquidity markets operating effectively and we should not be put off too quickly by 'experts' who claim the market will be too thin. International linkages would aid liquidity but are not vital
Competitive effects: The extent to which market design features encourage competition for both the emissions permit (input) and in the final product market (output)	There will be competition for emission entitlements. The granting of allocations to new entrants on the same basis as existing businesses will be helpful for competition in output markets. There is no competitive bias in the gratis allocation mechanism. Indeed new entrants that can adopt better than 'best practice' will have the opportunity to sell surplus entitlements
Regulatory certainty: The degree to which the regime and how it will evolve is certain	The comprehensive coverage of the proposal adds to the regulatory certainty. The use of the 10-year evergreen rolling allocation process will also limit the impact on investor confidence
Practicality and robustness: Does the proposal square with international experience? Is it compatible with the overall structure of the New Zealand economy?	While there are still a lot of details to be ironed out, the proposal has enough detail to identify that it is likely to be practical and robust to changes in the international environment (such as linking with other national emission trading schemes, or adopting international sector-based targets) or in the stringency of the target (including the mix of gases, and their global warming potential)

Source: NZIER

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1. Introduction

Emissions trading is a market-based instrument used for environmental protection. It has been adopted as one of the primary tools for international cooperation to reduce greenhouse gas emissions under the Kyoto Protocol.

Domestically, emissions trading has been evaluated as a policy option for New Zealand since the mid-1990s. It was contemplated that the broad based carbon tax that was to have been introduced in 2007 could migrate into an emissions trading scheme.

The prospects of emissions trading being introduced in New Zealand have recently grown stronger. In June 2005, following the significant shift in New Zealand's forecast Kyoto net position to a deficit position, a cross ministry Climate Change Policy Review[1] was initiated.

On the 21st of December 2005, it was announced that the proposed carbon tax would not go ahead. The Government would instead consider other ways to ensure New Zealand meets its commitments.[2] This decision was justified on the basis that "the proposed carbon tax would not cut emissions enough to justify its introduction". The Government's confidence and supply partners had also expressed opposition to the tax.

The 2005 Climate Change Policy Review had given a clear recommendation that the Government should not develop a New Zealand Emissions Trading Scheme (NZ ETS) to apply before 2012. Emissions trading was, however, included as one of the options to be evaluated in the pre-2012 period as an "alternative measure to the carbon tax".[3] These options cover "large direct emitters of greenhouse gases in both the electricity generation and industrial sectors".[4]

Politically there has also been a convergence on emissions trading as a policy option with the announcement of the National Party's Blue Green Vision[5] which proposes to:

> *Introduce a tradeable emissions permit system to manage New Zealand's Greenhouse Gas emissions.*

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[1] Public version released 21 December 2005, www.climatechange.govt.nz/resources/reports/policy-review-05/index.html

[2] Hon David Parker, 21 December 2005.

[3] Cabinet paper: Climate Change – Review of Policy and Next Steps: CBC (05) 394 and Cabinet minutes: CBC Min (05) 20/10.

[4] Hon David Parker - Climate Change Work Programmes, 4 July 2006 www.beehive.govt.nz/ViewDocument.aspx?DocumentID=26353

[5] www.bluegreens.org.nz

> *The first step will be capping electricity emissions by requiring all additional emissions from fossil-fuel power stations to be offset by forestry planting or other emission reductions.*

This could lead to emissions trading being introduced in the electricity sector prior to broader implementation.

New Zealand is not alone in considering an emissions trading scheme. Internationally, emission trading is increasingly seen to be the favoured policy instrument to address energy related greenhouse gas emissions. This is exhibited by the implementation of the European Union (EU) Emissions Trading Scheme (ETS) and the development of domestic and regional emissions trading proposals elsewhere.

The effectiveness of any such ETS in addressing greenhouse gas emissions and its impact on New Zealand business will be heavily dependent on its design. Recognising this, Business New Zealand commissioned this report to:

- Outline the international experience in greenhouse gas related emissions trading schemes;
- Document the pre-conditions that should exist before New Zealand implements any scheme; and
- Propose an emissions trading framework appropriate to New Zealand.

2. New Zealand's economy

The ease with which a country can reduce its greenhouse gas emissions depends on the structure of its economy and the characteristics of its emissions profile. New Zealand has some distinctive characteristics in both its economy and emissions profile compared to other developed countries that present some distinct challenges in meeting emissions reduction targets.

2.1 New Zealand's greenhouse gas emissions

2.1.1 New Zealand in global emissions

The Kyoto Protocol counts six types of gas in assessing anthropocentric greenhouse gas emissions: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), two groups of synthetic gases known as hydro fluorocarbons (HFCs) and per fluorocarbons (PFCs), and sulphur hexafluoride (SF_6). Other gases contribute to the atmospheric greenhouse effect but cannot be attributed to human actions or sources (e.g. water vapour).

New Zealand's emissions of the six Kyoto greenhouse gases grew from around 62 million tonnes of carbon dioxide equivalent in 1990 to around 75 million tonnes in 2004. This is an average annual rate of 1.4% (Table 1).

Under the United Nations Framework Convention for Climate Change (UNFCCC) Annex 1 countries (comprising OECD countries plus the Eastern European economies in transition) have obligations to constrain their greenhouse gas emissions. Other countries, mainly developing economies, do not have obligations. The aggregate emissions of Annex 1 countries exhibited a slight decline over the period from 1990 to 2004. But this was largely due to fortuitous circumstances, such as the collapse of heavy industries in Eastern Europe following the disintegration of the Soviet planned economies, and the substitution of gas for coal in electricity generation in the UK.

New Zealand accounts for only 0.4% of total emissions of the UNFCCC Annex 1 countries, and an even smaller proportion of total global emissions from both developed and developing countries. Estimates of global anthropocentric emissions of all greenhouse gases are fraught with uncertainty because of inadequacies in monitoring and measurement across countries. The most reliable estimates are for global CO_2 emissions alone, of which in 2003, New Zealand contributed 0.13% of the global total of 24,983 million tonnes. By comparison, the five largest emitters of CO_2 were the USA (22.93%), China (15.05%), Russia (6.11%), Japan (4.81%) and India (4.2%).[6]

[6] International Energy Agency (2005) *CO_2 Emissions from Fuel Combustion, 1971-2003*, IEA Paris.

Table 1 Aggregate anthropocentric emissions 1990 & 2004

Million tonnes CO_2 equivalent	1990	2004	*Annual average %*	*Share 2004*
Annex 1 Greenhouse Gas Emissions	18,551.5	16,931.6	-0.7%	100%
NZ Greenhouse Gas Emissions	61.9	7501	1.4%	0.4%

Source: NZIER; UNFCCC National greenhouse gas inventory data

In the context of international emissions, New Zealand is an insignificant emitter and nothing it can do alone will have an appreciable effect on the accumulation of atmospheric greenhouse gases or on climate change. This implies that any emissions trading in New Zealand needs to be seen as part of a coherent global approach to a global problem.

Between 1990 and 2003 New Zealand experienced the third highest increase in CO_2 emissions from fuel consumption among the 23 OECD countries. We were behind only Spain and Portugal.[7] New Zealand's growth in non-CO_2 agricultural emissions has given it the 8th fastest growth in total emissions among the 40 Annex 1 countries between 1990 and 2004.[8]

While this growth attracts much attention among the media and some policy commentators, New Zealand does not have particularly high energy emissions on a per capita basis compared to other Annex 1 countries. Its CO_2 emissions of 8.09 tonnes per capita place it well below the median position for emissions, and it has less than half the per capita emissions of Australia, Canada and the USA (Figure 1).

Among the 23 countries covered by Figure 1, New Zealand has a somewhat higher ranking in terms of emissions per unit of Gross Domestic Product. When GDP is compared in US dollar terms, New Zealand has the 6th highest emissions per unit of GDP; when compared in purchasing power parity terms, it has the 12th highest emissions per unit of GDP.[9] This indicates that New Zealand's production is slightly more emission intensive than other countries, and that reducing emissions to meet targets under Kyoto or other agreements is likely to have greater economic impact, other things held constant.

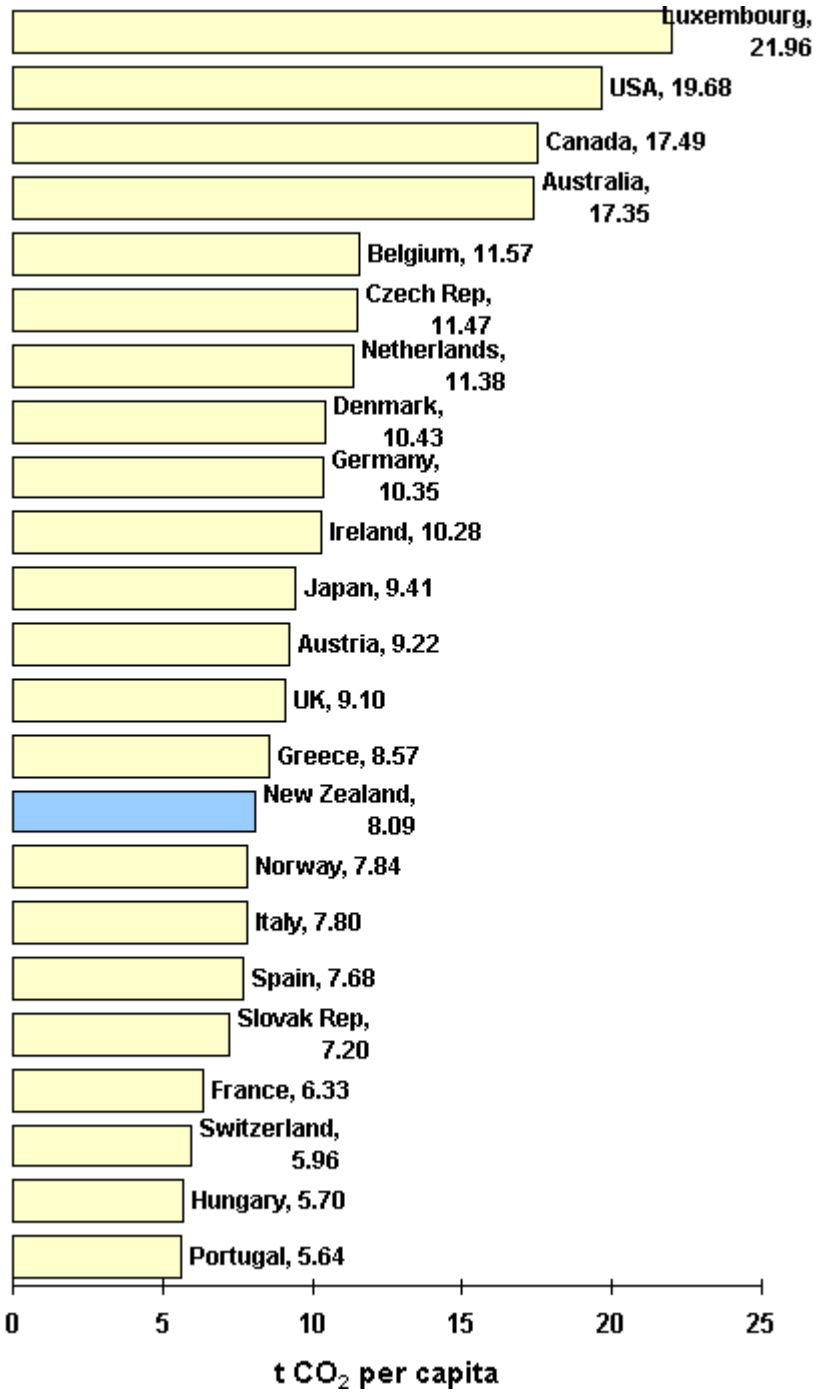
[7] Ministry of Economic Development (2006) *Energy Greenhouse Gas Emissions 1990-2005*, p.109.

[8] UNFCCC (2006) *National Greenhouse Gas Inventory Data for the Period 1990-2004 and Status of Reporting*, notes by the Secretariat to the 25th Session of the Subsidiary Body for Implementation, Nairobi.

[9] Australia's relative emissions per unit of GDP do not vary as much with changes in the GDP base; it is the fourth highest emitter on US$ comparisons, and second highest on purchasing power comparisons.

Figure 1 New Zealand's per capita CO_2 emissions 2003

Comparison of CO_2 emissions on a per capita basis



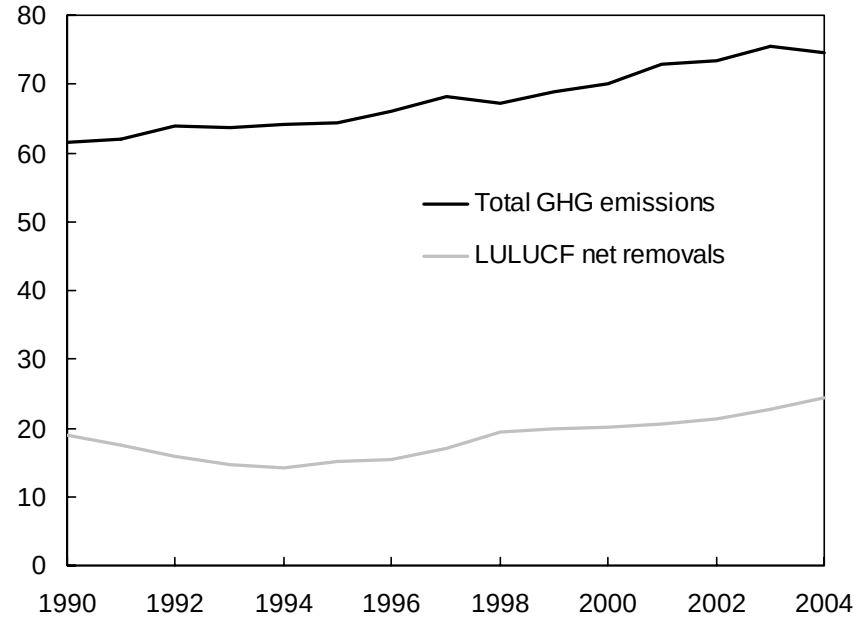
Source: Ministry of Economic Development

2.1.2 Trends in New Zealand's greenhouse gas emissions

Figure 2 shows the trend in total greenhouse gas emissions in New Zealand and in the net removals from land use, land use change and forestry (known as LULUCF) which are offset against gross emissions in New Zealand's greenhouse gas inventory. These removals, which largely comprise the sequestration of carbon in new areas of growing trees, have been increasing recently as trees planted in the forestry boom in the early 1990s reach the age of most rapid carbon sequestration. They reduce New Zealand's net emissions each year by around 20 million tonnes of CO_2 equivalent.

Figure 2 New Zealand's greenhouse gas emissions

Million tonnes CO_2 equivalent per year



Source: NZ Climate Change Inventory data

The composition of New Zealand's greenhouse gas emissions is presented in Table 2. In 1990, carbon dioxide (CO_2) and methane (CH_4) were almost level pegging with the largest shares of total emissions, but by the latest year in the inventory, 2004, CO_2 emissions had grown significantly faster (2.1% per year) than methane (at 0.5% per year) to overtake it as New Zealand's principal greenhouse gas. The table also shows the 100 year Global Warming Potentials used to convert the different gases into carbon dioxide equivalents (i.e. one tonne of methane is equivalent to 21 tonnes of carbon dioxide, and so on).

Table 2 Composition of New Zealand's emissions

Thousand tonnes CO_2 equivalent per year

	100 year Global Warming Potential	1990	2004	Change from 1990 %	Annual average % change
CO_2	1	25,373	34,039	34%	2.1%
CH_4	21	25,405	27,064	7%	0.5%
N_2O	310	10,307	12,879	25%	1.6%
HFCs	140-11,700	0	597		0.0%
PFCs	6,500-9,200	516	88	-83%	-11.9%
SF6	23,900	12	21	74%	4.0%
Combined total		**61,614**	**74,688**	**21.2%**	**1.4%**

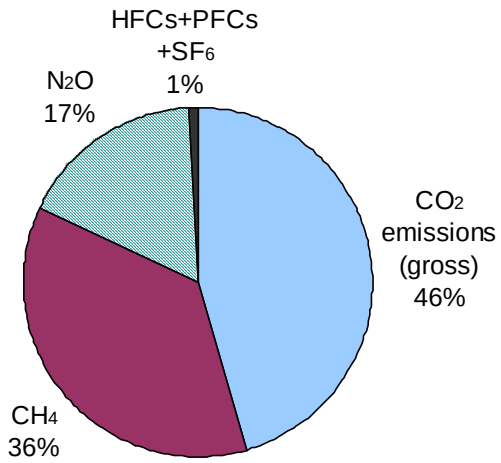
Source: New Zealand Climate Change Inventory Data

The shares of the different gases in 2004 emissions are presented in Figure 3 and contrasted with the average shares in Annex 1 countries.

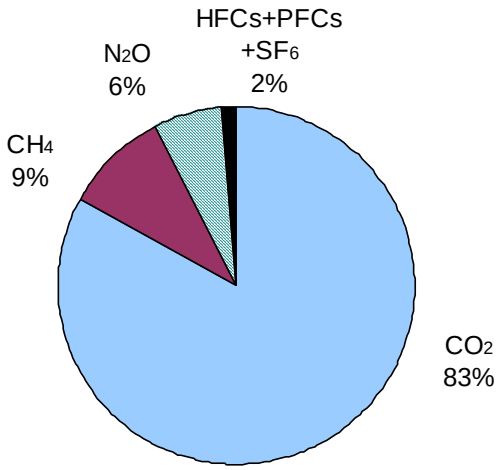
Figure 3 Greenhouse gas emissions by gas

CO_2 equivalent basis

New Zealand



Annex I Countries

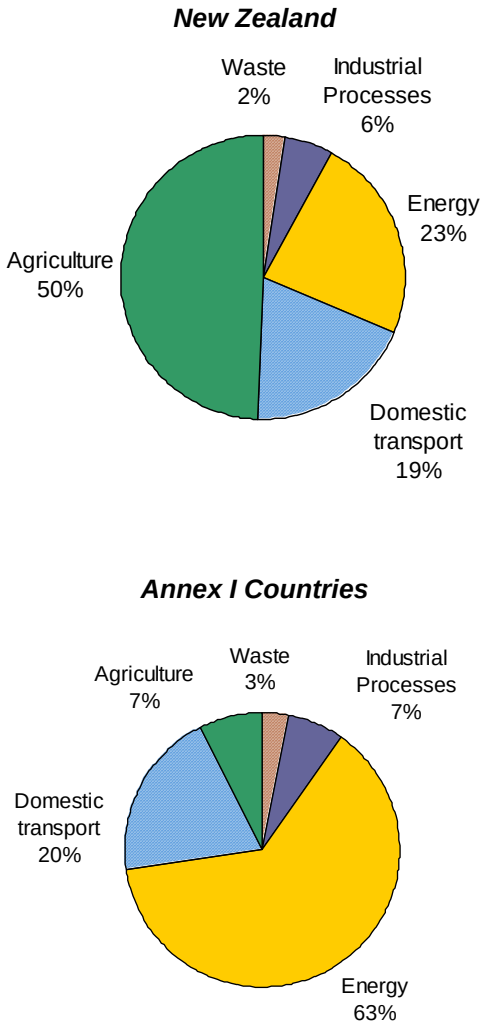


Source: Table 2 above; NZ Climate Change Inventory data

Figure 4 shows the contribution of different sectors to gross emissions in 2004. Unlike other Annex 1 countries, where carbon dioxide emissions from energy dominate the profile, New Zealand's highest share is attributed to agriculture, predominantly of methane and nitrous oxide emissions from livestock and the management of manure and animal wastes.

Figure 4 Emissions by activity/source

CO_2 equivalents basis



Source: NZ Climate Change Inventory data

High growth in energy-using sectors has been recorded, particularly in thermal electricity generation and domestic transport, Thermal electricity generation emissions more than doubled between 1990 and 2005, growing at an annual average rate of 4.9% per year. Domestic transport, emissions increased by 62% (3.3% per year) over the same period.[10]

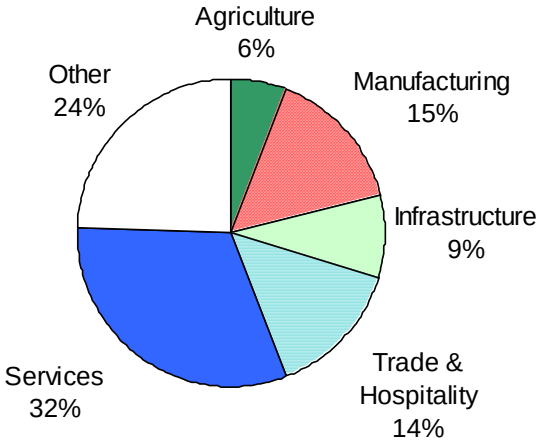
Current projections of future emissions do not show much change to this proportional split of emissions by sources. The most recent projections for emissions over the first Kyoto commitment period of 2008-2012 show agriculture's share unchanged at 50%, energy's share increasing by 1% to 43% and other emissions declining to 7%.[11]

[10] www.med.govt.nz/templates/ContentTopicSummary____23719.aspx
[11] www.climatechange.govt.nz/resources/reports/projected-balance-emissions-jun06

2.2 Profile of the New Zealand economy

The current contribution of different sectors to New Zealand's GDP is illustrated in Figure 5.

Figure 5 Sectoral composition of New Zealand's GDP

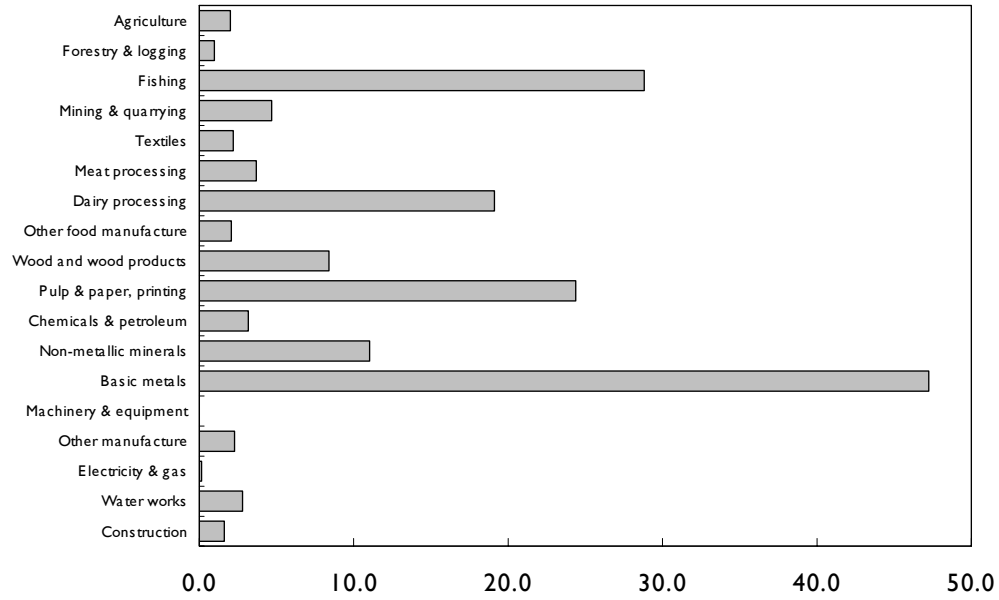


Source: NZIER Quarterly Predictions

Agriculture, forestry and fishing together accounted for 6% of GDP in 2006, and manufacturing for 15%. The infrastructure industries, which comprise electricity, gas and water supply industries, building and construction and mining and quarrying, accounted for a further 9%. The remainder of economic production comprised services, including wholesale, retail and hospitality trades (14%), service industries (32%) and the other category, which includes central and local government administration, education, health and community services (24%).

New Zealand has a relatively high proportion of its manufacturing industry in energy intensive activities, as illustrated in Figure 6. The most energy intensive industries, basic metals, fishing, pulp and paper, and dairy processing contribute to the largest manufacturing sectors.

Figure 6 Energy intensity of New Zealand industries
Terajoules/$million Output 2001



Source: NZIER

From 1990 to 2004, real GDP grew at an annual average rate of 2.9%. Real economic growth is greater than the 1.4% annual average growth in New Zealand's greenhouse gas emissions recorded over the same period. However, this does not mean there has been a 1.5% (2.9% less 1.4%) reduction in the emission intensity of economic activity over that period. There has been an increase in forestry over the period which has increased the level of carbon sequestration and constrained the growth in emissions. In absolute terms, emissions have increased with growth in population and economic activity.

2.3 Implications for emissions trading

New Zealand's emissions profile and economic structure present some distinct challenges for meeting an emission reduction target at minimal cost to the economy. By international standards, New Zealand is not particularly profligate in its energy use, but it does have some significant energy-intensive industrial sectors, established when energy prices were relatively low. These could be appreciably impacted by a cost imposed on energy emissions. The large share of agricultural emissions also presents challenges in how to engage with numerous farm producers to create and incentive to reduce emissions without simply cutting production. Under current carbon accounting conventions developed under the Kyoto Protocol, agricultural emission estimates are largely driven by the number and type of livestock.

2.3.1 Agriculture and land use

There is no international experience of including agricultural emissions in a trading regime, and past approaches to emissions policy in New Zealand have offered exemptions to agriculture. As recognised in the Government's 2005 Review of Climate Policy, exempting such a large sector from the price incentive is likely to limit the overall effectiveness or efficiency in reducing emissions in New Zealand.

As agriculture does not figure as largely in other countries' emissions profiles as it does in New Zealand's, New Zealand cannot rely heavily on importing new technology in this area, and technological gains specific to agriculture are likely to have to be developed in New Zealand, with limited scope for exporting the technology (i.e. limited returns).

Carbon sequestration through forestry represents one possible area of comparative advantage for New Zealand, given the availability and cheapness of land relative to other developed countries. However, this too is currently limited by issues surrounding the verification of forest sinks and the reluctance of existing carbon markets to accept sink credits for trade.

The conventions of carbon accounting developed under Kyoto also add to the constraints on using sink credits. When trees are harvested or die, the rate at which the carbon sequestered in them returns to the atmosphere depends on the uses to which the timber is put. However, it is difficult to predict how much timber is used in different ways or to establish a full life-cycle analysis of different timber uses, and there would be high transaction costs in observing timber emissions as they occur or in establishing verifiable average emission rates.

The Kyoto Protocol has adopted the accounting convention that liability for emissions from harvesting timber occurs almost immediately after harvesting[12] and in the country of harvest. This means that Kyoto inventories overstate the emissions from forest harvesting to the extent that the stores of carbon are assumed to be emitted quickly, rather than spread over the lifetime of forest products. This also implies that there is little to be done to encourage low emissions use of forests – since differences are not measured. Moreover, it means that Kyoto inventories ascribe the emission from forest harvesting to New Zealand even if the log is exported (rather than to the importing country). The same accounting approach is not taken to coal, for example. The emission from coal used to generate electricity for example, is counted where it is combusted.

[12] Under the Kyoto Protocol this liability is avoided by forests that are immediately replanted for continuous rotation, as the carbon emitted is assumed to be absorbed back into new growth. The New Zealand forest owner still bears the opportunity cost of the liability as it distorts the choices for land use management.

2.3.2 Issues of scale

The size and geographic characteristics of New Zealand present a number of difficulties in emission restraint that are more acute than in other, larger countries.

a) Energy issues

New Zealand has a distinctive electricity supply system, with much of its generation capacity (mostly hydro) in the less populated South Island, and large centres of demand load in the North Island. It is also an isolated island nation and has to generate all its own electricity, without connections to neighbouring countries to provide a buffer when high demands coincide with constrained supplies.

It has managed electricity requirements with a mixed system dominated by hydro and thermal generation linked by an extended transmission network. Thermal capacity includes gas, coal and oil-fired generation, and is complementary to hydro generation for security of supply purposes, being used when hydro capacity is constrained by shortages of 'fuel'.

With around two-thirds of electricity generation from renewable sources (hydro, wind and geothermal), New Zealand has a different electricity make-up to most other countries. In countries where renewables make up a small share of total electricity generation capacity, it is relatively easy to reduce emissions by increasing the share of renewables that can provide base-load power and displace thermal generation.[13]

As the renewables share increases, however, the electricity system becomes more susceptible to the vagaries of renewable sources, such as low rainfall years or days when the wind stops blowing. Managing this variability has costs for the electricity system, increasing the need to have capacity in reserve and improved transmission links, or face the risk of power failures.

Being an isolated country with an already high proportion of renewables, New Zealand faces potentially higher costs in managing further expansion of renewables than other countries, by virtue of needing to be more self-sufficient in its electricity supply. Norway, for example, is a similar sized country with an even higher proportion than New Zealand of hydro in its domestic generation capacity – but it is linked to other hydro, thermal and nuclear generation in neighbouring countries, and obtains benefits from trade in electricity that are precluded by New Zealand's geography.

Scale considerations also affect the economic feasibility of nuclear power in New Zealand, where at present the largest generation units (or turbines) have a rated capacity of around 350 MW. Even the largest power station at Huntly comprises 3 separate units to give it a total capacity of only 1000 MW. This diversity of

[13] Geothermal generation, while generally classified as renewable since it does not consume fossil fuel, does emit some CO_2.

medium scale generation means reserve capacity can usually be found quickly to make up any deficiency and ensure continuity of supply should any one unit fail.

Nuclear plant that are economic to run have in the past been much bigger, and at present the optimal size is still around 2-3 times that of New Zealand's current largest generation unit. While nuclear turbines can be base-loaded to displace thermal plant, to use them would require larger capacity in reserve to cover the eventuality of an outage.[14] Large countries with extensive domestic networks and links to other countries can accommodate nuclear generation more securely than small countries such as New Zealand. Small countries require a greater proportion of redundancy in the system to cover the greater potential shut down, and this imposes greater cost per unit of electricity consumed.

b) Transport issues

Transport has been one of the growing sectors in New Zealand's emissions profile, and has contributed to CO_2 emissions expanding faster than methane emissions. It is also recognised as a key source of emissions growth overseas, where various proposed solutions have included improving transport systems management and greater public transport. These will reduce the number of vehicle-kilometres travelled on the roads and will reduce greenhouse gas emissions and provide other benefits as well (e.g. reduced congestion and local air pollution).

Unlike more populous countries, New Zealand does not have a legacy of mixed transport networks it can draw on to adopt such solutions. Its road network is less developed than in many other countries, with no motorways outside of urban areas; its rail network is skeletal, and it has no mass transit subways or similar systems. Urban development has evolved around the assumption of personal mobility chiefly by road and private vehicles, with low density residential developments that add to the costs of providing public transport.

While changes in fuel price caused by emission restraints will shift the balance between private transport and public transport to some degree, significant mode switching is likely to be more costly than in many other countries, either involving substantial investment in new infrastructure or sizable subsidies to encourage more people out of their cars.

2.3.3 Trading out of difficulty

The characteristics of New Zealand's emissions profile and economic structure suggest that it is not safe to assume that emission reductions are likely to be realisable in this country at low cost compared with other countries, at least in the short term. Under such circumstances the ability to buy emission reductions from elsewhere may be very important if the least cost way of meeting New Zealand's

[14] Nuclear generation is evolving: particularly relevant is the development of smaller pebble-bed reactors. This suggests that nuclear power may become an option in the future depending on political trade-offs.

emission reduction targets are to be found. This means that New Zealand has more interest than most countries in the establishment of an effective international emissions trading system and a domestic trading regime to link in with it.

3. What is the objective?

The purpose of setting an objective is to clearly articulate what it is that is sought. All government policy should have a clearly stated goal. This enables both the explicit evaluation of policies *ex ante* to determine which is most likely to achieve the desired outcome, as well as *ex post* monitoring of the effectiveness of the chosen policies. So an objective must be able to be monitored and measured.

This paper focuses on emissions trading schemes. Emissions trading needs to be seen in the context of climate change objectives. Any emissions trading scheme (ETS) would be one component of climate change policy and therefore the objective of the ETS must be set within the wider context of the objective for climate change policy. In order to determine an appropriate design for a trading regime or market it is vital to decide, and clearly articulate what it is that we are seeking to achieve both from climate change policy in general, and emissions trading in particular.

The Government has given some background to its intentions in the recently released package of papers relating to the draft New Zealand Energy Strategy.[15] The papers do not clearly identify a consistent goal for climate change policy, so a possible objective is developed here.

3.1 Government's draft Energy Strategy objectives

Appendix A discusses the suite of papers recently released by the Government, outlining the possible objectives and concerns raised. These are relatively diverse. These papers outline a raft of concerns which for simplicity we have divided into energy market, climate and economy-related issues:

- Energy market
  - Electricity system security
  - Sustainable, low emission energy
  - Competitive energy prices
  - Maximising energy efficiency
  - Maximising renewable energy as a proportion of generation
- Climate
  - Reducing greenhouse gas emissions
  - Pricing greenhouse gas emissions
  - Cost effective policy/least cost emission mitigation

[15] For a discussion of the objectives outlined in these papers see Appendix A.

  - Long term international climate change policy
  - Very high cost of emissions/climate change
  - Recognition of international changes in emissions
  - International benchmarking/competitiveness in emission levels
  - Wide use of forests in land and climate management
- Economy-related
  - Developing and promoting environmentally sustainable technology
  - Economic development
  - Long term reduction in emissions and enhancement of sinks across 'key sectors' of the economy
  - Consistency with national interest
  - Ensuring the 'health and comfort' of New Zealanders
  - Capturing business opportunities arising from climate change
  - International economic competitiveness (of forestry sector at least)

The challenge is to capture these concerns in a clear, concise manner within an objective that allows the selection and monitoring of the best policies to mitigate the concerns outlined.

3.2 Defining a climate change objective

Two following nested objectives are recommended as capturing the Government's concerns in a way that should allow policies to be formulated and evaluated against the objective:

> *To commit to a climate change target or mitigation mechanism that yields a net benefit to New Zealanders.*
>
> *To minimise the total long-run cost of meeting New Zealand's climate change commitments in a global context, including the cost of fulfilling any obligations arising from failure to meet these commitments.*

The first objective encompasses two key issues. First, climate change mitigation policy *of some sort* is an international reality. Climate change mitigation policy should recognise that the atmosphere is a global resource with a finite capacity to absorb greenhouse gases without detriment. Beyond some (unknown) point, greenhouse gas emissions change the climate in unpredictable ways.

As a result of increasing acceptance of this scientific position, there are likely to be some repercussions of refusing any kind of explicit climate change target or mitigation mechanism. There has been talk within the European Union, for example, of tariffs on exports from countries with no Kyoto commitment. While it is acknowledged that some political effect is likely, it should be recognised that the form of any economic repercussions will be governed by other international agreements, such as the General Agreement on Tariffs and Trade (GATT), which is likely to limit the form or extent of action against non-climate target countries.

The second issue addressed in the first objective is contained in the phrase "that yields a net benefit to New Zealanders". This recognises that any commitment should benefit New Zealand, rather than cause economic or social harm. The wording used here draws on the experience of the Commerce Commission. The Commission generally only considers benefits to the public of New Zealand when it is making its decisions regarding authorisations for acquisitions and mergers. It does not consider benefits to foreigners, except where they yield a benefit to locals as well. So, for example, profits earned by a foreign-owned company as a result of some climate change incentive should not be counted as a benefit, but the transfer of some energy efficiency or other technology from a foreign market by the same company would be a benefit to New Zealand if it lowered prices to New Zealand consumers.

The welfare of New Zealanders should be central to all government policy. Some may argue that since climate change is by its nature a global issue the focus of policy should be global. However, this also means that the solution is global.

There is no reason why one country should accept more of the cost of the solution than the value of the benefit that they capture. Likewise, each country should be willing to bear the costs up to the value of their national benefits. If all countries were to accept this role the least cost solution would be found.

Unless there is a net overall benefit to the world taking into account all factors, then one has to question why any attempt to deal with the matter should be made. If there is a net benefit to the world, then it must be possible to share the costs and benefits to individual countries so that each country receives a net benefit.

A second important point to note about the expression "net benefit to New Zealanders" is that it does not take notice of which New Zealanders benefit. So benefit to a small group (say producers) should not be considered differently to the same level of benefit to a large group (say consumers). There are two reasons for this. First, any decision about distributional issues would be purely subjective. Second, with few exceptions, benefits that accrue to a small group are eventually diffused to a larger group and it is often difficult to determine the actual incidence of the costs and benefits.

For example, a benefit to one company will lead to greater expenditure by that company and amongst its shareholders and employees. This may generate

efficiencies in the companies supplying goods and services to the first company, and then amongst their suppliers, and so on. The ultimate beneficiaries of an efficiency gain may be diffuse and difficult to identify.[16]

The second objective outlined above captures the relatively simple point that the least cost method of achieving the climate change target should be adopted. Although this seems an obvious point it is not necessarily an easy objective to achieve. All costs must be taken into account in determining the least cost method. This includes the costs of implementation, costs of monitoring and other transaction costs in their broadest sense should be accounted for in choosing a policy. For example, a balance should be sought between the benefit of including all emitters in a scheme (such as an ETS) and the costs associated with monitoring an individual firm or household who may have only a small effect on overall emissions.

Mitigation of climate effects has the same benefit regardless of where in the world it occurs. So if the cost of emissions reduction is lower in another country, then that should be preferred to imposing higher costs here. This reflects our earlier point that the distribution of costs and benefits is not relevant. The same logic applies locally. Whether the cost of climate change mitigation is borne by taxpayers or by firms and consumers directly, the costs, like the benefits, will almost certainly be diffused through the economy.

To the extent that New Zealand's policy reflects international agreement over a mitigation mechanism that is also aimed at finding the lowest cost solutions on a global basis this logic extends to exporters and those competing with imports. However, if the policy is adopted unilaterally then the initial party on which costs fall becomes more important for those exposed to overseas competitors. For example, exporters may find that they cannot increase prices to reflect 'new' climate costs. Similarly, New Zealand-based firms that have international competitors for their products in the New Zealand market may find they cannot increase prices. These costs are, therefore, ultimately not diffused to all consumers of the product (the beneficiaries of the emission or use of the atmosphere). Rather, they are wholly captured within the New Zealand economy affecting the profitability of exporters or those competing with imported products.

This mismatch between the beneficiaries and those who pay will affect the achievement of objective one: the net benefit to New Zealanders. Depending on the size of this cost this may mean exporters should be treated differently to firms operating exclusively in the domestic market if the climate change policy is exclusive to New Zealand, or not reflected adequately in the policies of the relevant competitor nations.

[16] See the Commerce Commission's *Guidelines to the Analysis of Public Benefits and Detriments in the Context of the Commerce Act* (1994, revised 1997).

If the international penalty for failure to meet the climate change target is correctly set and lower than the cost of meeting the target, then the penalty should be paid in preference to meeting the target. If the penalty is set at the correct level internationally then this approach is efficient since the penalty signals the global value of mitigating climate change.[17]

3.3 Climate change objective and Government concerns

The objectives outlined in Section 3.2 are compared in Table 3 with the concerns of the Government as expressed in its recently released draft Energy Strategy documents. In the table, we have placed a tick where a Government concern is captured by an objective. We have also identified which aspect of the objective covers this concern.

Fundamentally, specific policy goals such as 'pricing greenhouse gas emissions' and 'wide use of forests in land and climate management' are encapsulated in the objective of least cost mitigation. This objective says every policy should be considered and implemented up to the point where it becomes more expensive than the next best policy. The more general goals such as 'reducing greenhouse gas emissions' and 'long-term, international climate change policy' are agglomerated into the first objective to set a target which benefits New Zealanders.

From the table it can be seen that all the Government's concerns we identified are encapsulated in the climate change objectives we have suggested. The objectives underlie our discussion of the design features for a New Zealand emissions trading scheme.

[17] For an efficient outcome, the penalty should reflect the marginal benefit to the climate from mitigation efforts. Any expenditure on mitigation that is higher than the benefit to the climate would be inefficient and should not be made.

Table 3 Objectives and Government concerns

	Objective 1: Climate change target, net benefit to New Zealanders		Objective 2: Minimise total long-run cost including penalties, in global context	
Energy Market				
Electricity system security	✓	net benefit		
Sustainable, low emission energy			✓	min cost
Competitive energy prices	✓	net benefit		
Maximising energy efficiency			✓	min cost
Maximising renewable energy as a proportion of generation			✓	min cost
Climate				
Reducing greenhouse gas emissions	✓	CC target		
Pricing greenhouse gas emissions			✓	min cost
Cost effective policy/least cost emission mitigation			✓	min cost
Long term international climate change policy	✓	CC target		
Very high cost of emissions/climate change	✓	CC target		
Recognition of international changes in emissions			✓	global context
International benchmarking/competitiveness in emission levels	✓	CC target		
Wide use of forests in land and climate management			✓	min cost
Economy-Related				
Developing and promoting environmentally sustainable technology			✓	min cost
Economic development	✓	net benefit		
Long term reduction in emissions and enhancement of sinks across 'key sectors' of the economy	✓	CC target	✓	min cost
Consistency with national interest	✓	net benefit	✓	min cost
Ensuring the 'health and comfort' of New Zealanders			✓	min cost
Capturing business opportunities arising from climate change			✓	min cost
Wide use of forests in land and climate management			✓	min cost
International economic competitiveness (of forestry sector at least)	✓	net benefit		

Source: NZIER

4. Options to meet the climate change objectives

4.1 Common approaches

Emissions trading has emerged in contention as an instrument for climate change policy because of the successful implementation of trading schemes in managing stresses on other natural resource stocks (such as fisheries and local air quality emissions). It is also because, despite formidable hurdles in setting up an emissions trading system, the workable alternatives are not necessarily any easier.

Common approaches to controlling discharges into a stock resource are:

- 'Technology-Push' policies such as subsidies to research and development and favourable patent rules;
- 'Moral suasion' through education and information campaigns to change behaviour to less damaging discharge levels;
- Prescription of technical solutions through regulations (e.g. particular technologies, or controls on emission rates);
- Applying market incentives and price instruments.

4.1.1 Technology-push

Technology-push policies have been favoured in some countries and present a positive way for government to work with industries in developing technologies that have both commercial and environmental benefits. The Australian Government initiative to fund research with the Chinese to develop clean-burning coal technologies is an example of this approach. New Zealand's promotion of research into methane emissions by animals is similar.

The justification for subsidy is that there is some market failure in innovation that prevents innovators from achieving a sufficient return on their research and development activity. But such policies face a high risk that research will not deliver commercially or scientifically successful innovation, and may impose substantial cost on the taxpayer and the wider community.

Even if effective new technologies are developed, their adoption and effectiveness in reducing a country's emissions may be low in the absence of any disincentive on further emissions. If meeting a domestic emission target is the aim, technology-push is more of a complement than an alternative to regulatory or price measures.

4.1.2 Moral suasion

Moral suasion sometimes works to change behavioural norms over the long-term, but in many cases (such as energy conservation campaigns) its effectiveness in changing behaviour appears short-term. This is because opportunities for 'free

riding' mean there is little long-term incentive for individual restraint, when others can get the benefit of that restraint.

The main role of moral suasion may be to make what would otherwise be unacceptable policies tolerable to the voting public.

4.1.3 Regulatory prescription

Prescriptive regulation can work effectively where activities are relatively homogeneous and their costs are well known, but they are less likely to provide optimal outcomes where the regulated activities are diverse in composition and face different costs in adopting the prescription. In addition, such prescription may stifle innovation, as the regulated have little incentive to achieve beyond the prescribed standard.

Regulated solutions have a tendency to be 'captured' by regulated parties who can subvert its intention for their own benefit. They also encourage wasteful lobbying for favourable changes to regulations and can have unintended consequences in that the regulated outcome has an effect which is actually contrary to the initial objective.

4.1.4 Market instruments

Market instruments have advantages in reducing emissions across diverse activities because they provide flexibility: those subject to such instruments can pay the cost of the instrument, or change their activities to avoid it, whichever is least costly to them. Such instruments also provide a continuous incentive for innovation or improvement over time, as every additional abatement of emissions saves a cost for the emitter. This contributes to dynamic efficiency in the economy.

There are two broad approaches to market instruments:

- Market adjustment instruments, such as taxes, charges and subsidies that change the price of an activity (such as taxing discharges to air or emissions, subsidising renewable energy or the transmission needed to connect them);
- Market creation instruments, such as tradable permit markets that create a property right in the stressed resource that can be traded in a market to encourage the rights to be transferred to their highest valued uses.

4.2 Emission taxes and emission entitlements

While countries may consider a carbon tax as a means of encouraging emission restraint, in an international setting this is a difficult instrument to apply because there is no international body with authority to set such a tax or ensure its consistent application across countries. If each country sets a different level of tax or applies the tax differently by, for example, exempting different sectors, then companies face a different incentive to abate depending on where they locate.

This could lead to inefficiencies with companies relocating to obtain more favourable tax treatment.

A traded permit market operates differently, in that the authority sets a limit on the allowable emissions, and the value of permits is set by trade in the market between those with permits to spare and those needing permits to stay within the prescribed limit. While such tradable permit schemes may also have imperfections in implementation, a broad international trading regime would peg the price of emissions at a consistent level, and make it more likely for abatement to occur at the least costly locations across countries.

It has been argued that an internationally 'harmonised' carbon tax, in which each country collects a common tax and uses revenues for its own purposes, including reducing other taxes and paying for any international emission reduction obligations the country fails to satisfy, would be less costly in practice than international emissions trading.[18] This is because:

- The emissions quantity constraint in emissions trading can lead to extreme price volatility in response to random factors (such as hot summers, cold winters), as borne out by recent experience in the EU ETS and the USA's sulphur market, whereas the price signal with a tax is relatively constant and easier for businesses to plan for;
- The incentives for cheating are greater in emissions trading, where both sides of a transaction may have an interest to misrepresent, whereas with a tax at least one party to the transaction, the government, has a strong incentive to eliminate such cheating;
- The generation of financial derivatives around emissions trading entitlements attracts speculation that accentuates volatility, there is no volatility with a tax;
- By creating assets of substantial value, emissions trading creates opportunity for perverse allocation of wealth by corrupt governments.

The general case in environmental regulation for preferring quantity restrictions is that they make emission reductions more certain. This is not a compelling argument for a global stock resource like greenhouse gases, where the year-to-year variations in reductions have little effect on the overall stock and long term climate impact, so a tax with rates that were adjusted periodically to achieve the target reductions could be as effective as emissions trading, without such periodic price volatility.

However, banking and borrowing between emission trading accounting periods would reduce such volatility in the market, financial derivatives could help firms manage long term risks around price variability, and it is not clear that a harmonised tax would be significantly less susceptible to cheating or government corruption than an emissions trading scheme would be.

[18] Shapiro, R.J. (2007) *Addressing the Risks of Climate Change: the Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes* www.theamericanconsumer.org/Shapiro.pdf

The experience with the Kyoto Protocol and other less comprehensive international environmental agreements suggests countries are slightly more willing to commit to restriction targets than they are to ceding sovereignty over part of their tax structure to an international body. There is no apparent movement towards establishing an international body to set such a harmonised tax, so for now such a tax appears less likely to emerge than emissions trading.

Emission trading schemes in more limited contexts than greenhouse gases have been demonstrated to reduce the cost of reaching overall reduction targets at a lower cost than regulatory alternatives. A critical question for greenhouse gas emissions trading is whether they can be extended to the multiple sources and types of greenhouse gases, and across international boundaries, without incurring undue transaction costs that would outweigh the benefits they provide.

5. International experience of ETS

5.1 Early history

Emissions trading is not a new idea, having been applied in practice since the early 1970s in the USA. It evolved as an extension of regulatory controls over the quantity of emissions allowed to be discharged, and has developed in parallel with other applications of tradable permit schemes in environmental and natural resource policy (e.g. water permits, fish quota).

The first applications were to localised discharges of pollutants, and enabled firms to receive credits for reducing emissions beyond their required standard. They could sell the credits to other firms in the same air-shed that had not reached their required standard. These had limited trading activity, as the pool of market participants was small.

Over time applications became more ambitious in scope, and more often based on a system in which a cap was set on emissions of a given category in a wider region and allocated amongst emitters, allowing trading of larger quantities and even incentivising closure of least efficient plant. The sulphur dioxide emissions trading under the 1990 Clean Air Act in the USA demonstrated large savings over previous regulatory approaches in reducing the emissions that cause acid rain, confirming the feasibility of emissions trading as an effective tool for environmental policy.

More recently emissions trading has been applied to the multiple greenhouse gases through the Chicago Climate Exchange, in which firms in the USA, Canada and Mexico commit voluntarily to legally binding emission reductions below their historic baselines to earn tradable credits.

The most wide-ranging multi-country trading scheme to date has been the EU's Emissions Trading Scheme, in which all EU member countries participate. It is just coming to the end of its exploratory Phase I pilot stage and moving to a Phase II to assist countries to meet their Kyoto targets.

To date, schemes have generally covered only a single type of gas or been restricted to a limited group of participants, such as electricity generators. Many of the early schemes were voluntary and most have been operating or operated for a comparatively short period making evaluation problematic

5.2 Current ETS

A number of countries currently operate ETS and we have reviewed a selection of these in detail (see Appendix B). These schemes are not of uniform design or application and the selection is intended to highlight these different options and the economy-specific factors that may make them more or less applicable to New Zealand.

Experience to date has generally seen political considerations and ensuring transaction costs are low dominate the design of trading schemes. The table below outlines this experience and draws out possible lessons for New Zealand. The following issues are addressed:

- Which sectors are covered?
- Which greenhouse gases are covered?
- At what point in the supply chain from raw fuel to final emission is the obligation placed?
- How is the cap on emissions of entities covered by the scheme set?
- How are permits to emit allocated (including allocation to new entrants and ex post adjustment)?
- How is early action to limit emissions rewarded (if at all)?
- How are sectors and firms whose competitiveness is at risk from non-obligated foreign competitors dealt with?
- Are the schemes linked to others internationally?
- Are offsets (negative emissions such as from carbon sequestration by forests) allowed to be traded and if so how?
- How long is the period for which permits are allocated? How long is a trading period?
- Are permits able to be banked or borrowed for future or early use?
- What is the penalty for non-compliance?
- How is the scheme owned and governed?

Following the table, we briefly summarise the performance of these schemes, again more detailed analysis is provided in the appendix.

Table 4 Emissions trading schemes internationally – design and lessons for New Zealand

Parameter	International experience	Lessons for New Zealand
Coverage	Most schemes have either voluntary coverage or cover only limited sectors (usually electricity generation and in some cases emission-intensive industry such as oil, iron and steel, pulp and paper). Most schemes have lower size limits. Most schemes are national although some in US and Australia are restricted to individual (contiguous) states.	There is limited experience of broad trading except in a voluntary capacity. This may aid capacity building for later mandatory schemes, but raises issues around self-selection (only 'winners' are likely to adopt the scheme). Since New Zealand is likely to have liquidity issues a broad and mandatory scheme is theoretically likely to bring substantial efficiency gains. Issues relating to inter-sector and inter-gas trading that have not been identified in overseas experience may arise. Transaction costs will be important for setting any lower limit on firm size (or emission level). There is no experience of agricultural emissions permitting or trading, this is problematic for New Zealand given agricultural emissions are dominant in the overall emissions profile.
Gases	Most schemes relate to limited gas types. Outside the US most schemes are carbon dioxide specific, the significant EU scheme is in this category. The US schemes are more diverse with some including only nitrous oxide and some sulphur dioxide as well. Australia has been more ambitious in including all six greenhouse gases (although the industry coverage of the schemes means in practice that it is unlikely that all gases will be traded).	See above: liquidity issues means New Zealand should aim for a broad coverage of gases to allow the pursuit of desired emission target across the economy. There may be as yet unidentified issues with terms of gas exchange (i.e. conditions where one gas is accepted as equivalent to another). Broad coverage of gases also prevents gaming (if participants are able to abate one greenhouse gas in favour of another).
Point of obligation	All schemes place the obligation on the operator of the facility that generates the emission – i.e. there is no experience reviewed of placing the burden on the fuel supplier.	The point of obligation in international markets reflects the limiting of schemes by industry – it would be more complicated to target the fuel supplier as the final consumer of the fuel would have to be identified. This highlights the importance of checking the relative transaction costs associated with the options. Placing the obligation upstream has the advantage of allowing wider coverage of emitters – smaller emitters, for example, would be captured by such a scheme.

Emissions cap (target)	Varied methods for determining this: voluntary schemes take what is offered; some used a percentage of projected emissions (e.g. EU, Norway, Canada), some use a long term goal with interim targets intended to achieve a smooth transition. Those that used benchmarking or baselines or any form of projections invariably ran into data problems.	Given that year to year variation in the flow of greenhouse gas has a relatively minor impact on the longer term stock, longer term targets seem more relevant to the ultimate objective with some year-to-year variation allowed. Targets seem relatively arbitrary on the whole. Percentage reductions and absolute targets are equivalent. Consideration of how increases in production (i.e. economic growth) will be allowed for is required, for example, by a target per unit of output rather than an absolute target. It must be ensured that increases in emissions by any sector excluded from the scheme-are also excluded from the target. Data problems encountered highlight the importance of allowing for later adjustment.
Permit allocation	Most allocated free of charge based on historical use. Some attempted to use benchmarking (EU Phase I) but generally abandoned for reasons of complexity or data constraints under a tight set-up time constraint. Auctioning has been used in a limited number of cases (in particular in the UK but this was for 'incentives' which turned out to be higher than the cost of abatement, and limited use in the EU generally for new participants only).	The allocation methods adopted internationally appear to be a political tool for industry buy-in to what essentially represents a new cost. There is some evidence that allocations have been over-generous with firms profiting from the sale of permits. Although the distribution of benefits (income) from the permits is clearly affected by the initial allocation the marginal effect (whether to abate and sell a permit) is constant regardless (except in special cases where a permit seller or buyer has market power). This suggests that permit allocation policy can be used to achieve other policy goals (such as buy-in from industry (through free allocation), or profitability maintenance for trade-exposed firms, or reduction in other taxes (through auction of the permits by the government and subsequent use of the revenue).
Credit for early action	Widespread use of allocations based on historical use means that there has been limited or no incentives for early action in the allocation process. Unless the historic use relates to some years ago, those that have recently reduced emissions receive a lower allocation because of their early action.	It is important not to disincentivise parties who take early action. If parties believe they will be in a worse position because they have acted then they will delay action and this makes the adjustment more difficult.

Competitiveness	Mostly dealt with via allocation of permits freely to affected industries (see above). Some schemes retain allowances for free allocation to new entrants (some require payment). Benchmarking to best practice emissions used for new entrants on the basis they have free choice of technology (EU and Australia). Denmark adopted a low penalty for electricity generators given competition with neighbouring countries (it is not clear how real this is, given that the neighbouring countries also participate in the EU scheme).	See above on permit allocations – this seems to be the most common way of ensuring competitiveness. For new entrant firms benchmarking appears to be a best-practice approach where the new entrant is trade-exposed (non-trade-exposed sectors are required to purchase permits, often from the government). Australia advocates no allocation to new entrant electricity generators. This seems a reasonable approach for New Zealand given generators are not exposed to competition with non-obligated overseas generators (and the idea is to increase their costs relative to non-obligated non-emitting local sources).
International linkage	The only countries to adopt international trading fall within the large EU scheme. Canada appears to be trying to link with overseas schemes but other commentators suggest that this may be difficult given their low penalty rate.	Very little experience of international trading to date. This could be problematic for New Zealand as liquidity concerns mean international trading could be important. Design should therefore consider whether there are aspects of a scheme which would limit international transfer (such as limits on price, exchange between gas types, or exclusion of particular industry).
Offsets	Some schemes allow offsets from project-based emission reductions (outside the industries covered by the scheme or where they can meet 'additionality', permanence and measurement' criteria). Fewer schemes allow sinks (forestry and other forms of carbon sequestration). In the case of forestry this reluctance to allow their inclusion may reflect in part difficulties with Kyoto Protocol accounting for forestry (whereby trees are deemed to emit their whole carbon store as soon as they are harvested).	Offsets generally seem relatively complicated to implement as it is important to ensure that they are additional to business as usual, permanent and able to be accurately measured. For example, it is important that other regulated activities are not double counted as offsets (highlighted in Australia's multi-layered schemes and in Canada where some emitting activity is regulated other than through their ETS).

Trading period duration	Most schemes have annual reporting, some allow trading only between the reporting date and the settlement of obligations. It is assumed that even where year round trading is allowed, the period between reporting and settlement is likely to be the most heavily traded. A few schemes have longer trading periods (3-5 years). Allocations are generally made for a period of around 5 years, some have rolling allocations (so allocation for future periods does not wait until the end of the first period).	Annual reporting is the most common and the regular flow of information about whether the market is short- or long- relative to emission the supply of entitlements is desirable. Annual targets are not a good idea, however, given the characteristic of climate as a long-term stock. This concern can be mitigated through banking/borrowing allowances. Although trading is most likely to occur between reporting of emission levels and the reconciliation of permits there seems no reason to restrict trading to this period. Trading will occur in an open market when it is deemed most profitable by the participants (and investors may wish to secure an allowance before committing to an investment in which case restricting the trading period would restrict investment). Rolling allocation would enhance investor certainty (and therefore economic growth).
Banking and borrowing	Banking is common to almost all schemes. Borrowing is not – a handful of US schemes and the EU scheme explicitly allow borrowing although EU member states have restricted operations; the Australian MRET scheme has a de facto borrowing scheme through a three year penalty holiday. It is not completely clear why borrowing is so unusual, although it is likely to relate to fear of default.	Banking and borrowing are theoretically useful tools for a resource like the atmosphere since annual variability in flows will have little impact on the long term stock, more important is to reduce the long term level of emissions. Banking is common and has no reported adverse effects. If New Zealand links to an overseas scheme that allows banking a de facto banking system will be in place anyway (as New Zealand companies can register their surplus with an offshore parent or sell to an overseas buyer who can hold the permits for later use). Although there is no clear explanation for disallowing borrowing, the transaction costs would have to be identified to ensure they were covered by the benefit – for example, limits may be required or excessive recovery costs would outweigh the benefit of flexibility. There may be additional concerns where international borrowing is contemplated (this may be unavoidable if schemes are linked). Consideration could be given to a scheme like the Australian MRET where a 10% allowance for shortfall was made before penalties allowing limited de facto borrowing (the shortfall had to be made up in 3 years).

Penalty	Most countries have a financial penalty for non-compliance with the value set by the government a priori. This has disadvantages where the trading price is unknown (since the penalty limits the price of permits), although it is argued that this is beneficial for investment since businesses have certainty over their maximum exposure. The UK and EU schemes require a penalty and make-up of the shortfall. In the UK a list of non-compliant firms was published.	A number of countries inadvertently set a penalty that was so low their scheme failed to work as participants were better off paying the penalty than attempting to comply. The EU/UK idea of requiring the shortfall in emissions to be made up plus a penalty (in the case of the EU a financial penalty, in the UK an additional reduction) ensures that this trap is avoided. A third alternative would be to set the penalty ex post based on the market price plus a margin (say 30%). A list of non-compliant firms should be released with caution since such information can be misunderstood by the public and have an excessive impact on firm profitability.
Market ownership and governance	Most schemes are operated by the government. Private sector operators have emerged in some countries to facilitate trading (e.g. the EU). Most verification and registry functions are run by central or state government.	Although most countries have state-owned and run systems, it is not clear why this is the case since, once the cap is set, the only requirements are that measurement be verified and penalties be enforceable and it is not clear why this cannot be done under private contract. New Zealand has considerable experience with privately run registry and exchange systems (and internationally stock markets are exactly this model). However, it should be considered whether other countries will agree to trade with a country that has a non-state owned system (or would they perceive a higher risk of default and therefore restrict transfer).

Source: Various, see appendix for details on each country

5.3 Performance of overseas schemes

The previous section considered the design of the overseas schemes and the lessons that could be learned from this for New Zealand. This section focuses on the effectiveness of the schemes, their impact on firm profitability and the level of transaction and administrative costs associated with scheme design.

5.3.1 Effectiveness

The key EU scheme has been operating for only a couple of years and hence it is too early to definitively judge its success either overall or specifically. Comments made here are therefore interim judgements based on research and surveys to date.

Likewise the Australian MRET scheme was reviewed after only two years of operation. Although it was deemed a success, this was based on subjective statements by industry stakeholders, who arguably had an incentive to argue for the continuation of the scheme. Furthermore, the MRET scheme is not strictly an emissions trading scheme and in this sense offers little assistance to New Zealand scheme designers. The Australian National ETS has not yet been implemented and offers no particular lessons to New Zealand.

The US schemes in contrast have been operational for longer, and have been judged successful in reducing the cost of meeting and surpassing emissions reduction goals. Important design tips from the US schemes are that the traded unit must be clearly defined and tradable without requiring certification of every trade (in other words, emissions permits are preferable to reduction credits); banking has played an important role in achieving both environmental and economic goals for ETS; initial allocation decisions have allowed for equity and political considerations without impairing trading.

Over allocation of permits in some countries has meant that schemes have not been very effective in reducing emissions (UK, Norway, EU).

There is no evidence that ETS have resulted in the adoption of less carbon intensive production technologies (as opposed to continuing to operate existing technologies); this is thought to be because of the longer-term uncertainty over policy direction (EU).

Pilot schemes, and some of the early schemes have, despite their flaws, provided valuable learning opportunities for participants (UK, US, Australia, EU). In the EU, around 50% of firms surveyed in 2005 stated that they incorporated carbon pricing into their operational decisions and longer-run decisions including those related to technological development.[19] Voluntary schemes tend to attract only

[19] This finding could be skewed by the over-representation of electricity generators in the sample (relative to other emitters) and should be treated with caution. Electricity generators are more likely to reflect carbon prices in their decisions as they are most likely to be targeted by policy-makers.

those who benefit from the rules of the scheme (US, Canada) this limits the success in environmental terms of the policy.

5.3.2 Profitability effects

It has not been found to be generally necessary to allocate 100% of permits to existing emitters free-of-charge to secure their profitability (US); in this sense high levels of gratis allocation often reflect political decisions around increasing the palatability of policy change rather than strictly mitigating the economic effects on firms.

An initial lack of information over the demand for permits has resulted in price volatility (UK, EU). This has been exacerbated by uncertainty over future climate change policy initiatives (EU). Price volatility can produce unanticipated effects on firm profitability since the effect of the emission permit incentive will vary depending on when firms purchase (or sell) their permits rather than any more fundamental driver.

The treatment of the electricity sector in the EU has highlighted that different allocation schemes can work within a single trading scheme, but that there is a political risk that governments have a propensity to put a disproportionate burden on a sector that is relatively sheltered from competition because it has a limited, obvious effect on the countries relative economic performance[20]

5.3.3 Transaction costs

Allocation rules have been a significant problem to date in the EU with: over-allocation initially, costly competition between member states over their allocations, a lack of good information about historical emission levels and an iterative process of allocation encouraging firms to hold-up their emission levels in order to gain higher permit levels in future periods (exacerbated by high forward prices).

Allocation rules need to be clear and transparent with little room for negotiation or lobbying costs can escalate (EU and US). Auctioning is a low transaction cost means of allocating permits where competition or profitability concerns do not require gratis allocation. Auctioning also tends to reduce price volatility once the scheme is operational, by sending an early price signal (US).

Coverage of installations emitting small levels of pollution has been found to be not worth the administrative cost due to data problems and transaction costs (EU, especially Spain and the Netherlands).

[20] This judgement ignores the flow-through impacts on all electricity consumers, including industrial users of higher electricity prices and is therefore overly simplistic in economic terms.

6. The New Zealand policy context

New Zealand also has some previous experience in investigating the design and use of emissions trading and related economic instruments for restraining growth in greenhouse gas emissions.

Climate change has been on the Ministry for the Environment's agenda since its formation in 1987. Early interest was in the likely scale and sectoral impact of climate change rather than choice of instruments to address it (NZIER, 1990).

At the Earth Summit in Rio de Janeiro in 1992, New Zealand signed up to the UN Convention on Climate Change and, along with other Annex 1 countries comprising OECD and ex-Eastern Block nations, committed to stabilise its greenhouse gas emissions at 1990 levels by 2000.

6.1 The Rio after-glow – early policy responses

A 1994 policy package aimed at achieving the Kyoto Protocol target envisaged 80% of the necessary emissions restraint coming from new forest planting and sequestration and 20% from emissions reductions. This was intended to be achieved through minor encouragements of tree planting (which was already high, for purely market reasons), the establishment of the Energy Efficiency Conservation Authority to implement a programme for improving energy efficiency, voluntary agreements with some major industrial emitters and deregulation of the energy sector. The package also envisaged the possibility of a low-level carbon charge from 2007 if, by this time, insufficient progress had been made towards the target.

By 1996 it was clear that little progress had been made and the Ministry for the Environment convened a Working Group on CO_2 Policy to investigate the use of the Resource Management Act for greenhouse gas emissions and whether a carbon charge was the most efficient economic instrument for achieving the Government's carbon dioxide objectives (Working Group on CO_2 Policy, 1996). Its report concluded that the optimal instrument would be a capped tradable carbon certification scheme, for both emissions restraint at a national level and at an international level. It recommended that government endorse such a scheme as its intended instrument and begin work on its design.

Nevertheless, a low-level carbon charge continued to have its advocates, and there was sufficient interest for the Treasury to prepare a paper on its design and likely effects (Treasury, 1997). This envisaged taxing the sources of carbon rather than the emissions themselves, given the close correlation between the two in most activities, and applying a uniformly-rated charge across all emitters to equalise incentives for restraint. It would thus cover the production and importation of fossil fuels and carbon dioxide sources not associated with fossil fuels (i.e. industrial processes and geothermal steam extraction).

Government continued to pursue voluntary agreements for emissions reductions with major stationary sources of fossil fuel emissions, with the implied threat of an emissions charge. This encouraged firms to focus on the sources of their emissions and improved site emissions data, which contributed to compilation of New Zealand's greenhouse gas emissions inventory.

6.2 The Kyoto Protocol

At the end of 1997, New Zealand signed the Kyoto Protocol and made an international commitment to reduce its emissions of greenhouse gases net of new carbon sinks to 1990 levels by the 2008 to 2012 first commitment period (i.e. the average annual net emissions over 2008 to 2012 would be the same as in 1990). The Kyoto Protocol introduced a framework of 'flexibility mechanisms', which were all intended to allow creation and trade in emissions entitlements amongst signatories, to reduce the overall cost of emissions restraints across countries.

Within New Zealand, domestic policy debate turned to what policies and instruments would allow New Zealand to best meet this commitment. At the time, it appeared that a combination of 'achievable' emissions restraint and generous estimates of eligible new forest sinks would enable New Zealand to be a net seller of credits in the first commitment period.

As the rules for international emissions trading under the Kyoto Protocol were slow to emerge, initial focus was on technical design issues for a domestic ETS (Ministry for the Environment, 1998). Officials' concern focused on the definition of the unit of trade, the point of obligation to monitor emissions and surrender certificates, the method of certificate allocation and the market forum for trading certificates.

One year on and the official focus had shifted away from emissions trading, with release of a government policy statement providing a mix of policy measures (Ministry for the Environment, 1999). This included three options for the central price signalling measure:

- Enhancing awareness of future domestic and international trading systems to facilitate forward trading;
- A pilot ETS and low-level carbon charge prior to a comprehensive domestic ETS; and
- A low-level carbon charge prior to a comprehensive domestic ETS.

At the end of 1999, the National government was replaced by a Labour administration which brought a new impetus to climate policy. In 2000, a set of inter-departmental working groups was established to progress climate policy on several fronts, co-ordinated by a joint steering group.

6.3 Warming to the Kyoto Protocol challenge

The newly renamed Ministry of Economic Development convened the emissions trading working group, which began work on design of a domestic ETS that would mesh with international trading. This built on previous work in 1996 and 1998 on aspects of design and included some tentative dialogue sessions with industries likely to be affected.

Concurrent with work on the design of an ETS, the government commissioned work on the likely impacts across sectors of the energy price rises that might result (ABARE, 2001a; ABARE, 2001b; PA Consulting Group, 2001). This work pointed to heavy impacts on some sectors, the distribution pattern of which did not change much with altered assumptions. Buoyed by the prospect of New Zealand being a net seller of emission units in 2012, the government ratified its commitments under the Kyoto Protocol at the end of 2002.

The government's 2001 climate change policy package proposed a carbon tax from 2007 as the central price instrument, with a number of interventions to deal with the issues raised. This went against the prevailing tide of official thinking on economic instruments for climate change from the preceding few years, as well as against the government-commissioned tax review, which concluded that environmental taxes had practical disadvantages, mainly due to their tendency to destabilise the government's tax revenue stream (MacLeod *et al*., 2001).

The 2001 policy package envisaged government engaging in international trading on behalf of New Zealand, by acquiring and surrendering emissions units against recorded national emissions. The carbon tax was to incentivise emissions restraint, which would lower recorded emissions during the first commitment period. To encourage greater restraint, government instituted a Projects to Reduce Emissions scheme, which entailed rewarding project developers for savings in emissions caused by their projects (mostly renewable energy such as wind farms, landfill gas collection and energy recovery schemes).

To do this, the government nationalised the sink credits from new tree planting, side-stepping decisions on the allocation of credits and reaching agreement with the forest industry on the liabilities for felling. It also retained all the Assigned Amount Units created by the Kyoto Protocol target. Effectively, the government took on the responsibility, as well as the risk, of meeting its Kyoto Protocol obligations by selling or buying emissions units from international markets. Other organisations that earned emission reduction credits, such as under the Projects to Reduce Emissions scheme, could also trade these internationally and some have already on-sold their credits to European firms and governments.

The proposed tax still raised several difficult questions of implementation and coverage. Agriculture was exempted from the tax in exchange for demonstrating commitment to research into emissions reduction. To ease impacts on industries competing with other countries not subject to Kyoto Protocol emissions restraints

(e.g. Australia and the USA), the government developed criteria for assessing Competitiveness At Risk firms and exempted such firms the tax in exchange for Negotiated Greenhouse Agreements (NGA) that demonstrated that the firms achieved world best practice in curtailing greenhouse gas emissions from their activities. The Negotiated Greenhouse Agreements incorporated some elements of emissions trading (e.g. the baseline-and-credit approach) and necessitated detailed reporting on site inventories. Such negotiation was a slow process due to information asymmetry between firms and government, exacerbated by turnover and disjointed mandate amongst officials handling negotiations.

The foundations for this policy package cracked in 2005 when, after revision of the means of calculating the inventory and a sustained period of growth in economic activity and associated emissions, New Zealand's net position in 2012 changed from a forecast net seller to a net buyer of emissions units. Further problems arose from New Zealand's sink credits having proved to be far less fungible in the eyes of international traders than original Assigned Amount Units.

A government-appointed review reported in November 2005 that, with the wide exclusions in coverage granted to agriculture and industries with Negotiated Greenhouse Agreements, the proposed carbon tax was too narrow to achieve significant emissions restraint, yet could have widespread adverse effects on many firms (Ministry for the Environment, 2005). Accordingly, in December 2005, the government announced the abandonment of the carbon tax, but retained the possibility of a limited carbon charge applied to large direct emitters (industry and power generation), as well as the prospect of future transition to emissions trading.

This policy change has had other indirect effects on the future direction for emissions trading. It has reduced the incentive for site emissions inventory reporting built up under the Negotiated Greenhouse Agreements and Voluntary Agreements processes. This could potentially create an information gap for the implementation of future trading regimes (e.g. in establishing baselines or historical entitlements to allocation). Although existing Projects to Reduce Emissions agreements will be honoured with the award of Assigned Amount Units for demonstrable emissions reductions, no further projects will be accepted and decisions have yet to be made on whether a similar incentive scheme will be implemented in future.

The Government's draft Energy Strategy and associated documents released in December 2006 revisit much of the ground traversed over the past 15 years. They state that the Government has a 'positive view' on use of economic instruments and retains the possibility of a carbon charge on stationary point sources of emissions (e.g. thermal power stations) as a means for transition to an ETS.

7. General market design

It is important to consider the requirements for a successfully operating market. If we cannot identify the key features of a market *"policy recommendations could neither be evaluated in relation to the purported objectives of market creation nor tested with respect to the empirical implementation of a market."* (Rosenbaum, 2000).

Since we are considering a market for emissions, part of a group of effects known to economists as spill-over costs or externalities, we have illustrated some of the relevant questions using this example. This should not be interpreted as meaning the feature is specific to a market for this type of good.

7.1 Requirements for a market

There are perhaps surprisingly few efforts in the economic literature to outline the requirements policy advisers should consider when they wish to successfully develop a market.

Davidson and Weersnik (1998) define a market as "a group of institutions which evolves or is designed to facilitate the transfer of rights and titles to ownership in goods, services, and properties". They argue that it is the presence of transaction costs (larger than the benefit derived from the exchange) that prevents some markets from evolving naturally.

Trading occurs when two bundles of rights are exchanged. But not all trading occurs in a market – some consists of one-off or non-standard transactions. Trading occurs *in a market* when there is a group of similar trades undertaken voluntarily over a period of time where:

- One of the bundles is a similar group of assets over different trades;
- The price of that standard group of assets is relatively stable either in money terms or in the value of the bundle of rights given in exchange; and
- There is competition between either or both buyers and sellers trying to outbid one another for the asset.

Trading requires:

- The right to some bundle of goods or services to be defined in a clear, enforceable manner;
- An allocation of the rights to an initial owner;
- An ability to transfer that right to another party; and
- Enforceability of the transfer *ex post*.

We examine each of these aspects in further detail below.

7.2 Defining the right

In order to facilitate trading we must define clearly and specifically what it is that will be traded. Davidson and Weersnik (1998) argue that the property right must be defined in such a way to make it as exclusive as possible. Property rights should identify the relationships between people regarding use of goods and services, and the penalties for violating those relationships. The use that people will make of an asset and the value they place on it will depend on the bundle of rights associated with ownership, because those rights determine the consequences of the owner's actions.

Accurate and sufficient data must be used to define the good. This can be difficult: measuring and verifying information can be costly and a choice must be made between official verification or voluntary reporting of use of a good, for example, the level of inspection of fish catches to verify quota compliance.

Any aspect of the good or service in question that is able to be varied should be specified. For example, a right should be defined geographically if this can vary: in the case of water rights, over what physical area is the right to take water defined.

The time over which a right is allocated must be specified (or the right must be permanent). Any uncertainty over the period for which the right endures will affect its value and investor confidence. For example, how long a right to take water lasts will affect the level of investment in plant that uses the water such as irrigation equipment or electricity generation.

It also has to be made clear what happens if a right is not used in a particular period. For example, if a right to emit in a particular year is not used in that year, is it forfeit, or is it banked for possible later use?

In the case of emissions permits, a right to release a certain amount of gas is required. But it is not that simple:

- What happens when a party releases more than their allowance?
- What level of monitoring and auditing of reported emission levels is required?
- What right does a party have to assign an unneeded permit to someone else?
- What types of gas emissions require permits (and what is the rate of exchange between gases)?
- Where can the emission occur?
- Is there any restriction on what creates the emission?
- Is the right to emit permanent?
- How often can the right be exercised (e.g. every month, year, commitment period)?
- What happens to the right if it is not used in a particular period?

The answers to all these questions form part of the definition of an entitlement to emit one unit of greenhouse gas.

7.3 Allocating the right

Once we know what the right is, and we can measure how much of it exists, some initial allocation of the right must be made. This allocation will affect the equity of the outcome of trading and may affect the efficiency of the market. Unless the initial allocation of a good is efficient (i.e. those who value the good most highly hold the right to use it after the initial allocation) then trading will generate an increase in efficiency – i.e. everyone will be better off.

In order for a market to yield an efficient outcome three conditions must be met:[21]

- Sufficient markets – in other words, there have to be sufficient opportunities for people to buy and sell the asset at a price;
- Competitive buyers and sellers – i.e. each is willing to trade provided the price is equal to or for sellers, higher than, or for buyers, lower than their valuation of the good; and
- An equilibrium – there has to be a price at which supply equals demand: if the cost of supplying a good or service is greater than anyone is willing to pay to obtain it then there is no equilibrium – and there may be no production.[22]

In a market with no transaction costs, provided these conditions are satisfied then the outcome of trading will be such that no one can be made better off without making someone else worse off. Economists call this a Pareto optimal outcome.

The second fundamental theorem of welfare economics shows that in such a market *any* initial allocation of the goods will yield an efficient (Pareto optimal) outcome. Each initial allocation is associated with a different final outcome, and the distribution of wealth after trading has occurred is, therefore, different, but each outcome is nonetheless efficient. So markets, or trading, should not be directly held responsible for equity. It is the initial allocation of the asset that is important for the distribution effects.

The objective for an initial allocation is to allow the resource to be used in the most valuable way while recognising that those who used the resource previously have an existing investment and the profitability of that investment will be affected by unanticipated costs and hence the ability and desire of that firm and others to reinvest for the future may be diminished. A balance also has to be reached between permanence and flexibility to allow for mistakes in the initial allocation, while recognising that non-permanent rights have lower value.

[21] These are the three conditions of the first fundamental theorem of welfare economics.

[22] A natural monopoly is an example of a market where the outcome is inefficient because there is no equilibrium. A natural monopoly occurs where there are high fixed costs and low marginal costs. In an efficient market consumers pay the marginal cost of their demand for the product. In a natural monopoly, the fixed costs would not be recovered and the firm would prefer to go out of business.

The initial allocation can affect the efficiency of the outcome in some circumstances where one firm is in a dominant position in the market. This problem and suggested solutions are discussed further in section 7.6.

7.4 Transferability

Transferability and enforcement of the transfer are essentially about minimising transaction costs. In order to trade, the right which we have defined and allocated must be transferable.

This requires three activities: first, a search for information about potential buyers and sellers and about the distribution of the asset's price and quality; second, bargaining to determine the price; third, making a contract. A market needs to be *created* only if the costs of undertaking these three activities prevent a market evolving on its own despite potential efficiency improvements from trading. If this is the case, an institution should be established to reduce search and bargaining costs and to protect from market thinness. The most effective markets minimise these transaction costs.

In the case of pollution, it is the high level of transaction costs associated with transferring the right to a third party that prevents a market from forming to allow parties to pay polluters to reduce their pollution. If alternative arrangements exist that reduce transaction costs and allow parties to pay polluters to reduce pollution then the current situation is inefficient. If no such arrangements exist then the present allocation of pollution is efficient.

The most efficient market is the one with the lowest transaction costs since this allows the most trading to occur. Striving to minimise transaction costs "will ensure we come as close as possible to a Pareto optimal solution that exists in a world of zero transaction costs" (Davidson and Weersnik, 1998)

7.5 Enforcement

The transfer must be enforceable. This requires monitoring of contractual partners; enforcement of contracts and payment of any relevant damage provisions; and protection against third party encroachment. The greater the uncertainty about enforceability the more time is spent on specifying and/or monitoring the contract, this results in higher transaction costs and less trade. In the extreme if the costs of enforcing compliance are too high, trade will not occur.

7.6 A note on market power

Market power is a recognised problem in the context of output markets. It is also a problem in other types of markets including the market for transferable property

rights.[23] The presence of a player with market power can limit the likelihood of achieving the objective of policy makers and is, therefore, a critical consideration. It turns out that the initial allocation of rights is important in the extent to which a dominant firm can exert market power.

This may be of particular concern in New Zealand. Since New Zealand is a small market with few industrial emitters, the risk of adverse outcomes from market power is greater than in larger economies. This may influence decisions around the breadth of participation in the scheme required to achieve a competitive (efficient) outcome and the extent to which international linkages are required.

Hahn (1984) and Eshel (2005) both look at the problem from a theoretical perspective. If not all firms in the market act as price takers the efficiency result initially shown by Coase (1960) – that the initial distribution of assets is irrelevant to the efficiency of the final outcome – does not hold. If all firms except one behave as price takers then the final outcome – both the efficiency of the market for permits and the market for output – is affected. In other words, in the presence of market power not only the equity of the outcome but the efficiency of the outcome is affected by the initial distribution.

Hahn finds that the only way to guarantee a cost minimising outcome in the market for permits in the presence of market power is to allocate the firm with market power exactly the number of permits it wants to use (i.e. so it does not trade and affect the price). It also can be shown that the larger the allocation of permits to the dominant firm the higher the price of permits will be and the higher the level of emissions the dominant firm will emit.

The key seems to be the excess demand for permits from the different players. If the price taking firms receive allocations that fall short of their uncontrollable emissions then the firm with market power can set a high price limited only by the decisions of the other firms to close down. If all the permits are allocated to the price taking firms then the dominant firm may be able to act as a monopsonist buying the permits at a lower cost than their marginal abatement cost.

Eshel (2005) shows that it is more efficient for the dominant firm to be a buyer than a seller of rights. This paper also shows that it is possible to partially correct inefficiency in the output market by adjusting the allocation of permits. If the allocation of permits increases the price of permits, by over-allocating to the dominant firm, then the competitive firms will have higher costs and hence lower output, increasing demand for output from the dominant firm and increasing the output price. So a decrease in the share of rights to the dominant firm increases the efficiency in the market for rights, where the firm is a seller, and may also increase efficiency in the output market.

[23] Transferable property rights refers to the right to a resource which is available only in a limited quantity such as fishing quota, water, or air pollution. These rights are transferable between parties, but new rights cannot be created.

This result highlights the need for some flexibility in the allocation of rights as information is needed about the volume of trade by competitive and non-competitive firms, and about revealed prices in order to allow the regulator to improve the relative inefficiency in the system by reallocating rights between competitive and non-competitive firms.

7.7 Conclusion on markets

In order to for a market to evolve, the government needs to define a bundle of rights over time, space and product dimensions. It must then allocate the rights to owners.

A market for trading can be said to exist where there are repeated voluntary exchanges of similar goods over time, with multiple buyers and/or sellers of the goods seeking to trade at the same, or a similar, time. If transaction costs are sufficiently low and there is competition for the rights then a market will evolve and an efficient outcome will result.

If transaction costs associated with searching for buyers or sellers, negotiating a contract or enforcing the contract are high then limited trading will take place. This will limit the efficiency of the final outcome (depending on the efficiency of the initial allocation) and may mean that the market would benefit from policy intervention to lower transaction costs associated with search and enforcement.

If one firm in the market has some market power then the initial allocation of rights becomes significant for the efficiency of the final outcome. In order to achieve the most efficient outcome, the dominant firm should be allocated the amount of resource it will ultimately use; it should not be trading in the market, or it will affect the price. If this is not possible because of a lack of information, it is generally more efficient for the dominant firm to be a buyer of resource rights rather than a seller, as long as they are not the sole buyer.

8. Emissions trading scheme choices

8.1 Broad requirements

The international experience shows there are many variants in design around the broad requirements for emissions trading. This creates a number of choices for consideration in designing a scheme for New Zealand's circumstances. Some of these choices relate to matters that affect the transaction costs and efficiency of the trading system and others relate to the equity and hence political acceptability of the scheme.

8.2 Unit of trade

The international experience with trading mechanisms has approached the units of trade in two ways. One is to deal directly with the emissions to be restrained, effectively unitising an allowable capacity of emissions so that these can be traded between interested parties. Another approach has been to indirectly deal with emissions by creating a trade in obligations for emission-relieving technology, such as certificates for utilising renewable sources of energy. The indirect approach is likely to be less effective at pursuing a specific emission reduction target than the direct approach and we do not pursue it here.

A purpose of greenhouse gas emissions targets is to slow down the annual flows of emissions to the global stock resource of atmospheric capacity, the most direct approach is to define the unit of trade as a right to emit a unit of greenhouse gas over a defined period. There are various ways in which this could be done:

- Term limited rights (e.g. 1 tonne emitted any time within the specified period) These make it easier for regulators to adjust the total emission limit over time, and to adjust future allocations, but they make it more difficult for emitters to assess their future entitlements and hence long term investment risks;
- Perpetual rights (e.g. 1 tonne emitted any time within the specified period, and in all subsequent periods) These make it easier for emitters to assess their future entitlements, but regulators need a clear mechanism for adjusting future limits on aggregate emissions, which may include provision for buy-back or compulsory surrender of a proportion of entitlements in future periods;
- Perpetual shares (e.g. a 1/N share of aggregate allocation in the first and all subsequent periods) These make it easier for regulators to change the overall limit on aggregate emissions in future periods, putting more risk for future changes in entitlement volume and price onto emitters and changing the value of entitlements accordingly.[24]

[24] Shares are more effectively defined as set entitlements like company shares (1 share out of N) than as proportional rights (a percentage), because this entails lower transaction costs in any changes to the total emissions (N). For instance, if a sector such as agriculture came into the emissions trading system after other sectors were already in it, the increase in total emissions (to N+A) would bring in a new cache of emission units for allocation (A); whereas proportional rights would require the proportion on all existing entitlements to be changed to reflect the new enlarged total (given the increased number of participants).

- Evergreen rolling entitlements (e.g. entitlements to emit 1 tonne each year over a term of years, which is renewed before the end of each year or sub-period in the term, allowing changes in entitlements to be foreshadowed with several years notice). This is an adaptation of a common practice used in granting bank credit lines. It provides some certainty for emitters that their entitlements will not be abruptly reduced, while allowing some flexibility for regulators to signal a change in entitlements in anticipation of future conditions.

Where entitlements are attenuated to enable easier adjustment of future aggregate emission targets, the rules of such attenuation should be clearly notified in advance, to reduce uncertainty for those acquiring the entitlements and to improve the efficiency of decisions based on them. This could be, for instance, by specifying the scientific basis or availability of technical abatement options on which changes in the aggregate entitlement would be made, so those affected can conduct their own scientific research and assessments of emerging technology to reduce the uncertainty they face on future entitlements.

While the rights may be issued for a defined period, the international experience is clear that the market can be improved if unused rights can be banked for future periods. This effectively increases the trading choices for the right-holders and increases the likelihood of them achieving a mix of emissions aversion or disposal of rights that maximises their present value return over time. It also dampens some of the fluctuation in emission prices that may arise at the end of the accounting period when there is likely to be stronger demand for emission units for settlement purposes.

Table 5 Unitising rights to emit greenhouse gases
(CO2 equivalent terms)

Variant	Effects
Term limited (e.g. 1 tonne emitted any time in defined period)	Easy for regulator to adjust total cap over time and adjust allocations Difficult for emitters to assess future allocation entitlements Poor environment for investment decision making
Perpetual (e.g. 1 tonne emitted in defined period and all successive periods)	Easier for emitters to assess future allocation entitlements Ideal investment for investment decision making Regulator needs buy-back, claw-back or other clear mechanism for adjusting future caps
Perpetual shares (e.g.1 share of total allocation cap N in first and all subsequent periods)	Easier than perpetual quantity rights for regulators to change overall cap in future periods Emitters assume risk of future reductions in volume, but process is known from outset and reflected in value Shares need conversion to term-related emission entitlement with each change in aggregate cap Mixed in terms of investment environment
Evergreen rolling renewable rights	Allows regulators to change rights over time in line with changing circumstances Emitters face risk of future reductions in volume, but are spared sudden drops in entitlements Proven to be very satisfactory investment environment when applied to bank lending

Source: NZIER

8.3 Points of obligation

The point of obligation is the term given in emissions trading to the entity with responsibility to report emissions and demonstrate it holds sufficient entitlement against those emissions. It is also usually the entity that bears the cost of acquiring emission entitlements in the first instance, although in many situations that cost will be passed on in full to customers whose demands drive emission levels.

The main choices for points of obligation are between:

- 'Downstream' obligations at the point where emissions actually occur;
- 'Upstream' obligations at the point where sources of emissions originate;
- 'Hybrid' systems combining a mix of upstream and downstream obligations.

Choosing the point of obligation for a particular emission stream involves balancing the transaction costs of monitoring and verification of emissions and the incentive for emission restraint.

All practical experience of emissions trading to date has been with downstream systems, with obligations placed principally on large stationary point sources such as thermal power stations and industrial plant.

Such downstream obligations work with both cap and trade and baseline and credit approaches to emissions trading. They are politically appealing in appearing to work directly on the sources of emissions, and because they involve regulators engaging with operators in assessing what emission restraints are feasible and what their impacts are likely to be when considering the setting of baselines or the allocation of capped entitlements. However, because of their monitoring requirements on distinct emission points they place heavier demands on both scheme administration and on compliance by affected industries, compared to upstream obligations with costs passed on.

Upstream obligations would entail placing obligations on the producers or importers of the source of emission (e.g. the fuel), on the assumption that these will be used for combustion with predictable effects on emissions. These suppliers would be required to acquire entitlements for the emissions, and the costs of this requirement would generally be passed on to their customers. While these suppliers would engage in the market for entitlements, their customers would not.

There have been proposals to devolve obligations to individuals through what are known as personal carbon allowances. Under such schemes individuals could charge up a debit card with allowances and use this to pay for selected goods such as motor fuel which would otherwise have the emission cost loaded into the price (Roberts and Thumin, 2006).[25]

It is suggested that transaction costs of such a scheme could be as low as those for existing loyalty card schemes available through retailers, but the motivation for these schemes appear to be primarily to affect redistribution of entitlements between heavy and light carbon emitters through the allocation process.

[25] See Roberts, S. and Thumin, J. (2006) *A Rough Guide to Individual Carbon Trading*, report to UK Department for Environment Food and Rural Affairs.

Table 6 Points of obligation

Variant	Requirements	Effects
Downstream at emitting entities	Accurate emission recording and reporting Ability to verify emissions at entities	Direct incentive for emission abatement Suited to industrial processes and direct heat and power generation
Upstream at source of fuels and chemical causing emission	Accurate recording of fuel or chemical flows	When demand inelastic (unresponsive to price changes), emission costs passed on in full in prices to consumers Incentive for emission restraint and substitution, but impact on emissions limited because of inelastic demand Suited to situations where there are numerous end users, motorists etc and as a result monitoring costs are high

Source: NZIER

8.4 Choice of trading system design

The choices for emissions trading system design is usually thought to fall broadly between:

- Baseline and credit, whereby individual emitters are set a baseline of emissions over a period and given credits for emission reductions below this level which can then be sold, or required to pay for emissions above that level by purchasing credits; and
- Cap and trade, whereby a cap or limit is placed on total emissions over a period, the quantity of allowable emissions is unitised and allocated in some way, and entities with emission obligations are required to surrender emission units against all of their recorded emissions over the period;

The reality is that there is very little if any practical difference between these two arrangements from a firm's point of view. To a firm both systems require it to buy emissions entitlements if it has too few relative to an administratively determined limit and allow it to sell entitlements if it has too many.

The real issue for the firm is how the limit is set. The two broad options are to have limits defined in terms of either absolute or relative emission levels. The absolute approach defines the baseline or cap in terms of an absolute quantity of

emissions, whereas the relative approach defines it in terms of a rate of emissions per unit of output.

Absolute approaches give greater assurance to the regulator of a reduction in emissions being achieved, whereas relative approaches may achieve a reduction in emission intensity, yet still result in growth in total emissions if output growth is particularly strong. The relative approach thus has less impact on economic activity as it still allows growth, but its environmental efficacy is less assured.

Table 7 Relative or absolute targets

Variant	Requirements	Effects
Relative targets (tCO_2 / unit of output)	Knowledge of each sector's feasible abatement Pre-existing standards for setting baseline Information on emissions/output per facility Process for verifying emissions relative to the baseline or cap	Allows activity growth while meeting baselines Perceived as less constraining for firms Less certainty on achieving emission reduction Total emissions can grow when baseline is met
Absolute targets (tCO_2/year/entity)	Knowledge of each sector's feasible abatement Pre-existing standards for setting baseline Information on emissions per facility Reliable forecast of business as usual Process for verifying reductions below baseline	Baseline more constraining of activity growth Reduction targets tighter and more costly Emission reductions more likely to be achieved

Source: NZIER

8.5 Market forum and institutions

The basic requirements of a trading scheme are:

- A registry to record ownership of entitlements and transactions that result in change in ownership;
- An inventory of recorded emissions from each obligation point, with which to match individual entitlements held, and to assess aggregate achievement against the emission reduction target; and

- A trading arena in which offers can be made and accepted, with changes of ownership reported to the registry.

Compatibility with, and linkage to, other trading arenas at the international level, to increase the opportunities of establishing worthwhile trades are desirable, but not vital to the establishment of a scheme.

8.6 Initial allocation

8.6.1 Options

The principal allocation choices are between:

- Sale of emission units by government or system regulator, which creates incentives for emission restraint and generates revenue for government/regulator that can be used to offset taxes or compensate those bearing undue burden from the change in emission cost;
- Gratis allocation of emission units, which creates incentives for emission restraint through the opportunity cost of surrendering emission units against emissions (i.e. the value of selling the units); gratis allocations may be made by:
  - 'Grandfathering' on the basis of historical emission levels. This limits the opportunity for emitters attempting to manipulate entitlements, but those with older, less efficient technology receive more than those with more efficient technology, and new entrants without an emissions record receive nothing unless special provisions are made for them;
  - 'Performance' based on the emissions which would occur with international 'best practice' operation in terms of emissions. The standard might be absolute best practice or some level short of this, such as, the top quartile or top decile level of some peer group for which data is available;
  - Grants based on an emitter's expected future emission levels. This is more likely to soften the impact on industries of emission costs, but is open to attempts to manipulate entitlements, which is likely to be inefficient; and
  - Grants based on some other basis (e.g. balloting). This is less prone to manipulation.

8.6.2 Gratis allocations

To think that gratis allocations somehow reduce the efficiency incentive on a firm is a common mistake in discussions of ETS. The incentive for emission restraint is the same from sale or gratis allocation, if recipients are rational and recognise the opportunity cost of the units received gratis. Most businesses can be assumed to behave in this manner. A failure to reduce emissions and sell the emission entitlement has the same cost to a business irrespective of how much it paid for the units.

This point is worth expanding by giving an analogy, as the misunderstanding is so common. To refuse to sell your house to someone who has offered you $1 million means you have effectively paid $1 million (net of sale costs) as by not selling you have given up the opportunity to spend the $1 million on something else. The opportunity cost of the house to you has become $1 million, irrespective of whether you bought it for $50,000 20 years ago, paid $2 million before the crash or inherited it last week from your great aunt. If you would not pay $1 million for the house (net of sale costs etc.) then you should rationally sell it. Opportunity costs are the costs that matter if you are going to maximise wealth for the shareholders of business. We do not expect that owners who have inherited a house will view its prospective sale any differently than those who bought it; in the same way businesses should not be expected expect businesses to treat a gratis allocation of emission entitlements as any less valuable an asset just because they have been given them.

It is sometimes claimed that the sale of units is more efficient because of the opportunities it provides the government for revenue recycling to offset more diverse distortions in the economy. It is also argued sales are less prone to industry lobbying than gratis allocations, so are likely to have lower transaction costs as long as there is a low cost means of affecting the sale (e.g. auctioning).

In practice, it is debatable whether governments always use revenue in an efficient manner, and they may be tempted to 'hypothecate' the revenues to be used solely on climate change projects, with a risk of expenditures being driven by the availability of revenue rather than by the expectation of maximum net benefits for the economy.

An argument against gratis allocations is that if the firms are required to purchase emission entitlements in auctions they will value them more and be more pro-active in reducing their emissions. This argument completely overlooks that even if a firm receives an over-allocation the firm still faces the same opportunity cost of retaining entitlements it does not need, or could avoid requiring by reducing its emission levels when it is cost efficient relative to the value of the entitlements. This argument assumes that firms treat the value of assets differently depending on their original cost, and willingly pass by profitable opportunities.

A further argument sometimes put forward to justify limiting gratis allocations is that the revenue raised by auctioning the entitlements to them can be used to subsidise emissions reduction research and other schemes to deal with climate change. However, schemes need the discipline of proper scrutiny to ensure that they are the efficient response to a real market failure. The availability of a large pool of auction proceeds to fund projects chosen by bureaucrats and politicians is likely to lead to an inefficient response and a loss of economic welfare.

Gratis allocations are opposed by some on the grounds that allocation by auctioning is more efficient in terms of transaction costs. It is correct that an auction regime is likely to incur lower costs of allocation than a scheme in which

an administrative decision has to be made about the appropriate allocation for individual firms.

In the New Zealand context, the number of firms requiring competitiveness at risk allocations is not likely to be large, and much of the work undertaken in developing NGAs will be able to be utilised. These costs are now sunk and so the incremental transaction costs of a gratis allocation compared with auctioning will not be as great as it would have been had this work not already been done.

Moreover, the argument only considers one form of efficiency – productive efficiency. It overlooks the impact on dynamic efficiency of requiring firms with competitiveness at risk to purchase emission entitlements through auctions, or otherwise.

Firms that emit greenhouse gases into the air currently do so legally; they have the right to do so. They may have acquired this right through the procedures under the Resource Management Act or through some earlier legislative regime or because the emission has never been previously subject to restriction.

To impose a requirement to purchase in an auction, or otherwise, an entitlement to continue to exercise this right is to expropriate what is now a valuable asset and require it to be repurchased. Investors are hesitant to invest where wholesale expropriation of valuable assets without compensation is an acceptable practice; refusing to provide gratis obligations will tend to lower investment below the optimal level and so be dynamically inefficient. This dynamic inefficiency is very likely to swamp the productive inefficiency resulting from the higher transaction costs of gratis allocations compared with auctioning.

It can be argued that the above characterisation of the imposition of emission obligations as expropriation of an asset applies to all firms (and individuals), so what is special about firms with competitiveness at risk that means they should get gratis allocations? The counter is that if the firm is able to pass on the costs of entitlements to others then its economic interests are not seriously adversely impacted by the change in rights and entitlements around emissions. It will lose out on a windfall gain of getting emission entitlements to cover costs it will not bear, and so suffer a loss; however, investors are unlikely to react adversely in terms of investment decisions to the failure to get a windfall gain but they will to a sharp drop in the value of their assets brought about by government decision, and especially so when they know that impact could have been easily avoided by the government.

What we propose will reassign and redefine property rights relating to emissions; it will not create rights in an area where they do not exist. Our proposal includes a reduction in the rights of most of the firms that we have suggested should be given gratis allocations because we have suggested these be based on an international standard or some percentage less than 100 of historical emissions. So there will be wealth effects of what we propose. The point we are making is not

that all wealth effects have to be avoided; that is impossible. It is that if the wealth effects on investors in businesses at risk because their competitors did not face the same obligations are material, and could have been easily avoided, the reaction of investors will impact the dynamic efficiency of the New Zealand economy.

Another basis for objecting to gratis allocations is on the grounds that the firms that get them are 'the cause of the problem' so why should they be allowed off the hook by being given something free. This argument overlooks that the firms have been doing what they entitled to do and through the introduction of ETS are having their current rights taken away from them; they are not getting allocations for free, they are getting them in return for a loss of their existing rights. They are losing their old rights and getting new ones. The new ones are designed so they will be better incentivised to control greenhouse emissions. The environment society will be better off if they have rights with better incentives.

8.6.3 Practical experience with allocations

The practical experience of allocation in existing schemes suggests:

- The majority of emission entitlements need to be given away gratis, rather than auctioned;
- The basis for gratis allocations depends on local circumstances and needs to enable entities to opt for whichever method is most feasible:
  - Grandfathering based on historical emissions depends on the existence of reliable records of past emissions at the sector and plant level;
  - Performance based allocation using benchmarking may be feasible in industries that are technically similar wherever they occur;
  - Signalling expectations of future allocations can be used to incentivise firms to position themselves for participation in an ETS, e.g. a basic allocation for those with neither reliable emission records nor benchmarks, a higher allocation for those who establish verifiable records, and a higher allocation for those able to demonstrate compliance with benchmarks;
- Political economy considerations are likely to make some level of gratis allocations necessary, even if the efficiency arguments we have put forward above in favour of our proposal are not accepted;

Table 8 Initial allocation

Variant	Requirements	Effects
Sale by government/regulator	Market process for offers and acceptance	Incentives for emission restraint at the margin Revenue available to government for recycling Able to offset distorting taxes, undue burdens
Gratis (general)	Process for determining allocation	Incentives for emission restraint at the margin Value of allowances captured by recipients May offset undue impacts May attract distorting lobbying activity
Gratis (historical grandfathering)	Accurate historical emission records	The more historic, the less prone to attempts to manipulate May discriminate against new entrants Easier for smaller companies that are not able to afford extra costs of developing performance based data
Gratis (performance based)	Performance standard or peer group performance data set available	Suitable for industries with common standard products Suitable for larger firms that can afford extra costs of developing performance based data
Gratis (according to future needs)	Reliable forecasts of activity & emissions Knowledge of industries for reality checks	Prone to attempts to manipulate and lobbying Information asymmetry between regulated and regulator
Other distributions (balloting etc)	Clear, predictable process	Distribution based on process and not necessarily related to emissions

Source: NZIER

- Regulatory stringency is required to exercise control over the level of allocations, and is likely to become more critical the broader and more comprehensive an emissions trading scheme is;
- Reserving some allocation is desirable to provide for new emissions, from either new entrants or existing entrants (available to each on the same basis);
- If an industry is characterised by old and inefficient plant, encouraging exit of least efficient operators may be assisted by allowing them to sell the allowances they do not need on closure.

8.7 Dealing with windfall gains

Emissions trading may create windfall gains in two main ways:

- Directly, through the granting of emission entitlements which favour some industries over others, without justification in terms of minimising distributional costs across the economy; and
- Indirectly where there are two different technologies with different emissions levels that produce the same good and the price is set by the more emission-intensive producers. The most commonly cited example is electricity generation where hydro and wind generators benefit from higher prices when the marginal cost of thermal generation increases.

The initial allocation of entitlements will not effect whether the outcome is efficient or not, provided there are no major transaction costs and no market power being exercised. The allocations are essentially about wealth transfers. We have argued that the appropriate objective of climate change policy should focus on the net benefit to New Zealanders and not concern itself with the allocation of wealth between them. The windfall gains issue is essentially a political economy issue and its resolution will be in the political arena.

8.8 Recognition of early action

A distributional issue arising with any allocation setting is the recognition given to early emission reduction. Companies that have already invested in reducing emissions may argue that it is 'unfair' if they receive fewer grandfathered allowances than companies that have not. Political economy considerations will make recognition of early action unavoidable.

From a longer-term perspective there is also an economic case for recognising early action if doing so accelerates the participation of firms into the scheme, thus achieving wider coverage earlier, or if firms are holding off investments now in the expectation of getting better allocations in future. Investment is less likely to be postponed if allocation procedures are clearly announced in advance, and allocations are based on some international 'best practice' standard or, if that is not possible, on historical emissions from a period that means they are not open to manipulation to improve a firm's allocation (i.e. one that is already in the past when the announcement is made).

8.9 Transition

At present, the Kyoto Protocol places quantitative limits on countries that account for 30% of CO_2 emissions, and this proportional coverage is declining given the relative growth of emissions in the Protocol's Annex 1 countries with emission targets and those outside of Annex 1.

Embarking on establishing a comprehensive domestic ETS before there is a clear indication of what the successor agreement to Kyoto will look like and there is wider coverage of emissions restraint at the international level would almost certainly entail increased costs for New Zealand, for questionable benefit.

The costs arise because of the difficulties of setting domestic policy in an international vacuum and through higher competitiveness impacts that would be incurred in New Zealand, necessitating additional transaction costs in arranging allocations and other compensatory measures. These costs would be much reduced or eliminated if the future scheme was reasonably well understood and every country was facing the same emission restraints and implied cost of emissions.

The benefits of too early action are negligible because any emission reduction achieved in New Zealand will be eclipsed by increased emissions in countries without emissions restraint and some of that extra emissions would be due to production relocating from New Zealand to countries without constraints. Indeed, too early action by New Zealand may result in activities shifting from New Zealand to countries with lower environmental standards than New Zealand to the overall detriment of the world's environment, including the level of greenhouse gases in the atmosphere.

The transition path towards an ETS New Zealand adopts should be guided by careful cost benefit analysis. The ETS should be expanded to cover new sectors and emissions when the benefits from doing so outweigh the transaction and other costs that will be incurred.

A key aim during the transitional period should be to signal how future allocations will be determined to reduce uncertainty for those making investment decisions that will extend into future emission accounting periods. Another aim during the period should be to get in place the systems and records necessary to effectively implement the ETS.

9. Evaluation criteria

In order for the evaluation of options to be transparent and effective, the evaluation criteria need to be clearly defined. While there are several hints at criteria in the draft Energy Strategy documents released, the government has yet to state its intended criteria for climate change policy in a coherent manner.

The evaluation criteria for the design of an ETS we have borne in mind when developing our proposal are outlined below.

9.1 Efficiency

Economists consider a number of measures of efficiency to be important. Key measures are:

- Productive efficiency – the extent to which production occurs at minimum cost, i.e. resources are not wasted.
- Allocative efficiency – the extent to which resources are allocated to their most valuable use.
- Dynamic efficiency – the extent to which investment and innovation occurs efficiently over time.

Some economists consider the third of these to be the most important (and the Commerce Commission agrees). Both productive and allocative efficiency can be viewed in conjunction with dynamic efficiency. Dynamic efficiency is achieved when the net present value over time of a single production activity (productive efficiency), or of all production activities across the economy (allocative efficiency) is maximised. The key question with regard to dynamic efficiency is whether the option being considered distorts the incentives faced by parties to invest, or undertake risk mitigation activities.

9.2 Effectiveness

To what extent does the policy under consideration achieve the stated objective? This is closely linked with efficiency which considers the best way to achieve a desired outcome.

9.3 Administrative and compliance costs

One of the sometimes-overlooked groups of costs associated with regulation is the administrative costs imposed on the regulatory body and the compliance costs imposed upon participants. The extent to which a proposed approach imposes such costs should be considered a relevant evaluation criterion.

9.4 Information availability

In order for a market to perform in an efficient manner, information is critical. The key requirements are that the information is sufficiently complete, is available

to the parties that need it and is provided in a way that can be comprehended by the parties.

In evaluating options it is important to determine the extent to which the proposed approach ensures high quality accurate information is available to participants in a timely manner.

9.5 Contract availability

This criterion looks at the effect of market design on liquidity. In other words, to what extent does this market design characteristic increase availability of contracts at transparent prices? To what extent do parties still face transaction costs associated with entering a contract, for example, because of non-standard terms or credit risk?

9.6 Competitive effects

This criterion considers competitive effects and the extent to which market design features encourage competition for both the emissions permit (input) and in the final product market (output).

Competition in the market for the input (in this case emissions disposal to the atmosphere) increases efficiency, driving down the overall economic cost of abatement, because a more open market increases the likelihood of finding worthwhile alternatives to reduce emissions.

In the output market, it will be important to consider the extent to which the design of climate change policy affects a firm's ability to compete, both domestically and internationally. For example, the initial allocation of permits may affect the extent to which New Zealand firms' costs are comparable to overseas firms' as well as the extent to which new competitors can enter the product market.

9.7 Regulatory certainty

One of the factors that decision-makers take into account is the extent to which future, unknown changes in regulatory policy or approach could limit the returns to a decision. In terms of a long-term investment a higher probability of regulatory change will increase the risk premium on the investment. In other words, the investor will require a higher return in order to be willing to accept the risk associated with the investment. In the context of the design of climate change mitigation policy, the key question is to what extent the proposal is adaptable to future changes in climate change science or targets.

9.8 Practicality and robustness

The importance of identifying whether a proposal can be practically implemented should not be underestimated. At a broad level, does the proposal square with international experience? Is it compatible with the overall structure of the New Zealand economy?

It is also important to reflect the risk of mid-stream changes to the regulatory framework (this is related to the earlier criterion of regulatory certainty). What is the likely timeframe for implementing the proposal? What is the risk that the implementation will not be completed or will be imperfectly implemented (perhaps because only elements of the proposal are achieved)?

It is also important that the market is designed in such a way that it is robust to changes in the environment in which it is enacted. So a market should be appropriately sized to the proportions of the sectors that are initially included in trading. However, it is also important that the market be able to grow in terms of the number of participants and volume of trading over time. The relevant question then is: are there any barriers to expansion of the approach being considered to deal with a more complex or larger market?

10. Proposed design of a New Zealand ETS

As indicated in Section 2.2, New Zealand has a distinctive greenhouse gas emissions profile that sets it apart from other countries which it is commonly compared. In particular, New Zealand has a high proportion of agricultural emissions, a smaller proportion of energy emissions and a high proportion of total energy emissions being derived from domestic transport (45% in New Zealand, compared to 20% in Annex 1 countries on average).

This distinctive profile means that an optimal emissions trading scheme for New Zealand will not necessarily be similar to that in other countries, as scheme design should be tailored to the characteristics of New Zealand's industry structure if it is to achieve emission reductions at least long term cost to the country. The specificity of the New Zealand emissions profile and therefore its ETS must be balanced against the desirability of international trade in emissions and the need for similarities in the basic aspects of the national ETS to facilitate this.

10.1 Unit of trade

The unit of trade for international emissions trading will be determined by the wider international market. Under the Kyoto Protocol it has been measured in terms of CO_2 equivalents with gases other than CO_2 being converted to CO_2 equivalent units using Global Warming Potential (GWP) conversion factors. Future international agreements are likely to use the same approach, although the GWP factors may vary from the current ones.

There is some scope for New Zealand to customise its unit holdings for its particular needs.

We propose:

- Annual emission entitlements be issued on an evergreen rolling basis for ten years or so with entitlements for the next three years issued after three, six and so on years. This means that entitlement holders will know their entitlement at any point in time for at least the next seven years. We believe this is a reasonable compromise between the needs of regulators to be able to adjust entitlements as circumstances change and new information becomes known and the needs of investors for certainty.
- Emission entitlements that are auctioned should be initially offered for a range of years. In subsequent auctions forward entitlements that allow parties to extend their existing entitlements should also be auctioned. For example, in the third year of auctions an entitlement for 8-10 years forward should be offered to allow those that initially bought a 10 year entitlement to 'top up' the term back to 10 years.
- Entitlements should specify the units of CO_2 equivalent the holder can emit in each calendar year period. Firms with obligations will be required to do annual reconciliations of their obligations and entitlements.

- Banking of unused entitlements for an indefinite period should be permitted.
- Borrowing of up to 10% of any year's obligation from future years' entitlements should be permitted but any borrowings would be 'repayable' at a rate of 1.15 units per unit borrowed per year. This is effectively a 15% 'interest rate' which is high, but not penal. The 10% cap may be relaxed in future years depending on experiences. New Zealand is a country with very low corporate corruption and fraud and currently has a rational tax regime that means firms are not encouraged to have excessive debt levels to lower the cost of capital. We should use our advantages and allow borrowing. Permitting borrowing and banking will lead to a more efficient market and reduce price volatility.
- Failure to hold the correct level of emission entitlements within three months of the end of the calendar year for which they are required will incur a monetary penalty and an obligation to obtain in addition to the calendar year's obligations 1.15 times the emission units not delivered. The level of the monetary penalty could act as a short-term cap on price, but the repayment obligation means this cannot be a long-term solution. The 1.15 times requirement ties in with the proposed 'borrowing' cost. The cap on borrowing will constrain firms from borrowing indefinitely.
- Entitlements relating to all internationally recognised greenhouse gases should be fully fungible and convert to their CO_2 equivalent at the international Global Warming Potential (GWP) factor in force at the time of the annual reconciliation at which the entitlement is submitted in fulfilment of an obligation. This means the holders bear the risk of changes in conversion factors. It also means the ETS will cover all greenhouse gases. Under the Kyoto Protocol six gases are recognised. In view of the high level of non-CO_2 emissions for New Zealand we believe a multi-gas ETS is essential. We are aware that for three of the gases the volumes in New Zealand are low, and there may be practical difficulties in dealing with entitlements for very small amounts of gas. We believe this is not a good reason to limit the range of gases.
- Carbon sinks from forestry and other sequestration activities should give rise to fully fungible emission entitlements. Again from a New Zealand perspective this is critical due to the likely efficiency of sinks relative to direct abatement, even if it is of limited importance in other countries.
- Any party, whether New Zealand based or not, should be able to buy and hold emission entitlements. This is irrespective of whether they are holding the entitlements as a hedge or for speculative purposes. The difficulty of trying to identify hedgers from speculators and restrict international use of the New Zealand market would be a waste of resources. The more participants active in the market the more liquidity there is likely to be.
- Emission entitlements from other countries that are recognised by the party to which New Zealand is responsible for meeting its international obligations should be able to be traded in New Zealand, and used to meet local and international obligations.

New Zealand's commitments relating to climate change gases will change in future. They may become more or less stringent, depending on the development of the science and how emission constraint shapes up. The proposed allocation

procedures which include evergreen entitlements and forward auctions will allow the government to alter the overall availability of entitlements in response to the country's commitments in an orderly manner. Holders of entitlements will get clear messages in advance of changes.

10.2 Market forum, registry and governance

We propose:

- The registry functions should be delivered through electronic and internet based recording processes. The United Kingdom Department of the Environment, Food and Rural Affairs has developed software that is now also used by Norway. International compatibility would be an advantage and adopting an existing system should lower costs.
- The registry should be capable of communicating with national registries in other countries, and with international transaction logs such as the EU's Central International Transaction Log and the Kyoto Protocol's International Transaction Log.
- The trading forum should be simple, low cost and internet-based. New Zealand has considerable private-sector expertise and experience in the development of electronic markets to handle modest turnover activities. We should use that expertise.
- The development of a market should be left to private initiatives to determine who develops the most successful forum and the registry should be contracted out to the private sector.

10.3 Allocation

10.3.1 Firms with competitiveness at risk

a) Proposal

We propose:

- New Zealand firms subject to international competition from producers likely to be facing no or limited effective emissions charges should receive a gratis allocation of emission entitlements.
- To incentivise the firm receiving the entitlement to reduce its emissions, but not constrain efficient growth in output, the level of gratis allocation should, if practicable, be based on an international 'best practice' standard per unit of output.
- The 'best practice' standard could be set at the world best standard or at some point such as the upper quartile or top decile level for plants in an international peer group for which data are available. We favour the latter approach, as it would leave some positive incentive for even very efficient plants which are not quite at the economic limit of emissions reduction to become even better in terms of emissions.

- For smaller entities, the information costs of finding and checking peer group data may be too great, and their gratis allocation could be based on some percentage less than 100% of their historical emissions per unit of output. They should have the option of having their allocation determined on the basis of the emissions of an international peer group if they wish, however.

b) Level of allocation

We are aware that some international commentators have argued that a firm does not need anywhere near a 100% gratis allocation to protect its profitability. The analysis behind this argument depends on the firm facing a demand curve that is price responsive and the competitors of the firm also facing emission constraints that are roughly similar.

The New Zealand firms in the position of being vulnerable to competition from other firms that are not subject to constraint tend to be commodity producers (timber, aluminium, iron and steel, cement, pulp and paper, meat processors, etc) and typically face demand that is relatively responsive to price. Moreover, the commodities these firms produce are also produced in significant quantities in countries that are unlikely to be early adopters of emissions constraints.

The consequences of under-allocating to firms with competitiveness at risk will be that they will reduce investment and, over a period of time, either move overseas or have their output replaced by overseas production. Under-allocation, unless corrected, will therefore lead to inefficient resource allocation and a loss of public benefit to New Zealand.

On the other hand, the consequence of over-allocation is some wealth transfer to the owners of the firms, but no adverse impact on economic efficiency, in New Zealand or elsewhere. The errors of under and over-allocation carry with them an asymmetric risk; under-allocation will result in economic inefficiency and over-allocation will not. Given the overall objective of dealing with climate change in an efficient manner, running the risk of over-allocation to firms with competitiveness at risk is preferable to running the risk of under-allocation.

c) Potential criticisms of allocation proposals

We have discussed in Section 8.6 the various objections that have been made to gratis allocations to firms. We will not repeat that discussion here. Another potential criticism of our proposal is that it will allow emissions to grow because the allocations for firms with competitiveness at risk will be on a relative basis per unit of output. Because the allocations for the significant firms in the category will be on the basis of an international 'best practice' standard, New Zealand's emissions from a firm in this category are likely to initially drop. Emissions will only grow subsequently if the firm is efficient in both economic terms and efficient in terms of emissions relative to its international peer group. Its increase in output is likely to be displacing less economically and efficient production elsewhere.

d) Adjustment of allocations

Moreover, our overall proposal includes a reassessment of targets on a rolling three-year basis and if the overall level of emissions is not coming down as needed this provides an opportunity to impose tighter constraints on all firms and sectors with allocations. The firm will have seven years to adjust to this change.

The rolling three-year reviews of the 10-year evergreen contracts will also allow the level of any competitiveness at risk allocations to be adjusted with an adequate lead time to any changes in world best practice or the spread of obligations to competitors to New Zealand firms. Indeed, when all countries have imposed similar restrictions on firms in an industry, there will be no need for a competitiveness at risk allocation at all, and our proposal easily handles the complete phasing out of gratis allocations should this happen.

e) Electricity as source of competitiveness at risk

In Section 10.4.2 we propose that emission obligations be placed on thermal and geothermal electricity generators. This will raise the price of electricity when the marginal plant is a thermal or geothermal plant by approximately the amount of the emission charge per unit of electricity generated by the marginal plant.

Firms that are heavy users of electricity may have their competitiveness placed at risk through the increase in electricity prices. To deal with this we propose they be provided gratis allocations of emission entitlements per unit of output sufficient to cover what the impact on their profitability would be if they be using electricity in line with international best practice standards.

The calculation of this entitlement will require some assumptions to be made about the impact of the imposition of emission charges on the price of electricity the firm faces as this will vary depending on the extent and times at which thermal plant is the marginal generating plant, which thermal plant is the marginal plant, the electricity consumption pattern of the firm and, potentially, the provisions in its current contractual arrangements to purchase electricity.

Whether or not the downstream firm has assumed the emission obligation in relation to electricity from the upstream generator it not necessary for this arrangement to work. If there is an efficient market for entitlements then a firm receiving an allocation of entitlements to ensure it remains profitable despite the increase in electricity prices would be able to sell its entitlements in the market and the sum it receives should compensate it for the extra cost of its electricity inputs due to the imposition of emission obligations on the generators.

10.3.2 Firms with pass-through of costs to consumers

We propose:

- Firms with significant ability to pass through costs associated with the acquisition of emission entitlements should not receive any gratis allocations.

- They should be required to purchase their entitlements in auctions or from those with surplus entitlements or sink credits.

10.3.3 Opting to have obligation

We propose:

- The point of obligation for emissions in the supply chain vary by sector (see Section 10.4).
- Firms that are downstream in situations where the point of obligation is defined to be upstream may voluntarily assume emission obligations and in return receive any emission entitlements.
- Firms will need to negotiate any such arrangements with their upstream supplier and bear the administrative costs of these arrangements. Assistance with the negotiations may be necessary if the upstream supplier has market power in the negotiations.

This aspect of the proposal will improve the efficiency of the allocations as the party that considers itself best able to manage entitlements will end up doing so.

There are attempts to develop international sectoral targets for specific industries, such as cement and aluminium. The aim is to take the obligation away from countries and apply it to the industry as a whole. Multi-nationals with plants in both Annex 1 and non-Annex 1 countries are behind these schemes. They see them as a way of imposing obligations on plants in developed countries and hence as a way of stopping them having to shift their operations entirely to developing countries with limited greenhouse gas obligations. The flexibility as to point of obligation of the proposal outlined here means it can easily handle the introduction of such schemes, should it occur.

10.4 Application to New Zealand emission sources

10.4.1 Fossil fuel emissions

A focus of climate change concern has been the extraction and burning of fossil fuels that have stored carbon underground since pre-historic times. These account for around 45% of New Zealand's greenhouse gas emissions and come in various forms.

a) Oil and gas

In New Zealand, oil and natural gas are produced at a limited number of operative wells. Most of the crude oil and condensate is exported for processing; virtually all the crude used as feedstock at New Zealand's single refinery at Marsden Point is imported. Products from the refinery – gasoline, diesel, fuel oils, aviation fuel etc - are distributed to oil storage depots around the country for wholesale distribution. There are also imports of refined petroleum products to various ports with oil storage facilities.

Around 4% of oil product consumption each year is for non-energy purposes (e.g. lubricants, bitumen), and around 15% is used by international shipping and aviation which is outside the ambit of the Kyoto emission accounting system, because no agreement has been reached on attributing such emissions to individual countries. Around two-thirds are accounted for by domestic transport and the rest by other energy uses. So somewhat over 80% of oil consumption is combusted within New Zealand and contributes to this country's carbon dioxide emissions.

All the natural gas is processed for distribution and use in New Zealand. Around 20% is used for non-energy uses in production of methanol, much of which is exported, and ammonia-urea, which is used domestically. Around 35% is delivered directly to electricity generators, 14% used by co-generation units in various industries, and 45% delivered via the gas distribution system to other industry, commercial and residential customers. As with oil, about 80% of total consumption each year is used in combustion and contributes directly to greenhouse emissions.

The greenhouse emissions to be accounted for in New Zealand from the oil and gas stream comprise:

- Combustion emissions from energy uses of oil and gas;
- Fugitive emissions from oil and gas wells;
- Fugitive emissions from gas transmission and distribution pipelines; and
- Emissions from the refinery processes in production of finished products.

Combustion emissions

Combustion emissions are predictable from each class of fuel, so sales of both gas and oil products for combustion in New Zealand provide close estimates of emissions from their use. Neither has significant storage or stockpiling in New Zealand, so sales in any one accounting period will be a close approximation to actual emissions in that period. This means upstream obligations on the point of wholesale despatch into the domestic market – for example, oil depots and gas processing plants, such as at Kapuni – could cover all the emissions downstream from these fuels.

The companies that operate these obligation points – the oil wholesalers and the gas transmission companies – are few in number and know their throughputs, which should keep transaction costs of reporting and monitoring at these points low.

The price of emission entitlements would be passed on to their customers and as demand is relatively inelastic in New Zealand there would be little contraction in consumption. For customers downstream the emission cost would act like a tax, but the emission cost is likely to be more variable over time than a tax. There would also be the opportunity for competition between suppliers, when there is

more than one, to access the lowest cost emission entitlements and compete for customers by passing on lower emission-related costs.

The alternative of downstream obligation points for oil and gas would involve monitoring and recording emissions from more entities, with an associated increase in transaction costs. Some entities may find the direct management of an emissions account assists them in finding ways to reduce emissions, but for others, particularly smaller fuel users, that may involve high transaction costs with little benefit.

A hybrid system of obligations would entail upstream obligation points covering the bulk of oil and gas deliveries, plus downstream obligations for those entities that want them. Larger emitters using these fuels downstream may want to voluntarily take on the emission obligations because of the possibility of gaining from involvement in the market through, for example, accessing cheaper emission entitlements than suppliers, and to facilitate using various financial derivatives linked to emission units as a means of hedging against future variability in price. The use of hedge instruments is not limited to those holding the obligations themselves, but firms may find hedging easier to manage and account for if they do hold the obligation.

We propose adoption of the hybrid system for oil and gas as the outcome will be more efficient. Any downstream entity taking on the emission obligations would undoubtedly seek a rebate from its supplier of the value of emission units included in the prices it pays for fuel.

It would usually be most efficient to allow the arrangements for transfers of obligations to be determined by commercial negotiation. This would largely internalise the transactions costs and ensure that the transfer of obligations would only occur when it is efficient to do so, inclusive of these costs.

The supplier of energy would want to be sure that it would not have to account for any obligations it has transferred to its customers. The regulations covering obligations would have to provide for transfers of emission obligations to be registered, but this will be required if there is to be trading. The incremental costs of allowing transfers of the type considered here will be small.

One potential issue with leaving the transfers entirely to commercial negotiation is the possibility of suppliers exercising market power to extract some of the benefits downstream parties may gain from any transfer. This could result in the level of transfers of obligations from upstream to downstream being less than economically optimal. This issue could be left to the general provisions against using market power in the Commerce Act 1986, or additional requirements to deal with this risk may be necessary.

Fugitive emissions

If fugitive emissions from oil and gas wells are to be covered, this would require obligations upstream at the well-head. There are currently nine operative fields and four field operators. The cost to a regulator recording and monitoring emissions should be low because of the small number of parties involved. Since the level of fugitive emissions can be relatively cheaply determined by the operator, the costs on operators of extending an ETS to cover well-head gases should be reasonably low. A cost benefit analysis would be necessary to determine whether the benefits of extending the ETS to cover oil and gas well fugitive emissions exceed the costs of doing so.

The costs of the emission entitlements to cover obligations from an efficiently-run well could be largely passed on to domestic customers in the case of gas. If a well had particularly high emissions then it would struggle to fully recover the costs because of competition from other producers with more efficient levels of emissions. There is no great case, therefore, for gratis allocation of emission entitlements to cover fugitive emissions associated with gas production for well operators.

For crude and condensate production which is exported, the additional cost of emission obligations for fugitive gases would create competitive disadvantage compared to suppliers from other countries without such emission costs, and detract from profitability and ability to fund further field development, unless there were provisions offsetting this effect. Gratis allocation of emission entitlements based on international best practice per unit of these outputs would be a way to incentivise the control of emissions while not affecting the competitiveness of New Zealand production.

Transmission and distribution

Because of common access arrangements for the use of transmission and distribution gas pipelines, the party which 'owns' the gas that becomes fugitive emissions from transmission and other facilities may be difficult to identify with certainty. However, the reconciliation processes used in the gas industry will provide reasonable estimates of the quantity of fugitive and unaccounted for emissions from sections of a pipeline. The obligations relating to emissions could be placed on the owner of the facility. It would pass the costs on in its charges to those using its facilities and so there is little basis for providing with gratis allocations. The operators should acquire allocations through auctions or in the market place.

Some of the unaccounted for gas identified in the reconciliation processes will not be fugitive in the sense of escaping into the atmosphere. Some of it may be stolen by consumers by-passing meters etc. and some may be due to faulty metering or unmeasured changes in line-pack. Placing the obligation on the pipeline owner for the emissions will incentivise them to ensure the appropriate level of monitoring and control to deal with theft and faulty metering. Variations in line-pack are

unlikely to be a significant issue for determination of emission obligations in New Zealand

Refinery

Emissions from the refining process would also require the New Zealand Refining Company to have emission obligations. As the refinery faces direct competition from imports it would be constrained from passing costs on in prices of product for the domestic market. Costs of emission units would, therefore, detract from its competitive position and profitability.

We propose that to protect the competitiveness of the refinery against competitors not facing emission charges it be provided with a gratis allocation of emission rights. To incentivise the refinery to be efficient in terms of emissions, but not constrain its output growth, the allocation should be based on an international 'best practice' standard per unit of output.

If the refinery exceeded the 'best practice' standard it could sell its surplus emission entitlements; if it fell short of 'best practice' it would have to buy additional entitlements. Use of an international standard means that the refinery company's production will only expand in output if it is efficient, inclusive of emission costs, as it will only be compensated for the 'efficient' level of emissions through the allocation per unit of output.

b) Coal

Coal has a higher rate of emission per unit of energy content, but has distinctive characteristics compared to the other fossil fuels because of its production methods, variety of coal grades with differences in energy and moisture content, ease of transport which presents challenges for monitoring distribution and use, and the different end uses with different emission rates.

Coal production in New Zealand is mostly of bituminous coal but about 40% is sub-bituminous coal and 3% lignite. Of total production about 50% is exported. Of coal consumed in the domestic market, around 25% is imported. Over 50% is used for electricity generation (excluding co-generation), 20% used for the iron and steel industry for reduction of iron in the ironmaking process, around 20% for other industry and about 6% in commercial and other uses. There are currently around 90 productive mines in New Zealand. By far the largest operator with several mines is Solid Energy, but there are several other private companies operating mines.

The greenhouse emissions to be accounted for in New Zealand from coal comprise:

- Combustion emissions from energy uses of oil and gas;
- Fugitive emissions from coal mines; and
- Industrial processes that emit at a different rate from combustion.

Combustion

Monitoring of emissions through coal use is more complex than for oil and gas because the fuel is less uniform and evenly mixed; different grades of coal have different combustion properties due to varying energy and moisture content and they are difficult to tell apart once mixed in use, so applying a standard emission rate to volumes used is likely to involve greater approximation. Volumes used are also likely to be less precisely measured than through metered flows of oil or gas.

There are also a number of uses of coal that have lower emission rates than coal combustion, such as carbon filters. Industrial process emissions either need to be established through measurement at particular facilities, or by using international benchmarks for comparable facilities.

The choice of upstream or downstream as the default obligation point for combustion emissions is more finely balanced with coal than with oil and gas, because of greater transaction costs of monitoring use and resultant emissions. With over half of domestic coal going to electricity generation, a downstream obligation on electricity generators is likely to give a more accurate record of timing of coal use and associated emissions than an upstream obligation.

Similarly, a downstream obligation for iron and steel would enable more direct accounting for the coal used in combustion and that used in other processes with different emission rates. For small commercial and other customers an upstream obligation is likely to offer the lowest transaction costs. Overall, the appropriate point of obligation is an empirical question that would need to be investigated further.

Entities with obligations for coal would be able to participate in emissions trading by buying and selling entitlements to match their emissions. Their ability to pass on the cost to their customers depends on the degree of export exposure and impact on competitiveness. Coal destined for export would not attract any liability for obligations on emissions in New Zealand, but would face increased costs of production from emissions costs in other parts of their production inputs (e.g. diesel fuel), with a corresponding impact on competitiveness and profits.

Fugitive emissions

Imposing obligations on fugitive emissions from coal mines would require each mine to record and report such emissions. In principle, those mines for which the costs of recording and accounting for fugitive emission are outweighed by the benefit could be brought into an emissions trading scheme. However, the rate of emissions does not vary directly with production of coal. Moreover, coal measures vary significantly in geology and the extent to which they emit gases and there are natural coal seam emissions as well as emissions from productive mines. Estimating the fugitive gases due to a particular mining company would be very challenging, in practice.

Industrial process emissions

Industrial processes involving coal that emit at a different rate from combustion would require a downstream obligation, with direct measurement or international benchmarking to indicate the level of emissions. There would need to be a system for rebating any emission costs should any be included in upstream coal supply prices. If they are vulnerable to competition then a gratis allocation may need to be made to them.

10.4.2 Energy sector emissions

a) Electricity generation

Overseas, emissions trading schemes for both greenhouse gases and other gases have placed emission obligations on thermal electricity generators as a means of incentivising efficiency in thermal generation plant and increasing non-thermal generation.

The electricity sector in New Zealand is fundamentally different than in most other countries, as hydro and other renewables provide approximately two-thirds of electricity generation and an even higher proportion of installed generation capacity, so there are fewer efficiency gains and emission reductions to be wrested from including electricity generation in an emissions trading scheme.

Electricity generation could be covered by upstream obligations on gas and coal suppliers, with the additional costs reflected in higher cost of supply from thermal plant. Alternatively it could be covered by an obligation on electricity generators. We propose the latter, principally because of the practical difficulties associated with imposing a general upstream obligation on coal suppliers and the relative ease of estimating emissions from electricity generation plants based on their engineering design and fuel type. To understand the economic consequences of an emission obligation on generators it is necessary to understand how prices are set in the wholesale market for electricity in New Zealand.

Operations of wholesale market

Generators offer into the wholesale market at the price at which they are willing to sell at and the system operator uses these prices to determine the lowest-cost mix of generating plant to meet demand, after the costs of transmission losses and the effects of transmission constraints are taken into account. Generators are paid for the electricity they actually supply on the basis of the offer of the most expensive generator that was required to generate to meet demand; not on the basis of their own offer price.

The outcome of this arrangement is that every generator is incentivised (unless they believe they have market power) to offer at the marginal cost of production from each plant. The wholesale price, therefore, reflects the marginal cost of the marginal generating plant, except if one or more generators are exercising market power.

The imposition of emission obligations on electricity generation, either directly, or indirectly through the prices they pay for gas, oil or coal fuel, will lift the marginal costs of the thermal plants that produce emissions by the costs of emissions.[26] Their offers into the market will, therefore, also rise by the costs of emissions per unit of output. The marginal costs of production of the generation plants that do not create emissions will not change and so their offers into the market will also not change.

Since the demand for electricity is not very responsive to price at the margin, and 'thermal' generators that create emissions have typically higher marginal costs already than the 'non-thermal' wind and hydro generators, the outcome of the imposition of emission charges on electricity will be to raise the wholesale price of electricity by very close to the costs of emissions per unit when the marginal plant is a thermal plant subject to an emissions charge. However, it will not impact the electricity price when the marginal plant is a non-thermal plant. Nor will it alter whether the marginal plant is a thermal or a non-thermal generator, at least in the short to medium-term before there is significant investment in additional non-thermal plant in response, at least in part, to the imposition of emission charges.

In the longer-term, the emission charge will encourage more non-thermal generation and less thermal generation; that is what the policy is intended to do. This is likely to eventually result in thermal generators that would have otherwise run, not running, and through this adversely impacting the profitability of the generator that owns the thermal plant. However, current thermal (or geothermal) generators could build this extra capacity and benefit from the profits to be made from the higher prices.

Consequences

There are several important consequences of these characteristics of New Zealand's wholesale electricity market for designing an emissions trading scheme for this country:

- The imposition of an emission charge on electricity generation will not adversely affect to any significant extent the profits of companies with emitting generators, in the short to medium-term;
- The emission charge will be very largely reflected in the electricity prices paid by business and household consumers; and
- Generators with non-thermal plant will receive a windfall gain on each unit of electricity they produce from this plant when a thermal plant is at the margin. The gain will be roughly equivalent to the emission charge on each unit of energy from the marginal thermal generator.

[26] This also applies to geothermal if there is a direct obligation. Geothermal energy is commonly regarded as a renewable source given appropriate management, but it also creates fugitive emissions of CO_2 and CH_4, albeit at much lower rates per unit of energy produced than fossil fuel-fired thermal generation.

The first point above suggests that there is no justification for gratis allocation of emission rights to generators with thermal generators. Since these firms will pass virtually all the cost on to consumers, to do so would provide them a windfall benefit. Auctioning emission rights and allowing thermal generators to bid for them if they choose, or to acquire rights to cover their emissions on the market from other sources if they prefer, would avoid these windfall gains.

The third point above raises the possibility of a windfall gains tax on the non-thermal generators to recover the gains they will make from the increase in wholesale electricity prices for all producers, including those like them not paying the emission charges. Other countries have contemplated windfall gains taxes. This type of opportunistic behaviour by the government could adversely impact on future investment in New Zealand to the detriment of dynamic efficiency and this would be contrary to the long-term benefit of New Zealanders. We do not propose a windfall gain tax.

Much of the non-thermal generating capacity currently belongs to state-owned enterprises. A windfall tax would collect tax revenues that will otherwise largely return to government through dividends and retained earnings anyway. If these generators remain in state ownership, the extra returns will effectively go to government. Should the state-owned generators be sold in future, this extra return will be capitalised into the value of the generator and return to the government in the sale value.

There are privately owned generators that would also benefit from the windfall. However, some of their extra returns will be collected by government in enlarged corporate tax receipts, moreover, in the longer term, they will face the risk and consequential losses from lower utilisation of their thermal plant as the emission charge encourages the development of more non-thermal generation capacity.

Our analysis of electricity generation has taken into account the features of the current electricity market, and particularly the strong incentive it gives to generators to offer at their own marginal cost. From time to time there are criticisms of this feature of the market and calls for the payments to generators to be determined in some other way. The current arrangements are efficient, and we see no reason to change them, or any likelihood this will happen. However, if it does then the appropriateness of the proposals relating to generators may change.

Tax reduction

An alternative approach to imposing a windfall tax would be for the government to recognise the introduction of emission charges on electricity generators will provide it with extra revenue from:

- The sale through auctions of emission rights to thermal generators;
- Through higher tax revenues from the higher profits of non-thermal generators; and

- Through the windfall gains of the non-thermal generators it owns.

The government could also recognise that the emission obligations on electricity generation, oil and gas and other products will impose extra costs on business and private sector consumers. If it did not want to be accused of using what is meant to be an environmental policy to produce a wealth transfer from citizens to itself, the government should cut business and personal taxes simultaneously with imposing emissions obligations on electricity. The increase in tax revenue and the windfall gains accruing to the government should be able to be relatively easily estimated. So size of the tax cuts should be able to be calculated when the proceeds from the first round auction of emission rights to generators are known.

Competitiveness at risk

For co-generators operating in trade-exposed product markets (e.g. dairy processors and forest products manufacturers), there is a much stronger case for compensation to assist them adjust to the new cost structure from emissions charges being imposed on electricity generation. As their profitability and competitiveness may be impacted by other consequences of the scheme than just electricity obligations (e.g. cost increases on transport fuels and energy other than electricity) such entities may want a general downstream obligation covering all aspects of their operations.

This reflects the more general point that it is the ultimate consumers of electricity that will bear the increase in costs from the increase in electricity prices and to the extent that they compete with firms who have no exposure to climate costs they may require some form of compensation to preserve their profitability. We address this below.

b) Stationary engines

Stationary engines are found in a wide variety of applications in New Zealand, powering conveyors, machinery and manufacturing processes. They come in various sizes and forms, some electric powered, some using gas or oil products or coal. The population of such engines in New Zealand is not recorded in any official statistics, resulting in potentially high transaction costs in implementing a monitoring regime if they are to have emission obligations.

If the default point of obligation for gas and oil and electric power is upstream, as is proposed above, then there is no need to impose obligations on stationary engines powered by these fuels. If there is no upstream obligation on coal used in stationary engines, as is a possibility, then coal-fired stationary engines will need to have obligations if they are to be captured by the regime. There may need to be a minimum size of fuel consumption requirement. The net benefit of imposing obligations directly or indirectly on very small coal-fired engines or those that are used infrequently and act as a standby facility may not be positive. If it is not, then it would not be appropriate to impose an obligation on these engines as to do so would be inefficient and result in a loss of economic welfare to New Zealanders.

10.4.3 Emissions from industrial energy

A number of industries face increased costs as significant energy users if emission charges are imposed. These include aluminium smelting, dairy and meat processing activities, ferrous metals production, cement manufacture, forest products manufacture (especially pulp and paper) and fishing. These are also trade exposed industries and face risks to their competitiveness and profitability.

Such industries may opt to have emission recording obligations on their plant. The advantage will be in participating in the emissions trading market to hedge against future liabilities and changes in input prices. Companies do not need obligations to acquire emission entitlements as part of their portfolio of hedging instruments. But obligations may be viewed as an important motivator for emission restraint and make accounting for hedging transactions easier. Assuming our proposals are adopted, the obligations may also be a means of securing a share of any allocations of emission entitlements and the benefits of managing the obligation better than the supplier of energy.

We have already indicated in our discussion of oil and gas obligations (Section 10.4.1) we favour on efficiency grounds a hybrid scheme that would allow firms to assume emission obligations from upstream energy providers. In that discussion we outlined the likely requirements of companies before they will agree to a transfer of obligations and the advantages we saw from allowing transfers of obligations to happen. We will not repeat the discussion here.

The determination of the electricity related entitlement should be based on the principle of leaving the firm's competitive position and profitability no worse off than it would be if its electricity use was up to the international 'best practice' standard level per unit of output and emissions obligations were not imposed. To do this administratively would require analysis of the impact of the emissions trading on the average price of electricity faced by the firm that has assumed the obligation. Thermal generators would also need to receive credits against their emission obligations to take account of situations where a downstream firm has assumed the obligation for electricity emissions. Since it is not possible to trace what electricity was delivered to one consumer this will be difficult to calculate administratively.

A more efficient approach would be to leave generators and electricity users wanting to take on emission obligations to negotiate the terms of any transfer between themselves commercially. A firm will only take over emission obligations from a generator if the discount in the price of electricity it receives from the generator is in its view sufficient to compensate it for the likely costs of meeting the obligation. On the other side, a generator will agree to transfer emission obligations only if it thinks it will be better off selling electricity at the lower price demand by the customer in return for taking over the obligation. There is no need for an administrative procedure to work out the value of the transfers to the parties. This arrangement will only lead to a satisfactory outcome if the generator does not hold any market power relative to the consumer.

To the extent energy using industries are trade exposed and face loss of competitiveness against suppliers in countries without emissions restraints, there is a case for providing compensation. We propose this be done by providing the firm, and any new entrants, with a gratis allocation of emission rights based on an international 'best practice' standard per tonne of output. For smaller firms the allocation could be based on some percentage of its historical emissions.

It is not necessary that the downstream firm has assumed the emission obligation from an upstream party that has been allocated it for this arrangement to work. If there is an efficient market for entitlements then a firm receiving an allocation of entitlements to ensure it remains profitable would be able to sell its entitlements in the market and the sum it receives would compensate it for the extra cost of its fuel inputs due to the imposition of emission obligations upstream.

10.4.4 Industrial process emissions

a) Cement and lime production

Lime and cement manufacture emit greenhouse gases both through the calcination of limestone and the energy used in that process (mostly from coal). Calcination accounts for approximately half the emissions from cement manufacture, but emissions can be reduced with an increase in use of imported clinker in production.

Having distinct non-combustion emissions, cement and lime are likely to require downstream emission obligations. There are few operators in New Zealand and a limited number of production sites, so transaction costs on monitoring emissions should be low for the regulator. The information required to record emissions should also be reasonably readily available to the producers.

Most cement and lime produced in New Zealand is used domestically, but this is still an industry which is exposed to competition from suppliers in countries without emission restraints. Domestic cement manufacture faces increased costs from both its energy inputs and calcination emissions which could push the price of domestic cement above the landed price of cement from South-East Asia. New Zealand cannot tax imports to reflect emissions that occur offshore, and attempting such measures would contravene WTO rules.

To maintain the New Zealand industry and avoid creating competitive disadvantage that simply allows business and emissions to 'leak' to overseas locations, compensation for loss of competitiveness and profitability will be required to accommodate this industry into an emissions trading scheme. Again, we propose this be done by providing firms, and any new entrants, with a gratis allocation of emission rights based on an international 'best practice' standard per tonne of output.

b) Iron and steel

Substantial coal is used in the integrated steel works at Glenbrook in the direct reduction process that removes oxygen from iron-sand. This is responsible for about 90% of the emissions derived on site. There are also emissions from the use of natural gas, limestone, electrodes and coke. There are emissions from the electric arc furnaces used by Pacific Steel in recycling scrap.

As these are industry-specific emissions, placing emission obligations downstream on the steel works is likely to improve monitoring and incentives for emissions reduction. As there are only two such works in New Zealand, transaction costs will be low provided the firms are able to identify their emissions reasonably cheaply, which appears to be the case. Credits or rebates could be negotiated for any fossil fuels purchased that include the cost of combustion emissions if they are not used for combustion purposes.

Steel manufacturers will face some increase in costs through the price of other fossil fuels and electricity. To the extent that they are trade exposed they may face some loss of competitiveness against suppliers in countries without emissions restraints, so there is a case for providing compensation. Again, we propose this be done by providing firms, and any new entrants, with a gratis allocation of emission rights based on an international 'best practice' standard per tonne of output.

c) Aluminium

Aluminium production emissions comprise 78% from oxidisation of carbon anodes, 12% PFCs (on a CO_2 equivalent basis) caused by anode effects, with the remaining 10% being attributable to direct fuel usage. As the anode oxidation and anode effects are industry-specific emissions, placing emission obligations relating to these downstream on the aluminium plant is likely to improve monitoring and incentives for emissions reduction, with minimal transaction costs.

As a trade exposed industry the smelter will face some loss of competitiveness against suppliers in countries without emissions restraints or with very loose ones, so we propose it be provided with gratis allocations of entitlements to cover its industrial process emissions and any impact on its price of electricity arising from the imposition of emission obligations on electricity generators.

For the industrial process emissions, we propose the gratis allocation be based on an international 'best practice' standard per tonne of output. For the impact on electricity prices, we propose the objective should be to return the smelter to the same position as regards electricity prices it would have been in if no emission obligation had been placed on thermal and geothermal electricity generators, and the smelter was as efficient at using electricity as its international best practice comparator producers.

It would not be a requirement that the smelter assume any of the obligations for emissions of the generators that provides it with power in order to get emission entitlements relating to the impact of emission obligations on its price of electricity. The entitlements would still provide it with compensation for the increase in electricity prices because it would be able to sell them in the market and the money raised should offset the increase in costs.

The smelter may for other reasons, however, want to assume liability for the emissions associated with electricity. This could be left to the smelter and the generator providing it with electricity to negotiate commercially.

d) Petro-chemicals

The principal petro-chemical industries in New Zealand with greenhouse gas emissions are:

- Production of methanol at the former Synfuels plant at Motunui and the nearby Waitara plant;
- Production of ammonia-urea at the Ballance plant at Stratford;
- Emissions given off in the refining of crude oil into petroleum products;
- Hydrogen production from natural gas at the Marsden Point refinery and at a peroxide plant near Morrinsville.

Methanol production continues in New Zealand, but at a low rate due to the run-down of the Maui gas supply and uncertainty over future low cost gas supplies. The Motunui plant was mothballed in 2004. Other petro-chemical production seems likely to continue, but these are much smaller in scale than the methanol.

As these processes produce industry-specific emissions, placing emission obligations downstream on the respective plant is likely to improve monitoring and incentives for emissions reduction, with minimal transaction costs. Credits or rebates would be available for any fossil fuels purchased that include the cost of combustion emissions if they are not used for combustion purposes. For emissions accounting, any natural gas turned into product rather than combusted is not counted as an emission in New Zealand, so accurate records of this production are essential for maintaining the integrity of the national emissions inventory.

Petro-chemical production will face increased costs through the price of emissions in its energy and fuel. As a trade exposed industry it will face some loss of competitiveness against suppliers in countries without emissions restraints, so there is a case for providing compensation. Again, we propose this be done by providing firms, and any new entrants, with a gratis allocation of emission rights based on an international 'best practice' standard per tonne of output.

10.4.5 Minor gases

The minor greenhouse gases recognised under the Kyoto Protocol and likely to be recognised in any subsequent international agreements are a mixed bag:

- HFCs, used primarily in refrigerants and solvents;
- PFCs, which in New Zealand are primarily confined to emissions from breakdown of electrolyte in aluminium smelting;
- SF_6, which in New Zealand is confined to electrical switch gear in transmission and lines networks.

What they have in common is very low volume emissions per year – measured in kilograms rather than tonnes – but very high Global Warming Potentials. There is limited potential for substitution to less emitting substances, most in respect of HFCs.

There is only one emitting entity for PFCs, and few of SF_6, which suggests downstream obligations could be applied with low transaction costs for monitoring. There is a wider variety of activities and entity sizes giving rise to HFC emissions. An upstream obligation on the suppliers and importers of products such as solvents would have lower transaction costs than downstream obligations on small users. But some larger entities (e.g. in refrigeration) may see benefit in emissions trading for hedging future price changes in emission entitlements and opt for a downstream obligation. They should be permitted to pursue this option if they bear the costs on other parties of doing so.

10.4.6 Emissions from households

Household emissions of greenhouse gases are primarily indirect, arising through choices in the use of household energy and through transport. Upstream obligations on oil and gas suppliers, and downstream on electricity generators, would be translated into price increases for householders, which may change incentives for households adopting energy efficiency measures or changing choice of transport mode or vehicle.

There are equity concerns over the cost impacts on low income households, and some doubt as to the effectiveness of minor price adjustments in changing behaviour ($25/tonne CO_2 emission cost translates to around 3 c/litre of petrol and 1-2 c/kWh, depending on whether gas or coal fires the marginal generation plant). Both petrol and electricity have inelastic demand, so there is not likely to be much behavioural response from cost increases of that magnitude.

Because of these characteristics, there have been suggestions that issuing personal carbon allowances would increase consumers' awareness of the carbon consequences of their consumption, and have more impact on choice than price alone.[27] Such schemes would work by issuing each consumer a personal account with an allowance of carbon, and a debit card which they could use when making purchases to deplete their allowance for the emission content of the goods, or to top up their account at other times (as with a pre-pay phone card). The proposals

[27] Roberts, S. and Thumin, H. (2006) *A Rough Guide to Individual Carbon Trading*, report to UK Department for Environment, Food and Rural Affairs.

base their costs on the experience of retailers' loyalty card schemes, which can handle high volumes of transactions at low transaction costs.

Whether such schemes would provide any tangible benefit (beyond the warm glow for consumers of 'doing their bit') for emission restraint is open to question. Carbon accounts are not loyalty schemes, which are basically open ended and wholly positive for both sides of the transaction: customers get the illusion of gathering points to gain something for nothing, while the retailers obtain the lure to bring customers back for more business. Carbon accounts are more negative and limited – at some point customers will hit the floor of their allowance and either be charged an emission-inclusive price (which implies more complex accounting on the part of retailers) or be required to top up their accounts.

Such schemes would also operate at a vastly different scale from emissions trading for industrial concerns. In 2004, the CO_2 emissions from residences from use of gas, coal and liquid fuels is estimated to have been 565 kilo tonnes CO_2, which spread across 1.4 million occupied dwellings amounts to around 0.4 tonnes per dwelling. Indirect emissions from electricity would add to this around 1.8 tonnes per average household at marginal emission rates, but actual emissions per household would be less than this as they depend on an assumed mix of electricity used between renewables, gas and coal. At $25/tonne, the value of carbon emissions per residence is about $50 per household. This is not the total cost of an emission scheme on an average household, because, of course, consumers will bear costs in virtually all their other consumption expenditure, but it does suggest that households are not likely to assume gas, coal, liquid fuel and electricity obligations in the foreseeable future. The transaction costs would be too high.

10.4.7 Methane and nitrous oxide emissions

a) Agriculture

Two-thirds of New Zealand's greenhouse gas emissions from agriculture consist of methane from ruminant animals, and about another third consists of nitrous oxide from the management of manure and soils. There are around 45,000 farm properties in New Zealand with ruminant animals, including dairy farms, sheep and beef farms, deer farms, pig farms and mixed farms.

Animal emissions

As there is currently no practical way of metering the emissions from an individual animal without interfering with its general management and welfare, emissions are accounted for by applying standard emission rates for each class of animal to the respective numbers present in each class. This entails a degree of approximation. Individual animals emit at different rates from the class average due to their genetic make-up and circumstances such as environment, feed and management. The use of standard emission rates makes it inherently more difficult to create incentives for emission restraint. There is no point breeding a

less emitting animal or managing animals differently to reduce emissions if all animals are counted as equal in terms of emissions.

Placing emission reporting obligations upstream on individual farms would entail substantial transaction costs, because of the number of farms involved, the likely reluctance of farmers to take on the additional cost, and the opportunities for subverting the monitoring by shifting or misreporting stock numbers.

An alternative which would not overcome the current measurement difficulties but would require fewer parties to be involved, if and when they are resolved, would be to place obligations downstream at the point of production, i.e. at slaughterhouses and dairy factories. Under this approach emissions for each plant would be estimated on their throughput of the outputs from agriculture in each accounting period.

The ratio between livestock slaughtered and livestock in the paddocks (and emitting) can vary between seasons with re-stocking and de-stocking cycles, so some system for calibrating the emissions per unit of production in a slaughterhouse with actual livestock numbers would be needed before a downstream allocation to slaughterhouses is viable. Moreover, the ratio between milk or milksolids input into a dairy factory and the number of livestock in the paddocks also varies between herds, between seasons and within seasons. So again, there are currently insurmountable significant measurement issues.

For dairying, the measurement problem might be made somewhat easier if the number of dairy animals of various kinds on each farm supplying each dairy factory was recorded and the emissions estimate for each factory was based on this measure and not on milk or milksolids deliveries to the factory. The same approach would not be possible for slaughterhouses because of the loose relationship between a farm and where its output is slaughtered; stock can be sent from one farm to several slaughterhouses.

The incentive effective of any emission restraint on agriculture will be blunt unless there is some verifiable means to identify stock that have been bred or managed in different ways to obtain a different level of emissions. If, as is currently the case, there is no means to distinguish between stock, the imposition of any levy for emissions becomes a levy on production charging average costs, incentivising a reduction in production and creating a lot of unnecessary and wasteful paperwork, and nothing else. There would be no net benefit to New Zealand from introducing an emissions trading arrangement for agriculture in such circumstances.

Livestock emissions represent inefficiency in the animal in digesting its feed, so the options for reducing emission intensity are through the breeding of more feed-efficient animals and through changes in feed mix. Both possibilities are being actively pursued by researchers. The initial motivation for much of this research was not to find ways to reduce methane emissions *per se* but to increase farm

productivity and profitability by improving the efficiency of livestock in the conversion of feed to the pastoral outputs of meat and milksolids. In short, farmers want animals that are more efficient feed converters irrespective of the greenhouse gas impact this will have, so there is not a fundamental disconnect between what farmers want from research and the reduction of emissions over time.

Agriculture contributes such a large proportion of New Zealand's total greenhouse gas emissions it would be more costly to meet the country's emission reduction targets if agriculture is excluded forever, but the measurement issues and the risks to competitiveness and profitability need to be addressed through allocation or other compensation measures before it can be included. In the future, technology might be developed that would allow the farm sector to engage in emissions trading.

We propose that the medium-term objective should be to solve the measurement issues so as to be able to incorporate agricultural production emissions in the ETS with the point of obligation being finally determined once a solution to this measurement has been found and its technical and cost characteristics are known. As agriculture is subject to international competition there would likely need to be a gratis baseline allocation of emission entitlements per unit of production.

One corollary of this proposal is to underline that New Zealand has to make sure in the negotiations about future agreements that there is an opportunity to have lower emission factors applied to livestock when it can be scientifically established that identifiable animals do have lower emission levels either as a result of the way they are managed or their genetic composition.

Other emissions

The other main area of agricultural emissions result from manure and soil management. Around 30% of emissions come from urine and manure deposited around the farm. Given the impracticality of monitoring this activity in practice, the most likely option is to include this alongside methane in the generalised emission factor per unit of produce when and if the measurement issues related to the methane emissions are resolved.

About 6% of agricultural emissions come from fertiliser application. There have been promising scientific advances which offer potential to begin assisting in nitrous oxide reductions from fertiliser use. But the science is still evolving with nitrification inhibitors' usefulness dependent on soil type, temperature, and frequency of application .

Emission reporting obligations could be placed upstream on fertiliser suppliers, on the expectation that annual sales represent annual use and associated emissions. There are relatively few fertiliser suppliers in New Zealand, new entrants or importers could be covered by extending responsibilities of existing border agencies like customs, so transaction costs would be low. Those with obligations

could engage in emissions trading, and have some incentive for encouraging practices in fertiliser use that reduce verifiable emissions without simply cutting back on application.

Suppliers of fertiliser have limited influence on how their product is used, and in other contexts (e.g. nitrate contamination of water supplies) liability for the environmental consequences of fertiliser use is sheeted back to the users, either through general price instruments (like taxes) or contingent liabilities for identified environmental damage.

Despite this we propose that suppliers of fertiliser receive emission obligations based on the volume of fertiliser they sell. The current variability of the effectiveness of nitrification inhibitors means it would be a very big challenge to incorporate them into an ETS through, for example, providing their suppliers with emission entitlements based on the volumes of their sales.

Agricultural activity also generates emissions through the use of vehicles and machinery that use fossil fuels such as petrol and diesel. The upstream emission obligations on distributors and importers of oil-based products would apply to these products when used in agriculture and so no separate obligation would be necessary.

Competitiveness at risk

As much agricultural production is destined for export markets where it is a price-taker, there are clear risks to competitiveness if New Zealand imposes commitments on agriculture when other countries have not. Internationally this is problematic, as early emission trading schemes such as the EU ETS have excluded agriculture entirely from their coverage. The voluntary Chicago Carbon Exchange however is accepting verifiable emission reduction credits from land use changes consistent with Article 3.4 under the Kyoto Protocol.

The imposition of emission obligations on oil and gas products, fertiliser, and electricity will impose significant additional costs on the agricultural sector. Emission obligations on electricity will be particularly important for agriculture and especially so for dairy farming and irrigation-based horticulture. If the competitiveness of the agricultural sector is to be protected, then New Zealand has to make sure it does not impose obligations on these inputs to agriculture in advance of countries which compete with our agricultural exports. If a faster pace is desired, then measures to preserve the competitiveness of agriculture will be needed; the tax system is the most obvious means to achieve this.

b) Waste management

Emissions from waste management predominantly comprise methane caused by anaerobic fermentation in organic matter in landfills. Collecting this gas from landfills and flaring it converts methane with a global warming potential of 21 to carbon dioxide with global warming potential of 1, so there is a readily available

technology for reducing emissions from this source. There are also opportunities for recovering energy from this methane and using it for electricity or heat generation.

There are currently around 95 operating landfills in New Zealand, and over 200 that have been closed in recent years with the tightening of operating standards under the Resource Management Act. Some of these are operated by local authorities, but there has been increasing involvement of private companies that specialise in waste management activities.

As waste emissions vary with the mix and management of waste in landfills, placing obligations downstream on individual landfills offers the most direct means of monitoring emissions and incentivising changes in practice that reduce the likely emission rate. Because of the limited numbers of sites, transaction costs in monitoring such obligations would be low for the regulator. There are models for predicting the methane emissions of landfills from the volume and type of waste they receive. Provided these models are used with caution they should allow the estimation of emissions at relatively low cost. There is little sense in placing obligations upstream at the sources of waste, as this affects potentially all households and businesses in the country and provides only tenuous and indirect incentives for reducing emissions created by landfill practices.

Possible responses for landfill operators include installing and operating landfill gas recovery (which may collect over 60% of methane emissions) or diverting organic wastes that cause emissions to more controlled uses with lower emission rates (e.g. composting). Landfill operators could engage in emissions trading, buying or selling emission entitlements as required in relation to individual caps or baselines benchmarked against best practice landfills. The costs could be passed on to their customers with little impact on competitiveness or profitability, as demand for waste disposal is relatively inelastic. There may however be some transfer of business at the margin as waste materials are diverted from disposal to recycling where it is cost effective to do so.

We propose the operators of landfills be required to purchase either through auction or on the market emission entitlements to cover the emissions of their operations.

Around 20% of waste emissions arise from wastewater treatment plants. A downstream obligation point appears most applicable in this sector for similar reasons to those described for landfills. However, there are very many wastewater treatment facilities, ranging from large municipal sites which are well placed to take on obligations, to much smaller and dispersed facilities down to household septic tanks. There would be high transaction costs in extending emissions trading down the size scale, which are out of proportion to the limited opportunities for emission reduction in the smaller systems. Applying a minimum size limit is likely to be practical for this sector, with a section of emission allocation set aside by government to cover the emissions from the non-obligated facilities.

We propose that the operators of wastewater treatment plants over a specified size be required to purchase either through auction or in the market emission entitlements to cover the emissions of their operations. Operators with facilities of less than the specified size would be exempt from any obligation.

10.4.8 Forestry

Forestry is not an emitting industry in the normal sense, but as a readily available technology for capturing and storing carbon it needs to be included in an emissions trading scheme to lower the cost of meeting emissions reduction targets. The means to do this is to allow new carbon sequestration to be used as offsets or carbon credits to net off against other emissions.

Incentivising such new sequestration requires giving the benefit of credits to those best placed to create new ones, which are landowners or their assignees (e.g. holders of forestry leases). They have much greater flexibility and opportunity to gain from selling entitlements and forward commitments and fitting forestry into their land management plans in a least cost manner than government agencies. The current arrangements for sink credits in New Zealand, in which the value resides with government, must be abandoned if the recent trend of deforestation is to be reversed and forest sinks are to contribute to meeting emission reduction targets at lowest long term cost to New Zealand.

There is a problem in the current arrangements accounting for carbon from forests. Under Kyoto rules, forests accumulate sequestration credits gradually over time in line with the growth of the trees, but they are deemed to emit all the carbon they sequester on harvesting. This liability is avoided if the forest is immediately replanted for continuous rotation, as in these circumstances the carbon emitted is assumed to be absorbed back into new growth. Despite this concession, the Kyoto treatment of forestry ignores the actual emission of carbon to the atmosphere. These will take longer and depend on the uses to which the wood is put, moreover, much of the emission is likely to occur in other countries or be captured in the emissions from landfills and industrial processes. This not only creates major inaccuracies in the physical accounting for carbon emissions to the atmosphere, but also creates a major liability on harvesting that constrains forest operations and acts as a disincentive to additional planting.

A consideration of the cycle of forests and the products made from wood shows how large the problem is with the assumption that all the carbon in trees is released on harvesting.

Trees are planted, as they grow they sequester carbon. When they are cut down a small amount of the total mass ends up as trimmings and sawdust left to rot. This debris reasonably quickly breaks down and releases greenhouse gases into the atmosphere. The bulk of the wood mass from harvest is:

- Exported as logs;

- Processed into lumber and exported;
- Used domestically in buildings, furniture etc.;
- Pulped and exported;
- Processed into paper domestically and either exported or used locally;
- Used as firewood by households; or
- Used to fire industrial stationary engines.

Obviously, any release of greenhouse gases from the products made from New Zealand timber that occurs overseas should be the responsibility of the country in which the release occurs. Australia is not held responsible for the releases from the coal it exports; Saudi Arabia is not responsible for the releases from the oil it exports. This principle seems clear in the international greenhouse gas accounting conventions, except when it comes to forestry.

But even much of what does not leave New Zealand is already accounted for or will generate emissions that fall into categories that are unlikely to ever be subject to an emission obligation for transaction costs reasons. Consider, for instance, the timber that goes into buildings in New Zealand. When buildings are no longer useful they are not generally burnt down, nor are they allowed to remaining standing and rot away; the land is usually too valuable. They are either recycled or bowled over and the timber is sent with the rubble to a landfill. But we already count the emissions to the atmosphere from landfills, so to count a feedstock of the landfill and the emission is to double count.

Similarly, the paper that remains in New Zealand either ends up being recycled or going to the landfill as feedstock to emissions we already count. Very little of it is burnt outside of household incinerators. Timber that ends up as household firewood is likely to result fairly soon in carbon emissions to the atmosphere, but the emissions of households are generally considered to be too hard to monitor. Wood that goes to fuel stationary engines will be recorded as emissions from stationary engines and so will be double counted also.

New Zealand must try to ensure that any future greenhouse gas agreement does not continue these errors in the treatment of forestry and timber products. Acceptance of an agreement which does not correct the errors will be a decision by New Zealand politicians. Presumably they will do this out of concern about the diplomatic repercussions of not acceding to an international agreement even though it is fundamentally flawed in the way it treats the carbon cycle from trees. The costs of any such decision should be placed on the general tax payers and not on forest-owners, since the general taxpayers will presumably be the beneficiaries of any diplomatic goodwill created by such agreement. Moreover, the costs falling on general taxation will increase slightly the incentives on politicians to negotiate satisfactory arrangements dealing with forestry emissions in an appropriate manner based on sound science of when and where emissions occur, and whether they are accounted for already.

We propose that foresters should accrue the carbon credits while their trees are growing to maturity. Two or three years after harvest, the forester should face a small emission debit reflecting the return to the atmosphere of the relatively small mass of decaying debris created during the harvest process. If the forester replants within the two to three years then the credits from the growing trees should be able to be applied to satisfy the debit on harvest. If the forester does not replant it will have to settle the outstanding debit from harvest in the settlement period for the year in which the debit occurs. It could do this by applying formerly banked emission entitlements, by buying emission entitlements on the market, or at an auction, etc.

The arrangements that should apply to plantation forestry planting also need apply to native bush regeneration if the incentives for sink creation are to be equal across all opportunities, so that lowest cost sink creation can occur. When native bush and scrub is allowed to regenerate, the owner of the land should accrue the carbon credits while the bush grows to maturity. If native bush is crushed or sprayed and left to decay or burned *in situ* then the carbon debit will correspond to the high emission to the atmosphere from that action. This will be a liability of the landowner. There are already schemes in operation that offer credits for permanent restoration of degraded bush, such as the EBEX21 accreditation scheme run by Landcare Research Ltd. The Government's Permanent Forest Sink Initiative is a Kyoto compliant development of the EBEX21 scheme.

If New Zealand accepts an agreement which does not allow credits for regenerating forest then presumably this will be because politicians have judged it is not in New Zealand's overall best interests to refuse. For the same reasons as for forestry, failure to achieve an arrangement which provides credit for regenerating forests should be a cost to general taxpayers and not a reason why the landowners should not get entitlements.

10.5 Overview of emissions trading in New Zealand

From the foregoing discussion, a broad picture of an emissions trading structure in New Zealand begins to emerge. As a small country with a high proportion of its emissions coming from activities other than energy applications, New Zealand probably has more limited scope than most other Annex 1 countries in finding low cost means of abatement. Limiting this scope still further by applying emissions trading only to industrial activities and CO_2 emissions, as some other countries have done, is likely to result in increasing still further the cost of achieving substantive abatement in emissions.

An emissions trading scheme for New Zealand, therefore, needs to have as broad a coverage of both gases and activities as possible. This is a more challenging task than in most other countries that have taken on emission reduction targets to date. Linking into international markets for emission reduction credits increases the opportunities for New Zealand to find low cost abatement by buying it offshore. The characteristics of its emissions profile make New Zealand more reliant than

some other countries in being able to engage in international trade if its emission reduction target is to be achieved at minimal long run cost.

The main characteristics of a possible emissions trading scheme for New Zealand are outlined in Table 9. They are arranged by different types of emissions – energy, non-energy sources and end-use energy – and roughly ordered within those groups in declining order of practicality for inclusion in an emissions trading scheme, with those that could be brought in early near the top and those that are more problematic towards the bottom of the group. Note that end-use energy emissions are indirect i.e. they are the end-use sectors' shares of emissions from already identified source streams.

In summary, the main features of this scheme would be:

- Upstream emission obligations placed on:
  - Importers/wholesalers of oil products, with costs passed down to their customers
  - Importers/wholesalers of substances giving rise to HFCs
  - Dispatchers of processed gas for general commercial/residential use
  - Fertiliser suppliers (suppliers of nitrification inhibitors would receive entitlements)
  - Operators of gas wells and pipelines and coal mines giving rise to fugitive emissions if efficient to do so, which currently is unlikely
  - Operators of coal mines for minor users of coal, if efficient to do so
- Downstream emission obligations at plant level on:
  - Electricity generators with thermal and geothermal plant
  - Major users of oil and gas (and electricity) that have voluntarily assumed the obligations from the party upstream to them that was initially allocated it
  - Plant with non-combustion industrial process emissions (cement, iron and steel, aluminium)
  - Electricity transmission operators for SF_6 emissions
  - Landfills and major wastewater treatment plant
  - Major users of coal for combustion (dairy & meat processing plant, iron and steel works, cement works, forest production plant)
  - Petro-chemical production plants (methanol, urea, refinery)

10.6 Evaluation of proposal against criteria

Table 10 contains an evaluation of the proposed ETS for New Zealand against the criteria we identified as relevant in Section 9 above. This evaluation does not constitute a full cost benefit study of the proposal. Nor are any alternative proposals evaluated against the same criteria. It is a more limited exercise. We believe that the exercise shows that our proposed ETS rates highly against a reasonably standard set of criteria used for evaluations in these circumstances.

Table 9 Outline of emissions trading in New Zealand by emissions source

	Share of total emissions	Gases	Point of obligation	Emissions constraint	Competitive-ness impact	Gratis permit allocation
Oil and oil products						
Transport	19.1%	CO_2 & CH_4	Upstream on oil product importers & wholesalers	Acquire entitlements & trade	Negligible	None
Other	2.8%	CO_2 & CH_4	Upstream on oil product importers & wholesalers	Acquire entitlements & trade	Negligible	None
Fugitive		CH_4	Upstream on well-operator, if efficient to do so	Facility baseline based on 'best practice' & trade	Yes	Yes
Natural gas						
Non-combustion (petro-chemicals)	3.2%	CO_2 & CH_4	Downstream on facilities	Facility baseline based on 'best practice' or % historical emissions (small operators only) & trade	Yes	Yes
Combustion	6.5%	CO_2 & CH_4	Upstream on distributors and downstream for 'major users'	Distributors acquire entitlements & trade Major users facility baseline based on 'best practice' & trade	No for distributors Yes for major users	No for distributors Yes for major users
Fugitive	0.8%	CH_4	Upstream on well & pipeline operators, if efficient to do so	Acquire entitlements & trade	Negligible	None
Coal						
Combustion	8.6%	CO_2 & CH_4	Downstream on facilities for major users Minor users upstream or exempt if not efficient	Facility baseline based on 'best practice' or % historical emissions (small operators only) & trade	Yes	Yes
Industrial processes	5.6%	CO_2	Downstream on facilities	Facility baseline based on 'best practice' or % historical emissions (small operators only) & trade	Yes	Yes
Cement & lime	0.8%	CO_2	Downstream on facilities	Facility baseline based on 'best practice' & trade	Yes	Yes

Non-energy sources						
Wastes - Landfills	2.1%	CH_4 & N_20	Downstream on landfill facilities	Acquire entitlements & trade	Negligible	None
Wastes - Wastewater treatment	0.5%	CH_4 & N_20	Downstream on larger treatment plants Small plants exempt	Larger plants acquire entitlements & trade Small plants none	Negligible	None
Agriculture	50.0%	CH_4 & N_20	Determine whether upstream on farms of downstream on process facilities – dairy factories and slaughterhouses – if and when measurement issues resolved	Cap & trade with cap related to units of output	Yes	Yes
Fertiliser		N_20	Upstream on distributors of fertiliser	Acquire entitlements & trade	No	Suppliers of nitrification inhibitors receive emission entitlements
Forestry	-33.0%	CO_2	Upstream on landowners or assignees	Carbon credits accrue while growing. Small negative debit to reflect carbon emission from harvest debris 2-3 years after harvest. If land replanted harvest debit can be offset overtime against carbon credits from the growing new trees	Minimal and offset by sink credits	Retain sink credits
Bush regeneration & clearance	??%	CO_2	Upstream on landowners or assignees	Carbon credits accrue while bush regenerating. Destruction by crushing or burning leads to emissions that need to be covered by entitlements	Negligible	Retain sink credits for regenerating bush
Solvents & refrigerants	0.1%	HFCs	Upstream on importers/ suppliers	Acquire entitlements & trade	Negligible	None
Aluminum	<0.1%	PFCs	Downstream on facilities	Facility baseline based on 'best practice' & trade	Yes	Yes
Electricity transmission	<0.1%	SF_6	Downstream on network operators	Acquire entitlements & trade	Negligible	None
End use energy						

Oil Refining	1.1%	CO_2	Downstream on refinery	Facility baseline based on 'best practice' & trade	Yes	Yes
Other industry & commerce	1.6%	CO_2, CH_4 & N_2O indirectly	Upstream in electricity & fuel suppliers with downstream optional based on agreement Downstream for emissions not covered upstream	Facility baseline based on 'best practice' or % historical emissions (small operators only) if needed for competition	Maybe	Yes for trade-exposed energy intensive and tax relief from revenue from electricity and auction receipts
Households	1.2%	CO_2, CH_4 & N_2O indirectly	Upstream in electricity & fuel suppliers	None	No but bear cost impact	None but tax relief from revenue from electricity and auction receipts

Note: The end use energy shares of emissions are subsumed within the source sector emissions and are not additional to them.

Source: NZIER

Table 10 Assessment of proposal against evaluation criteria

Criterion	Comments
Efficiency: Productive efficiency – the extent to which production occurs at minimum cost, i.e. resources are not wasted. Allocative efficiency – the extent to which resources are allocated to their most valuable use. Dynamic efficiency – the extent to which investment and innovation occurs efficiently over time.	Design is intended to minimise the cost of reducing emissions The use of international best practice standards will encourage New Zealand businesses with allocations because of competitiveness at risk towards low emission production processes Clear signals about the regime and the use of 10-year evergreen rolling entitlements will aid dynamic efficiency The highly open nature of the proposal in terms of gas coverage, sectors, who can trade , what can trade will promote allocative efficiency
Effectiveness: To what extent does the policy under consideration achieve the stated objective?	The proposal should contribute to the climate change objective distilled from the New Zealand Energy Strategy by capping allowable emissions and seeking to minimise cost across a broad range of sectors: To commit to a climate change target or mitigation mechanism, that yields a net benefit to New Zealanders; and to minimise the total long-run cost of meeting New Zealand's climate change commitments in a global context, including the cost of fulfilling any obligations arising from failure to meet these commitments
Administrative and compliance cost: The extent to which a proposed approach imposes such costs should be considered a relevant evaluation criterion.	The proposal is intended to keep compliance costs low, by identifying the party in the supply chain where transaction costs would be lowest. The area where there will be some effort required will be in setting the international best practice standards. However, a lot of work has already been done negotiating NGAs with most of the firms that will seek 'best practice' baselines, which should reduce this cost
Information availability: The extent to which the proposed approach ensures high quality accurate information is available to participants in a timely manner	The proposal should generate good quality and timely information for market participants and policy makers through monitoring of emissions and market activity

Contract availability: The effect of market design on liquidity	The broadness of the market in terms of sectors, gases, types and countries of origin of entitlements that will qualify, range of permitted participants and allowing borrowing and banking should all aid liquidity. New Zealand has good expertise in getting low liquidity markets operating effectively and we should not be put off too quickly by 'experts' who claim the market will be too thin. International linkages would aid liquidity but are not vital
Competitive effects: The extent to which market design features encourage competition for both the emissions permit (input) and in the final product market (output)	There will be competition for emission entitlements. The granting of allocations to new entrants on the same basis as existing businesses will be helpful for competition in output markets. There is no competitive bias in the gratis allocation mechanism. Indeed new entrants that can adopt better than 'best practice' will have the opportunity to sell surplus entitlements
Regulatory certainty: The degree to which the regime and how it will evolve is certain	The comprehensive coverage of the proposal adds to the regulatory certainty. The use of the 10-year evergreen rolling allocation process will also limit the impact on investor confidence
Practicality and robustness: Does the proposal square with international experience? Is it compatible with the overall structure of the New Zealand economy?	While there are still a lot of details to be ironed out, the proposal has enough detail to identify that it is likely to be practical and robust to changes in the international environment (such as linking with other national emission trading schemes, or adopting international sector-based targets) or in the stringency of the target (including the mix of gases, and their global warming potential)

Source: NZIER

Table 11 Summary of key parameters of proposed New Zealand ETS

Parameter	Brief description
Coverage	Virtually all significant sources of emission including agriculture. Excludes within household emissions
Gases	All six greenhouse gases recognised by the Kyoto Protocol
Point of obligation	Some upstream, some downstream, some hybrid. Animal emissions to be determined if and when costs and requirements of measurement technology known
Emission cap (target)	Relative for firms with competitiveness at risk and agriculture. Based on international peer group based 'best practice' yardstick for larger firms and percentage of historical emissions for smaller firms Absolute for sectors not at risk from competitiveness
Allocation	Gratis to firms with competitiveness at risk and agriculture Forestry gets carbon credits for growing trees Native bush regeneration creates carbon credits No allocation for others; required to acquire on the market
Credit for early action	Some recognition in terms of facility baseline setting. Moreover, signals clear and need to acquire entitlements and reduce emissions will be obvious
Competitiveness at risk	Recognised with gratis allocation of emission entitlements based on either best practice or percentage of historical emissions (for smaller firms only)
International linkage	Credits accepted to meet NZ's international obligations tradable. Foreign buyers and traders permitted
Offsets	Carbon credits on new plantings can be used to offset harvest debit
Trading period duration	Evergreen 10-years with extensions back to 10-years every 3 years. Parties must surrender permits within 3 months of end of each calendar year
Banking and borrowing	Both permitted. Limit on borrowing to 10% of the value of a years entitlements. Repayment rate for borrowing at 1.15 times units borrowed per year outstanding (compounding)
Penalty	Monetary penalty per emission unit not delivered in three months after end of calendar year and requirement to deliver 1.15 times the emission units deficient within the following calendar year

Source: NZIER

10.7 Compensating measures

The above outline would involve increases in costs for all activities associated with greenhouse gas emissions in New Zealand. Where demand for products is relatively price inelastic, consumers will pay for emissions and adjust their savings and expenditure decisions in other areas. Where demand is elastic, there is likely to be more emissions reduction as consumers switch to other products with lower emissions cost. This is efficient, since real environmental costs are being accounted for, and effective since it results in lower emissions across the economy.

Calls for compensation may arise from those activities that suffer risks to their competitiveness and profitability, and also on equity grounds for some groups in society that bear a disproportionate burden from the new costs. Compensation may be delivered by cash measures such as changes in tax rates or specific rebates, or by gratis allocation of emission entitlements.

Gratis allocation has been a common practice in existing schemes where emissions trading creates risks to competitiveness. It is favoured by those who have direct obligations as it has the advantage of relating directly to the emission obligation, whereas compensation in cash may be distorted by price variation between the time when compensation is paid and emission units are due. Large emitters are likely to be able to establish world best practice or some other international standard as the basis for setting their emissions performance, and receive allocation on the basis of that performance per unit of output they produce.

Smaller entities that face greater transaction costs in establishing such standards may seek to use historical emissions as their default base for allocation, but an attempt to establish some international best practice even for smaller emitters will improve incentives and make it less risky in terms of meeting the country's overall international obligations to provide allocations on a per unit of output basis. If the baseline is based on international 'best practice' per unit of output then New Zealand's output will expand only if New Zealand is efficient internationally after taking into account emissions.

If, as we suggest, the gratis allocations are based on an international 'best practice' standard then in the early years there are likely to be fewer emission entitlements issued than the total emissions the country would find acceptable, given its international obligations. Since not all firms with obligations will be at 'best practice' standard there will be a demand for extra units in New Zealand (as well as from firms with no gratis allocation). The government should develop a programme to auction these extra emission entitlements.

Many entities, particularly small and medium enterprises, may face adverse impacts on their competitiveness yet face high transaction costs in demonstrating how large this is. There is a strong case, therefore, for introducing general

business and personal tax cuts to soften the impact of the scheme across the wider economy. Such tax cuts can be financed from three sources of additional revenue for government which will arise from the introduction of emission obligations: the sale by auction of emission entitlements to electricity generators or others; the windfall gains from state owned non-thermal generation which benefits from the higher cost of marginal electricity supply; and the higher tax revenue from the increased profits of non-thermal generators.

11. Preconditions

11.1 Gradation of requirements

Preconditions refer to the circumstances necessary before New Zealand can move towards establishing emissions trading and still meet the objectives for climate change policy, i.e. implementing commitments expected to result in a net benefit to New Zealanders and doing so at minimum long-run cost. There is likely to be a gradation of preconditions, some of which are essential for emissions trading and others which are themselves conditional on other circumstances coming into effect.

Because of the uncertainty around future climate change policy at a global level – caused by uncertainties over the evolving science, changes in our understanding of the risks of inaction, the level of emission restraint required and how the international politics will play out and so on – preconditions cannot be predicted with certainty at the current time. So in order to retain the flexibility needed for responding to climate change targets in the least costly way, the term 'preconditions' should not be viewed as meaning a set of criteria, achievement of which triggers development of some aspect of emissions trading. Rather it refers to a set of looser conditions or circumstances which, once attained, signal that it is timely to reassess aspects of ETS design to establish whether proceeding will yield net benefit for New Zealanders.

Many of what might be considered preconditions to establishing a New Zealand ETS can be addressed as part of its design by including mechanisms to provide the necessary components, tailored to circumstances and adapted over time as conditions change. For example, international experience has highlighted the importance of transparency, integrity, price discovery, allocation and trading rules, and other compliance mechanisms to ensure that such a market operates efficiently, with sufficient liquidity and depth and without undue price volatility, uncertainty or cost risk. These can be provided as part of the scheme's design. There are, however, a few fundamental preconditions, internationally and domestically, without which there may be little prospect or value in pursuing an ETS for New Zealand.

There are two fundamental premises underlying the discussion that follows. First, New Zealand accounts for such a small proportion of global emissions that nothing is to be gained by charging ahead of other larger emitting countries with policies that put New Zealand at a competitive disadvantage. This would achieve little, other than to provide an opportunity for business to shift to other countries which are less advanced in tackling emissions. Sacrificing New Zealand businesses for questionable environmental gain or, even worse, environmental losses as standards in other countries are lower also, is not consistent with achieving net benefits for New Zealanders. In this case, the true meaning of environmental leadership for a small country like New Zealand is to promote in

international fora an internationally and scientifically rational response to a global issue and the adoption of efficient and effective mechanisms world-wide to deal with it at minimum economic and social cost.

A second premise is that for emissions trading to provide lower cost emission abatement than other climate change policy options a market for emission reduction opportunities must emerge to enable lowest cost technology and other options to be adopted. Although emissions trading in a variety of contexts has shown that it is not necessary to have a large market of participants to yield lower cost emission abatement than alternative regulatory approaches, it is also apparent that confining trading to a few targeted industries with few sites would not suffice to obtain the widest choice of emission abatement options or select the least costly to use.

11.2 Some prerequisites

11.2.1 International

International preconditions:

- Acceptance that climate change presents a sufficient risk, albeit one with uncertainty, for it to be prudent to take action now to reduce the probability of significantly larger damage and costs later;
- Understanding of the potential for significant amelioration of climate change through reductions of emissions from human activities;
- International commitments to reduce emissions with an internationally agreed means of counting net emissions; and
- New Zealand and international agreement among a significant number of countries on emissions reduction targets.

It is not an absolute precondition that other countries have emissions trading, provided that they are addressing their emissions reduction commitments by some means. They may opt to use less economically efficient approaches domestically, such as standards, whilst New Zealand uses a domestic ETS as a more flexible, lower cost means to achieve our national target reduction in emissions. However, existence of an international market in which New Zealand could participate in trade would greatly broaden the range of potential trades, which is likely to reduce costs of emissions abatement.

In this context it is important for New Zealand that these markets recognise credits from forestry and bush regeneration and also recognise credits earned by saving emissions of greenhouse gases other than CO_2. The design features of early ETS, including the EU ETS, are not very encouraging in this regard. It is a major diplomatic challenge for New Zealand to ensure its scientifically legitimate, but particular interests around the type of gas and sources of emission reduction recognised in international trading schemes are both broad. An efficient global

outcome in which marginal abatement costs are equalised in all circumstances is unlikely to arise in the absence of trading across countries in some form.

How other countries choose to address their commitments would have some implications for the design of a New Zealand ETS. If other countries do not have emissions trading, we would be less constrained in needing to ensure alignment or consistency with other schemes (although it might still be in our interests to bear in mind potential future wider application, in establishing an effective and efficient system which could be extended to others should they wish to follow our example). The design of a New Zealand ETS might also be influenced in how it manages effects on the competitiveness of trade exposed industries by how these industries are treated in other countries.

If an international trading scheme, into which a New Zealand scheme might link, becomes sufficiently developed and established, harmonisation in design components would be useful – such as equivalent or comparable units of trade, rules for offsets, compliance periods, penalties, banking, etc. (For example, if a scheme with no banking is linked to one with banking, the latter effectively provides banking for the former.) This would ease overseas firms doing business in New Zealand, given our small size relative to other markets.

However, compatibility of systems need not be a major hindrance to the design of an emissions trading scheme. The main compatibility issues surround the recognition of another country's emission entitlements as valid for discharge of New Zealand emission obligations, and ability to communicate between each country's registry for recording entitlements against emissions. With those common elements, widespread international trading could emerge even if each country had greatly varying systems for domestic emissions trading, allocations, and market rules to fit the circumstances of their particular industries.

Whilst not a precondition, trading between countries with variation in abatement costs would make it more likely for total emissions reductions globally to be achieved at least cost. Delays in the emergence of such trading could also be an impediment to New Zealand, for which trading with other countries might be an important means of realising gains or meeting our commitments at least cost. Given our greater dependence on agriculture and already high renewable energy generation, purchasing additional allowances from other countries might be less costly than abatement.

11.2.2 Domestic

Domestic preconditions:

- An accurate and comprehensive emissions monitoring and reporting system, for measuring performance relative to targets and reconciling abatement with allowances and credits;
- The conditions required for a market to operate – a clearly and specifically defined tradable unit, transferability of units and enforcement of transfer,

sufficient numbers of competitive buyers and sellers, institutions and infrastructure for trade and exchange, and reasonable transaction costs;

- Established accounting, financial reporting and tax rules for participants in the ETS to use;
- Sufficient economic efficiency benefits from trading to outweigh the costs of establishing and operating an ETS;
- Public and social consensus that emissions trading will deliver the intended policy outcomes such as controlling emissions, without significant unintended side-effects. This will require there to have been a thorough economic analysis of the potential impacts of any ETS for New Zealand; and
- Sufficient public and social consensus on the need for moving towards emissions trading to ensure durability and avoid disruptive policy reversals that undermine the value of investments and confidence in the system.

11.3 Relative importance

From the foregoing discussion, preconditions for emissions trading to emerge are outlined below, in descending order of priority:

- International agreement and commitment to restrain emissions, to create some constraint and hence value on individual emissions entitlements:
  - sufficiently widespread inclusion across countries to avoid creating arbitrage opportunities or incentives for carbon leakage simply as a result of differential application of the constraint;
  - an indication of the rules and criteria by which the constraint is likely to change over time, to reduce uncertainty over future entitlements and engage emission entitlement holders in research to improve the science around setting the constraint that affects the value of their entitlements;
- International agreement on the measurement of emissions from different sources, and sequestration in different means, to create similar incentives for emission restraint and carbon sequestration and storage:
  - an internationally agreed basis for defining units of emission and sequestration that can be traded across locations;
- Political and social consensus within New Zealand that restraining emissions within a target and admitting the legitimacy of offsets and trading between locations suing an ETS, is a desirable and sustainable policy direction;
- Verifiable emission processes for each entity with emission obligations within New Zealand, which will be easier for some sectors/activities to achieve than others:
  - industrial processes and energy emissions will be measurable through end-of-pipe monitoring or indirectly through fuel inputs, but there will be scale economies that may limit the economic feasibility of monitoring to those plant with relatively high volume emissions;

  - waste emissions will be measurable through on-site monitoring and analysis of the volume and content of waste throughput;
  - agricultural emissions are currently estimable through applying average emission factors to different kinds of livestock and land use practice, but there are high transaction costs in measuring actual emissions from different animals subject to different management practices, limiting the refinement of emission reduction incentives;

- A registry for recording ownership of emission entitlements, and any transactions that result in the transfer of ownership, preferably in electronic form for instant update of records;
- A trading forum for emission units which may be provided by any one of a number of existing private market systems or exchanges (or a new one if that turns out to be more cost effective).

Without these preconditions being met, it is unlikely that establishing an ETS in New Zealand will yield net benefits for New Zealanders.

The precondition of achieving public and social consensus around using market instruments like emissions trading is one that could be particularly hard to meet. There is a suspicion of the market and business in general among some influential subsets of the public. There is also a view that environmental policy is about retribution for past misdemeanours rather than establishing forward-looking incentives for emission restraint at the margin that endure over time.

Market instruments provide continuous incentives more cost effectively than regulation, prescription or other controls. Their drawback is that they also have relatively transparent adverse cost impacts on affected businesses and their consumers, which will raise opposition to such instruments.

12. Timing and transitions

12.1 Costs of too early action

We have proposed a comprehensive emissions trading scheme that covers all sources of greenhouse gas emissions in New Zealand. It is an appropriate end-point to aim for to give effect to a comprehensive emissions policy at the international level, in which all major emitters have targets for emission restraint. At present, the Kyoto Protocol places quantitative limits on countries that account for 30% of CO_2 emissions, and this proportional coverage is declining given the relative growth of emissions in the Protocol's Annex 1 countries with emission targets and those outside of Annex 1.

Embarking on establishing such a comprehensive domestic emissions trading scheme before there is wider coverage of emissions restraint at the international level would almost certainly entail increased costs for New Zealand, for questionable benefit.

The costs arise because of higher competitiveness impacts that would be incurred in New Zealand, necessitating additional transaction costs in arranging allocations and other compensatory measures. These costs would be much reduced or eliminated if every country was facing the same emission restraints and implied cost of emissions. There may also be enhanced costs because of the limited market for emission entitlements – the more countries are brought into the scheme, the greater the likelihood of finding low cost alternatives.

The benefits of too early action are negligible because any emission reduction achieved in New Zealand will be eclipsed by increased emissions in countries without emissions restraint and some of that extra emissions would be due to production relocating from New Zealand to countries without constraints. Indeed, too early action by New Zealand may result in activities shifting from New Zealand to countries with lower environmental standards than New Zealand to the overall detriment of the world's environment, including the level of greenhouse gases in the atmosphere. Too early action may be counterproductive to environmental objectives.

12.2 Transition path

Keeping the end point of a comprehensive emissions trading scheme in mind, a transitional path that could get there would be as follows:

- Establish a fully functioning registry to record the creation, ownership and transfers of emission entitlements under Kyoto and whatever agreement succeeds it (there is a registry portal on the web run by MED, but it does not appear to be active at present).
- Enable voluntary participation in emissions trading on a 'grey market' basis in which firms that can reduce emissions below what they think will be their

baseline can trade their expected future credits and those with carbon sink ideas and schemes can participate:

  - through 'over-the-counter' trades within NZ;
  - on the carbon exchanges in Chicago, Europe and elsewhere if they emerge, assuming compatibility in traded units can be achieved;

- Once a basis for post-Kyoto targets becomes reasonably clear, and global coverage of restraint targets across nations looks likely to become wide enough to significantly reduce New Zealand's competitiveness at risk factors, move towards extending the scheme to the comprehensive model;
- Use cost benefit analysis to guide the pace of extension of ETS across the economy and the timing in which each sector or category of emission is introduced into the scheme:
  - Introduce a sector or emission into the ETS only when there is a net public benefit for New Zealanders for doing so;
  - Start first with the sectors with the largest achievable net benefits through realisation of emission reductions or verifiable sinks (a function of their size, substitute technologies available and low transaction costs);
  - Extend over time to the most difficult sectors and emissions, such as those where there are measurement problems or high transaction costs, to complete the coverage of the regime in NZ; and

Such a transition is dependent on the dates for a successor agreement to Kyoto, the pace at which countries with competitors to New Zealand's economic activities also move, and the pace in the development of technology for measurement and emission reduction.

12.3 Signalling intentions for investment decisions

There are practical difficulties in awarding actual emission units for post-2012 trading to early action, so the priority in the transition period should be to giving incentive for entities to position themselves for the onset of emissions trading. For instance, firms that enter into a voluntary agreement to achieve world's 'best practice' emissions standards for their industry could be enticed with the prospect of a higher gratis allocation relative to the standard in any future scheme than those without. Similarly improved records for allocations could be induced by offering a higher ratio of gratis allocations relative to the standard to those entities that present verifiable records over a series of years than those that do not.

A key aim of transitional measures should also be to signal how future allocations will be determined to reduce uncertainty for those making investment decisions that will extend into future emission accounting periods. This will also create benefits for early investment in, for example, livestock abatement and monitoring technology that will be rewarded later.

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Appendix A Energy Strategy objectives

A.1 Draft New Zealand Energy Strategy

The Energy Strategy is perhaps clearest in its enunciation of the Government's objectives. It outlines the Government's vision:

> *A reliable and resilient system delivering New Zealand sustainable, low emissions energy by:*
>
> - *Providing clear direction on the future of New Zealand's energy system*
> - *Maintaining high levels of security and reliability at competitive prices*
> - *Maximising how efficiently we use our energy to safeguard affordability, economic productivity and our environment*
> - *Maximising the proportion of energy that comes from our abundant renewable energy resources*
> - *Reducing our greenhouse gas emissions*
> - *Promoting environmentally sustainable technologies*

The crucial point to note about this goal or vision is that it focuses on the energy sector in isolation. This has a number of effects, most critically that goals such as 'reducing greenhouse gas emissions' lack specificity about how the trade-off with non-energy emitters is made. This goal also fails to indicate when a sufficient reduction in emissions will be reached (either across the economy or within the energy sector). It fails the test of measurability.

A.2 Transitional measures

This paper states the Government's objective "of moving towards low emissions stationary energy supply, and to facilitate a transition to greenhouse gas pricing in the future".[1] The paper also indicates that its intention is to contribute to the objectives outlined in the Energy Strategy (see above).

This paper also hints at objectives relating to "New Zealand's economic and sustainable development"[2] and "longer-term international climate change policy"[3]. It outlines a number of criteria for good policy[4]:

- Environmental effectiveness
- Cost effectiveness

[1] p.3.

[2] p.4.

[3] p.4.

[4] p.4.

- Impact on energy prices
- Ease of implementation (including regulatory and administrative issues)
- Compatibility with a long-term price on greenhouse gas emissions

And a number of 'other issues'[5]:

- Stimulation of innovation
- Treatment of new entrants
- Regional and technological diversity
- Applicability to the New Zealand energy sector

These align to some extent with the overall objective in the Energy Strategy, giving some indication of the considerations that will be important to the Government in finalising any objective statement. For example, an objective that could be compatible with the criteria outlined is:

To reduce greenhouse gas emissions at minimum overall cost to the New Zealand economy.[6]

This paper also illustrates the importance of setting the right target. An incentive-based policy is compared with a price-based policy.[7] The latter, it is suggested gives an uncertain outcome. Specifically, the paper argues it is not possible to be sure that coal-fired power stations will not be built with a price-based measure (implying that this is a bad outcome), while recognising that incentive or regulatory measures may impose higher costs on consumers.

This raises two important issues. First, a price-based measure such as an emissions trading scheme can give a certain outcome with respect to the total level of emissions (although not the source of those emissions). So the relevant issue to identify in the objective is exactly what outcome is being sought (e.g. no coal-fired generation or some overall level of emissions). Second, the apparent argument that incentive-based measures are preferred despite high costs to consumers raises an issue about how costs are included in objective statements. Will the Government make a trade-off between the costs of reducing emissions and the benefits of emissions reduction, or does it see emission reduction at any price as its goal?

[5] p.5.

[6] This example is intended as an illustration only. It differs from the government's objective in the draft Energy Strategy by referring explicitly to minimising overall cost, which is one of the 'good policy' criteria. This suggestion seems consistent with other comments in the Transitional Measures paper.

[7] p.49.

A.3 Measures to reduce greenhouse gas emissions in New Zealand post-2012

This paper focuses on measures "to reduce [New Zealand's] emissions, and protect and enhance its sinks, across key sectors of the economy"[8] "in a manner consistent with its national interests"[9] after 2012.

It explicitly puts to one side the "broader issue of the *stringency* of New Zealand's longer-term goals to reduce its emissions and enhance its sinks".[10] However, it states (without clear justification) that the cost of actions to reduce greenhouse gas emissions will be moderate compared to the higher predicted cost of inaction.[11]

This paper includes a number of possible specific goals; see, for example, pages 10 and 14 which outline a number of potential policy goals. Crucially, the "ultimate goal" is stated for a price-based measure as "[moving] to a broad emission trading system that allows access to least-cost emission mitigation opportunities".[12]

The paper also considers the importance of recognising international efforts: "reductions in emissions…anywhere in the world will have a comparable impact on mitigating climate change. …This enables climate change policy measures to support least-cost emissions reductions wherever they happen, and to maintain the environmental integrity of those emission reductions."[13]

A.4 New Zealand Energy Efficiency and Conservation Strategy

The New Zealand Energy Efficiency and Conservation Strategy (NEECS) draws it stated objectives from the Energy Strategy:[14]

- Maximising how efficiently we use our energy to safeguard affordability, economic productivity and our environment.
- Maximising the proportion of energy that comes from our abundant renewable energy sources.

These objectives seem to broaden in the section outlining how the strategy was developed.[15] For example, emphasis is placed on security of electricity supply. This could be seen as encompassed in the first objective above (safe-guarding

[8] p.3.

[9] p.4.

[10] pp.3-4, emphasis added.

[11] p.1.

[12] p.51.

[13] p.17.

[14] p.4 and see p.8 of the draft Energy Strategy.

[15] pp.4-5.

economic productivity), but serves to illustrate the point that it is important to clearly state what is meant in an objective.

Interestingly, the NEECS goes on to emphasise the importance of cost-effective changes (i.e. seeking efficiency gains only if they outweigh the costs of new energy supply). This idea is not adequately captured in the objective, which appears to focus one-sidedly on the cost of energy, ignoring the cost of reducing energy consumption.

In the Minister of Energy's introduction to the NEECS a slightly different objective is put forward "to cut the waste, help every New Zealander save money, use energy more efficiently and improve our health and comfort…[and to make] more credible …our claim to be a truly clean and green country and the envy of the world."[16] This introduces two additional ideas: some link between efficient use of energy and health and comfort, and some international comparison or benchmark.

A.5 Sustainable Land Management and Climate Change

The government sets out 'four key policy pillars' in this paper. These appear to be the underpinnings of its objectives:

- Adapting to climate change.
- Reducing emissions and creating carbon sinks.
- Capitalising on business opportunities arising from climate change.
- Working together.

Pillars one and three implicitly seek to avoid, reduce or offset the costs of climate change by adapting land management practices and identifying new business opportunities.

A number of quite specific, and detailed, potential goals are suggested for the agriculture and forestry sectors:[17]

- Develop safe, cost-effective greenhouse gas abatement technologies that will lower total New Zealand ruminant animal methane and nitrous oxide emissions by at least 20 per cent (compared with 'business as usual' emission levels) by the end of the Kyoto Protocol's First Commitment Period (2012) and beyond.
- Ensure New Zealand farmers have access to cost-effective technologies and management practices that have the potential to substantially reduce greenhouse gas intensity per unit of production.
- Make New Zealand a recognised world leader in research into ruminant animal greenhouse gas mitigation and measurement.

[16] p.1.

[17] p.24.

- Ensure that the New Zealand agricultural sector is positioned to take advantage of the economic opportunities arising from new technologies and management practices developed at least partly as a result of climate change (e.g. production of bio-fuels, carbon farming, renewable energy).
- Forests are fully integrated into New Zealand's land use patterns to deliver sustainable land management.
- Forests and forest products are widely used in adapting to and reducing the impacts of climate change.
- Land use flexibility is maintained, taking into account the environmental costs of land use decisions.
- The forestry sector is internationally competitive and profitable.

These are second level goals or policies (i.e. should sit under a broader climate change goal). In that context it is not clear whether any analysis has been done to determine whether this is the most efficient and effective way to achieve the Government's overall climate change goal. The paper does not explicitly state what this goal is. However, an impression can be gained that it is something like 'taking action to reduce greenhouse gas emissions and the impacts of climate change, and meeting New Zealand's international commitments'. This is slightly different to the Energy Strategy vision, which in focusing on energy does not explicitly mention climate change, nor does it mention international commitments.

This paper asserts that the "costs of inaction on climate change are *far higher* than the costs of taking action".[18] It is not clear how this conclusion has been arrived at. Although reference is made to Sir Nicholas Stern's comment in his report to HM Treasury likening the risk of climate change to Great Wars and the Depression, the costs of unspecified 'action' are not made apparent. A second cost of inaction is alluded to as international pressure, for example, "talk in Europe of border taxes for goods from countries that have not ratified the Kyoto Protocol".[19] While it may be true that some action can be taken at a lower cost than the effect of doing nothing, at some point the marginal cost of more stringent climate change policy will overtake the cost of the effects that could be avoided by the policy. This reality needs to be acknowledged and recognised in any objective set by the government.

A.6 Principles and strategic direction

A number of the papers in the Government's package include an outline of principles to guide climate change policy and a 'strategic direction' for policies. These are not objective statements but for the purpose of completeness are replicated below.

[18] p.17, emphasis added.

[19] p.17.

Figure I: Government climate change principles and strategic direction

In developing its climate change policies, the Government has agreed on a number of guiding principles. Climate change policies will:

Be long-term and strategic

Engage with the wider public, industry and business to inspire their willing, effective and long-term involvement

Focus on international engagement that advances New Zealand's national interest.

Balance durable efforts to reduce emissions with preparations for the effects of a more variable climate

Strategic direction

In addition, the Government has agreed a strategic direction for its climate change policies:

Faced with sufficient consensus on climate change science, the Government must act to address the risks for New Zealand's vulnerable environment, economy and way of life. While action to reduce greenhouse gas emissions over the long term will have a moderate cost, the predicted costs and risks of inaction are expected to be unacceptably high.

Effective international action is needed to reduce global greenhouse gas emissions. To support and encourage international action, New Zealand needs to play its part in reducing emissions, as well as in encouraging other countries, especially the major emitters, to act.

New Zealand's response should maximise the economic advantages of using energy and resources more efficiently. New and newly economic technologies will play a crucial role. Policy should facilitate New Zealand involvement in the development or adaptation of low-emissions technologies relevant to our needs.

Our policy response should start with the most achievable options and seek least-cost solutions. A combination of sectoral and economy-wide measures, including voluntary, price-based and regulatory measures, is likely to be needed. Short-term measures should be consistent with likely long-term solutions and should, at the very least, curb increases in emissions.

All sectors of the economy should play an equitable part in the national response to climate change, reflecting the fact that some sectors will be able to achieve emissions reductions more easily than others. An important policy consideration is the competitiveness of sectors in which there are no low-emissions technologies available at moderate cost.

Policy should maximise the wider benefits of climate change action in relation to economic transformation, improved sustainable land and water management, enhanced public health, reduced energy wastage, enhanced energy security, improved air quality and the conservation of biodiversity.

Any response to climate change must include policies to help New Zealand adapt effectively to the impacts of climate change.

The pace and stringency of New Zealand's response needs to align with our national interests. In particular, it should be in step with what major emitters (including our major trading partners) are doing. This is in line with the long-term position taken by other developed countries. Acknowledging this reality is important in building consensus among key sectors for a durable domestic climate change response.

Appendix B International markets

A number of countries around the world have introduced or are developing trading schemes, in various forms, aimed at reducing greenhouse gas emissions. Although different counties have made different choices, all have faced a similar set of questions on scheme design. Investigating the design and subsequent performance of existing schemes may provide valuable lessons for the design of an emissions trading scheme for New Zealand.

In this section of our report, we outline the design and performance to date of the most notable of current and proposed trading schemes in:

- United Kingdom
- Denmark
- Norway
- European Union
- United States of America
- Canada and
- Australia.

B.1 United Kingdom

B.1.1 UK Emissions Trading Scheme

The voluntary UK Emissions Trading Scheme (ETS) commenced in April 2002 and was the first cross-industry, national greenhouse gas ETS in the world. The scheme ran until December 2006, when it was superseded by the EU ETS.

Firms could choose to enter the UK ETS through either Climate Change Levy Agreements (CCAs) or as Direct Participants (DPs) with absolute targets. The UK ETS combined features of both cap-and-trade and baseline-and-credit approaches in so far as CCA participants operated in a baseline-and-credit fashion, whilst DPs operated in a cap-and-trade scheme.

CCAs were agreements negotiated with some 40 industry sectors, covering 6,000 firms and effectively provided automatic entry to the UK ETS. CCAs allowed energy-intensive sectors to receive an 80 per cent discount on the cost of the Climate Change Levy if they met targets negotiated with the Crown. The Climate Change Levy was £0.43 per kilowatt hour for electricity (15 per cent of the average price of electricity at the time the price was set in 2001) and an additional £0.15 per kilowatt hour for electricity produced. CCAs were negotiated with 10 major sectors: aluminium, cement, ceramics, chemicals, food and drink, foundries, glass, non-ferrous metals, paper and steel. Additionally, over 30 agreements were reached with smaller sectors, such as aerospace and agricultural supply industries. CCAs remain in force despite the closure of the UK ETS.

The government provided a £215 million financial incentive fund for organisations that agreed to take on voluntary targets. DPs were required to make absolute reductions in emissions against a 1998 to 2000 baseline. An auction held over the internet in March 2002 set targets for each DP and determined the share of incentive money each received. A total of 34 firms chose to be DPs. These varied by size and sector, from global firms such as BP, Shell, Ineos, banks and supermarkets, through to smaller players such as London's Natural History Museum.

Targets set through CCAs were often efficiency targets or output-based, many relative rather than absolute. Firms with targets set through CCAs could use the trading scheme either to help meet their target or to sell credits from overachievement. The scheme included a mechanism to reconcile credits achieved by CCA firms with allowances bid for by DPs in the auction process, and a gateway to control the flow of allowances from the former to the latter.

Currently in development are arrangements for longer-run emissions targets for participants of the UK ETS under a programme called the Energy Performance Commitment (EPC). The EPC, as currently envisaged, will be a mandatory cap-and-trade scheme in line with the UK ETS, although consultation documents are offering a benchmarking scheme as an alternative.

B.1.2 Design

Table 1 UK Emissions Trading Scheme

Coverage	National 2002 to 2006 Voluntary, participation was open to almost any emitters, and any individual or organisation could trade allowances Excluded electricity generation for sale, but allowed inclusion of electricity by consumers who obtained electricity off the grid or generated and consumed electricity on-site (e.g. cogeneration)
Gases	Kyoto Protocol (Annex A) six greenhouse gases Firms could choose to count just their carbon dioxide emissions or all six greenhouse gases
Point of obligation	Installation operator, emissions source (i.e. intra-firm trading needed to balance obligations at the firm level)
Emissions cap (target)	DPs committed to reductions of around four mega tonnes per year, totalling 12 mega tonnes over the scheme's four year period, relative to the 1998 to 2000 baseline (equivalent to an 11 per cent reduction) Other participants, subject to negotiated CCAs, were committed to reduce emissions by 1.1 mega tonnes by the end of 2006, but not all of this reduction was necessarily a result of the ETS
Permit allocation	Free of charge to baseline-and-credit participants Auctioned to DPs who bid for a pool of £215 million in incentive money
Credit for early action	None, reflecting the voluntary nature of the scheme

Competitiveness	No measures in the ETS itself, given voluntary participation The UK approach to climate change, of which the ETS is one component, includes features designed to mitigate negative effects on firm competitiveness (e.g. firms could avoid some of the cost of the Climate Change Levy by being party to CCAs, although in effect the Climate Change Levy was broadly fiscally neutral with the charge being offset by an approximately equivalent reduction in other charges levied on business by the Crown) Use of relative targets sought to avoid penalising firm growth
International linkage	Direct links into the EU ETS, including transitional measures for firms in the UK ETS (DPs in the UK ETS were exempt from participation in the EU ETS until after the UK ETS had ended and firms covered by CCAs were exempt from the first phase of the EU ETS altogether) Direct links to Kyoto Protocol mechanisms (see offsets, below)
Offsets	Project-based offsets were allowed if proved to be adding further reductions relative to business-as-usual Renewable electricity projects and some Combined Heat and Power energy projects were eligible for project-based credits (although CHP projects were subject to criteria for determining whether they were of sufficient quality) Clean Development Mechanism credits (i.e. Certified Emission Reductions) and Joint Implementation credits (i.e. Emission Reduction Units) allowed, but not clear if ever used (which is not surprising given that there was a surplus of allowances over emissions for most of the time the UK ETS was operating)
Trading period duration	Compliance year ended 31 December, with reconciliation of previous year's accounts required by 31 March Trading could occur during the three months January to March to reconcile obligations
Banking and borrowing	Unlimited banking until end of 2007 Limited banking between closure of the UK ETS and the first Kyoto Protocol commitment period, 2008 to 2012 (participants could only bank reductions below their own targets that they themselves had achieved, i.e. they could not purchase allowances and bank them) No borrowing
Penalty	Applied to DPs only If annual target not met by end of reconciliation period, incentive payments were withheld and emissions reductions had to be made up the following year with a 1.3 penalty factor If the five year target was not met, incentive payments received previously had to be repaid with interest Government published a list of firms failing to meet their annual targets
Market ownership and governance	Registry operated by UK Department of Environment, Food and Rural Affairs (DEFRA) Required verification of reporting of baseline emissions and annual emissions The UK Accreditation Service certified organisations and individuals that could verify baseline and annual emissions inventories and other compliance matters Trading was open to any person or organisation Rules were established for trading between firms with absolute targets (DPs) and relative targets (CCAs); DEFRA set up separate registers for each of these two groups; trading between the two groups was permitted but through a "gateway", so that allowances could not flow from the "relative" group to the "absolute" group unless there had been a net flow of allowances from the "absolute" group to the "relative" group (to prevent the situation where relative reductions offset absolute increases, resulting in an increase in total emissions)

Source: Various, see references in Appendix C

B.1.3 Performance

B.1.3.1 Emissions cap (target)

The UK ETS has generally been considered a success in driving reduced emissions of greenhouse gases. The Department for Environment, Food and Rural Affairs (DEFRA) (2006) reports that the scheme resulted in actual emissions reductions of over seven mega tonnes of carbon dioxide equivalent between 2002 and 2005.

These constitute reductions relative to a "point in time" baseline rather than a current business-as-usual counterfactual. Experience of target setting in the UK and elsewhere in the EU, including setting baseline periods and forecasting counterfactuals, suggests a tendency to overestimate business-as-usual emissions and therefore overstate the extent of emissions reductions. Certainly, it was the case that many UK ETS participants were able to meet their targets rather easily.

Furthermore, the UK ETS was largely a redistribution of public funds to industry. The ease with which targets were achieved raises questions about whether tax payers should have been paying for these reductions. DEFRA did attempt to address the apparent over-allocation of allowances by entering into agreements in 2003 with six major market participants to deliver further reductions. Some participants have criticised this intervention, arguing that it set a precedent for further intervention and thereby created unnecessary uncertainty over the supply of allowances.

B.1.3.2 Participants' views

Nonetheless, results from a DEFRA-sponsored survey of market participants (Enviros, 2006) suggest that the scheme was successful in a number of respects, including:

- Participants found the scheme to be a valuable learning opportunity in terms of experience of auctions and emissions trading generally and good practice in setting internal targets and objectives for emissions control;
- The registry system was deemed to be simple and easy to negotiate; and
- The certainty provided by explicit fixed timeframes was valuable for planning.

Some participants responding to the DEFRA survey also suggested that there was room for improvement in:

- The lead time for the auction process – some considered this phase of the market's creation too short, which reduced participation as firms had insufficient time to understand the rules and compliance requirements;
- Providing longer-run objectives for such a scheme, which firms can take into account in making long-term investments and organisational changes; and
- Keeping monitoring, verification and reporting rules and costs to a minimum, which were deemed to be the most time consuming elements of the UK ETS.

B.1.3.3 Prices

Hill *et al.* (2005) notes that the initial proposed incentive price led to emissions reduction offers far in excess of the total incentive funds available. This was dealt with via a dutch auction of sorts, where the price fell until such time as there was a reduction in bids, and therefore total incentive payout, fell to within the funds available. This was associated with commitment to total reductions of around four mega tonnes of carbon dioxide equivalent per annum, totalling around 12 mega tonnes of reductions over the scheme's four year period, although three DPs subsequently withdrew from the scheme, lowering the actual reductions achieved.

Early in the scheme, allowance prices reached around £12 per tonne of carbon dioxide, before falling to within a band of £2 to £4 through to 2006. This average price band was substantially lower than the £12.45 (net of tax) per tonne of carbon dioxide reduction that was provided by the government in incentive payments. The initial peak in prices has been attributed to delays in allowance allocations, causing a perception that the market was tighter than it actually was. There appears to have been minimal volatility in prices, however, with only one swing, associated with the negotiation of further targets with some market participants in 2003. This is in contrast to early trading in futures on the EU ETS where prices have been much more volatile, although low volatility in the UK ETS was perhaps to be expected given the ease with which firms were able to meet their targets.

In terms of trading volumes, there was a moderate volume of trade, although most was concentrated around each January as firms traded to meet the previous year's reduction targets.

Interviews with participants in 2005 found that firms viewed the level of the incentive payment as a substantial and sufficient financial incentive to reduce emissions (Hill *et al.*, 2005). They suggested that the incentive payment provided the impetus to look closely at costs from energy use and caused them to save costs, especially in the use of electricity and gas. From the level of the incentive price relative to other prices and levies in the suite of UK climate change measures, however, it is apparent that firms were able to gain economic rents from the scheme. The incentive price was much higher than the market price of allowances – which were substantially lower than the costs of non-compliance with CCAs (£20 per tonne) – and was higher than the cost savings able to be achieved through a discount on the Climate Change Levy (worth about £8 per tonne).

This meant that, in the presence of easily achieved targets, firms could meet their obligations and gain an additional source of income straight from the public purse (since the incentive payment more than compensated for the cost of allowances). For this effect to have been mitigated would have required much more demanding targets (i.e. a greater shortage of allowances). Of course, a voluntary scheme is unlikely to attract many participants if they face a high cost of belonging. So a demanding target would require a mandatory scheme, which is now in place via the EU ETS.

B.1.3.4 Banking

Allowing banking into 2008 to 2012 helped not only to prevent UK ETS participants from being adversely affected by the introduction of other schemes such as the EU ETS, but also to mitigate incentives to raise emissions to increase allocations under the EU ETS.

B.2 Denmark

B.2.1 Danish CO_2 Emission Allowance Scheme

The Danish CO_2 Emission Allowance Scheme commenced in 2001 and applied to large electricity producers in Denmark. This scheme was integrated into the EU ETS from 1 January 2005.

B.2.2 Design

Table 2 Danish CO_2 Emission Allowance Scheme

Coverage	National Ran from 1 July 2001 to 31 Dec 2004 Electricity sector
Gases	Carbon dioxide
Point of obligation	Electricity producers Minimum threshold of 100,000 tonnes carbon dioxide per annum per firm; only the eight largest producers, two of which hold 93 per cent of permits, covering 90 per cent of emissions from the electricity sector
Emissions cap (target)	Cap-and-trade
Permit allocation	Grandfathering on historical emissions 1994 to 1998 (a stringent target well below current levels) Allocated to firms rather than installations, as used by EU ETS Some permits withheld for new entrants
Credit for early action	Special provision for Combined Heat and Power plants (50 per cent of plants) by allocating allowances to them first, thereafter allocating the remainder of allowances *pro rata* to meet cap
Competitiveness	Grandfathering and low penalty for excess emissions to keep Danish power generators competitive with those in neighbouring countries Some permits withheld for new entrants
International linkage	None
Offsets	Verified project credits from carbon storage, wind power projects abroad and reforestation Can be exchanged for emissions allowances (although exchange rate not one-to-one) Open in principle to Joint Implementation and Clean Development Mechanism, but not used
Trading period duration	Annual reporting
Banking and borrowing	Banking allowed only where emissions below a specific limit

Penalty	Penalty of 40DKK/tonne; market price averaged just below this Low penalty undermined compliance
Market ownership and governance	Small number of market participants (eight) meant trade relied on bilateral agreements (only 14 trades in the peak year) Transfer of permits reported to Danish Energy Authority by buyer and seller within four weeks of trade Reporting of fuel consumption, fuel type, power generated, emissions generated, using standard conversion factors ex post; reports checked by Danish Energy Authority Registry a simple password protected spreadsheet at Danish Energy Authority; trades entered manually Electricity producers paid administration fee to Danish Energy Authority of around two cents per allocated tonne; total admin costs less than NZ$0.5 million per year An Energy Complaints Board to handle trade-related complaints

Source: Various, see references in Appendix C

B.2.3 Performance

This scheme has now ceased, with integration into the EU ETS. Together with the voluntary UK ETS, however, the Danish scheme is thought to have had a significant influence on the design of the EU ETS.

B.3 Norway

B.3.1 Norwegian Emissions Trading Scheme

Norway instituted a domestic cap-and-trade ETS in 2005, coinciding with the implementation of the EU ETS and adopting a similar scope in terms of industry and gas coverage. The scheme complements other emissions mitigation mechanisms such as a domestic carbon dioxide tax. Installations subject to the tax are exempt from participating in the ETS.

B.3.2 Design

Table 3 Norwegian Emissions Trading Scheme

Coverage	National Commenced 2005 51 installations covering energy generation, oil refining, iron and steel production and processing, production of cement, lime, glass, glass fibre and ceramics Installations covered by the national carbon dioxide tax are initially excluded, notably offshore gas and oil production Emissions covered amount to around 15 per cent of Norway's total emissions Small installations are excluded, but the size threshold is unclear from the available literature (although likely to be consistent with the EU ETS, with which the Norwegian scheme was designed to align)
Gases	Carbon dioxide
Point of obligation	Installation operator
Emissions cap (target)	20.5 mega tonnes of carbon dioxide for the period 2005 to 2007 (determined after consideration of applications from industry for allowances and amounting to 91 per cent of the allowances requested) The King has discretion to determine the size and allocation of allowances Decisions on allowances are required to take Kyoto Protocol obligations into account
Permit allocation	Installations operating prior to 2001 are allocated allowances based on average emissions for the 1998 to 2001 period (with some allowance for discretion if production was not representative, such as due to shut down in a given year) Allocation should take into account substantial or potential substantial changes in production in the post 2001 period, although some degree of benchmarking may be used to determine if reductions in emissions intensity may be achieved Similarly, new plant or new entrants in the 2005 to 2007 period may be subject to benchmarking of some kind in the allocation of allowances Allowances are issued each year to an installation's account in the Norwegian Emissions Trading Registry, for which a notional fee is paid (NOK 0.33, about 0.04 Euro) per emissions allowance Otherwise, the allowances are distributed free of charge The initial allocation can be changed annually if the conditions on which the initial allocation was based change significantly, although modifications can only reduce, not increase, the number of allowances issued A general rule for allocation was that installations would receive allowances that were 95 per cent of their demonstrated need; this was reduced to 91 per cent when authorities made adjustments to the calculations submitted by emitters
Credit for early action	No
Competitiveness	No explicit consideration of competitiveness issues
International linkage	European Union Allowances from the EU ETS can be used to fulfil obligations under the Norwegian scheme

Offsets	Provision for project-based credits from outside the sectors covered by the emissions allowances (although it appears that this has not yet been operationalised) Certified Emission Reductions obtained under the Clean Development Mechanism can be used to offset obligations in the 2005 to 2007 period, but these will not be used to meet reduction obligations under the Kyoto Protocol
Trading period duration	Calendar year compliance, 1 March reporting and 1 May surrender
Banking and borrowing	Excess allowances are cancelled (unclear whether borrowing is allowed)
Penalty	If reporting is not forthcoming (i.e. received by 1 April), the right to transfer allowances is removed; fines may be applied to encourage reporting requirements, although it is unclear what this fine is Fines for excess emissions are 40 euros per tonne of carbon dioxide, corresponding to the Norwegian carbon dioxide tax Any person wilfully contravening the Act may also be subject to a term of imprisonment not greater than three months (in addition to fines)
Market ownership and governance	The Norwegian Pollution Control Authority has a national level mandate to administer the right to emit and therefore power over the right to hold and therefore to trade allowances Considerable executive and ministerial discretion within the Pollution Control Act creates considerable flexibility over who in practice controls allowances (e.g. national or local authorities) For the 2005 to 2007 period, allocations mainly determined by the Pollution Control Authority, although the Norwegian Ministry of the Environment made determinations in the case of two generators The Pollution Control Authority has responsibility for verification and control of reporting The Norwegian Emissions Trading Registry contains information on the allocation, issue, holding, transfer, surrender and cancellation of allowances Operators have a duty to notify changes to operations that impact on allowance allocation, given that reductions in activity can lead to cancellation of allowances Reporting is made public and is submitted via an internet portal To ensure that one allowance is similar to one tonne of carbon dioxide emitted, there are strict requirements for monitoring and reporting of emissions, which are administered by the Pollution Control Authority

Source: Various, see references in Appendix C

B.3.3 Performance

Of the 51 installations participating in the Norwegian ETS, 32 submitted reports. These 32 installations reported emitting a total of 5.7 million tonnes of carbon dioxide in 2005. Total emissions were four per cent lower than the total number of allowances allocated. Most of this reduction came from two firms, through one increasing its use of bio-fuels and the other postponing production due to gas supply issues. Given that the latter represents postponement of emissions rather than a permanent reduction the success of the scheme to date is limited.

The Norwegian Pollution Control Authority has reviewed the scheme and found that emissions reports in general have been of high quality, notwithstanding the

fact that some installations will need to improve their monitoring mechanisms, including installing new measuring equipment.

As in trading schemes in other countries, there was found to be an initial over-allocation of permits. For Norway, this was attributable to over-estimates of future production. This will be taken into consideration in future allowance allocations and in the preparation of allocation rules for the second trading period (2008 to 2012).

B.4 European Union

B.4.1 EU Emissions Trading Scheme

The EU ETS commenced in 2005. The first phase of operation will run from the 2005 to 2007 calendar years, cover carbon dioxide only and apply to a limited number of carbon intensive sectors. The scheme follows a cap-and-trade approach. Caps are determined by individual EU member states according to National Allocation Plans (NAPs). NAPs must be accepted by the European Commission, following assessment on several criteria including effectiveness in helping member states meet their Kyoto Protocol obligations under the Burden Sharing Arrangement, which distributes the EU's aggregate Kyoto Protocol obligations across member states. Although the scheme was intended to be extended in later phases, early indications from NAPs submitted for Phase II suggest that there will not be any material expansion of the scheme.

B.4.2 Design

Table 4 EU Emissions Trading Scheme

Coverage	EU member states Phase I, 2005 to 2007 Phase II, 2008 to 2012 Phase I, power generation (all combustion installations regardless of sector), minerals and oil, iron and steel, pulp and paper, building materials Inclusion of aviation from 2011 Some plants in the chemicals sector have been included from 2008 Aluminium was to be considered for Phase II, but has not been incorporated Intention to cover all sectors post 2012 (Phase III), including transport, but not yet decided Excludes small energy plants (threshold of 20 megawatts), although member states could also opt-in additional sectors and sources of emissions; Finland, Sweden, and Latvia opted in several local heating installations under 20 megawatts Excludes producers of iron and steel, cement, lime, glass, ceramics, pulp and paper according to size criteria relating to rated production capacities or output (e.g. installations producing pig iron or steel are included if their rated capacity exceeds 2.5 tonnes per hour) Opt-outs: 63 installations participated in the UK ETS had limited exemptions (see section on UK scheme); Netherlands also opted out several installations with emissions below 25,000 tonnes per year Pooling within sectors allowed if firms wished to cooperate to produce sector-wide reductions; some evidence that pooling occurred but has not been widely used to date Covers approximately 11,500 plants as at January 2005 Covers approximately 45 per cent of total carbon dioxide emissions or 35 per cent of greenhouse gases (varies by member state from 20 per cent of greenhouse gas emissions in France to 69 per cent in Estonia)
Gases	Phase I and II, carbon dioxide only
Point of obligation	Installation operator, where combustion or release of process emissions occurs
Emissions cap (target)	Phase I total allowances are around 1,830 mega tonnes of carbon dioxide per year, with an additional 74 mega tonnes set aside for new entrants and

	auctioning (compares with a verified approximate 1,785 mega tonnes emitted in 2005) Phase I caps were set as an interim step to meeting the Kyoto Protocol constraint in Phase II (eight per cent reduction in greenhouse gas emissions across the EU) NAPs create different emissions caps for different member states, generally less than projected business-as-usual emissions, but not as severe as the proportional effort required to meet the Kyoto Protocol In establishing baselines, it would have been advantageous to use 1990 as a baseline to align with the Kyoto Protocol baseline and to reward early action, but proved impossible due to insufficient information on emissions
Permit allocation	Allocated primarily free of charge via grandfathering, i.e. based on historical emissions but taking into account projections of future energy use and economic activity Allowed to auction up to five per cent of allowances in Phase I and up to 10 per cent in Phase II , but auctioning has not been employed to the extent allowed: - In Phase I, of the 25 member states only four (Denmark, Hungary, Lithuania and Ireland) have or will use auctions - In Phase II, a sample of 18 Member States' National Allocation Plans shows that seven include auctioning, ranging from a share of 0.5 per cent in Ireland and Flanders to seven per cent in the UK; the quantity of allowances to be auctioned corresponds to 1.3 per cent of emissions trading budgets (including reserves) for the Member States surveyed In determining allocations by sector, many member states put considerable weight on whether the sector's output faced external competition (e.g. UK allocations were most stringent for the electricity sector, which produces essentially only for domestic consumption; Finland, which trades electricity externally, allocated allowances to the electricity sector that were 30 per cent larger than baseline emissions) Several member states tried to use benchmarking; in most cases this was abandoned due to large data requirements and the compounding impact of heterogeneous products and production technologies, and was used in only a few restricted cases such as allocations for new entrants, the electricity sector in Denmark and Italy, and CCGT generators in Spain All member states set up reserves for new entrants, to whom allowances were generally allocated using benchmarking and issued free of charge Future allocations are being subjected to much stricter review by the European Commission
Credit for early action	Limited provision for early action, varying by member state Most member states do not have early action provisions, but the Czech Republic, Germany, Hungary, and Poland have early action reserves in their total allocations Other members set aside a portion of new entrant reserve for firms installing cogeneration plants or treat cogeneration favourably in allocation calculation methodologies
Competitiveness	NAPs must be consistent with EC rules prohibiting favourable treatment of a particular sector at the expense of intra-EU competition

	NAPs give member states some flexibility to favour specific sectors according to concerns about effects on competitiveness, particularly through free allocation of allowances (should be seen as transitional only); allows firms that do not face international competition to earn economic rent if they can pass on the cost of allowances despite not facing the cost themselves, but helps to minimise negative impacts on profitability for firms that face strong competition from abroad Tendency to place most stringent emissions caps on (largely) non-tradable sectors, such as the electricity sector where costs could be most easily passed through, providing a signal to consumers and incentivising both effective consumer choice and effective plant decisions in terms of technologies that minimise carbon dioxide production Reserves to provide free allowances to new entrants Most member states require forfeiture of allowances upon installation closure
International linkage	The EC linking directive of 2004 (2004/101/EC) explicitly links the EU ETS to the Kyoto Protocol and provides for its project-based mechanisms (the Clean Development Mechanism and Joint Implementation) The EU ETS does not recognise Kyoto Protocol Assigned Amount Units unless they have also been issued as European Union Allowances Expansion is allowed through bilateral agreements, but has not yet been formalised with any other trading schemes The EU ETS provides a central registry which links member state registries
Offsets	No sink credits allowed Clean Development Mechanism credits (Certified Emission Reductions) are allowed from Phase I (from 2005) Joint Implementation credits (Emission Reduction Units) allowed in Phase II (from 2008)
Trading period duration	Phase I, three years, 2005 to 2007, initial transition phase Phase II, five years, 2008 to 2012, coinciding with first Kyoto Protocol commitment period Annual reconciliation of obligations by calendar year Five yearly allocation plans and distribution of allowances NAPs to be approved every five years
Banking and borrowing	Banking and borrowing are allowed, but restricted in most member states in Phase I Only France and Hungary have allowed banking between Phase I and Phase II and no member states have allowed borrowing Banking between Phase I and Phase II can only take place if it does not result in an increased allocation of allowances to a member state over what is approved in its NAP

	Banking between phases is also subject to state aid rules (see Competitiveness, above)
Penalty	In Phase I, 40 euros per tonne of carbon dioxide equivalent In Phase II, 100 euros per tonne of carbon dioxide equivalent Also required to make up shortfall in the following year, to mitigate the environmental impact of transgressing Additional allowances are allowed in cases of demonstrated *force majeure* (natural disasters, war, threats of war, terrorist acts, revolution, riot, sabotage or acts of vandalism), but only during Phase I and only to individual installations on a non-transferable basis
Market ownership and governance	European Commission provides an emissions counting system, operates a central registry and approves NAPs Member states operate own registries Trading not restricted to any particular organisation Private sector markets have emerged to serve trading of allowances, providing spot, futures and forward contracts

Source: Various, see references in Appendix C

B.4.3 Performance

It is as yet too early to assess the effectiveness of the EU ETS in achieving the objective of reducing greenhouse gas emissions at least cost. Some of its current deficiencies reflect that many components are incomplete or still being developed.

B.4.3.1 Permit allocation

Review of the EU ETS provides a number of insights into the design of such schemes, particularly in understanding the pitfalls of allowance allocation mechanisms. Indeed, whilst all such schemes necessitate a trade-off between pricing the cost of carbon emissions and negative impacts on firm competitiveness and profitability, the EU ETS and member state NAPs err considerably on the side of the latter and certainly ignore most of the guidance provided by economic theory about the effective functioning of a trading scheme.

It is clear that in Phase I there has been a significant mismatch in supply of and demand for allowances, partly because potential sellers have lacked reliable information on the demand for their product and partly due to insufficient infrastructure to support sellers (Egenhofer *et al*., 2006).

There was also an initial over-allocation of allowances in several member states, due to a combination of industry lobbying, fears of competitive disadvantage especially relative to other EU member states, and the scheme's coverage of only a handful of industries and emitting activities. Prior to the verification of emissions for most member states in 2006, there was no robust catalogue of emissions, especially not relative to 1990 levels. It was therefore not possible to ascertain whether a member state's total or sectoral allocation was broadly consistent with its obligations under the Kyoto Protocol. Furthermore, many commentators considered that the European Commission was insufficiently strict in ensuring compliance with Annex III and the environmental and greenhouse gas reducing objectives of the scheme. The Commission's refusal to accept many member states' Phase II NAPs has been welcomed in many quarters as an indicator of increased stringency around the allocation process.

A first review of the EU ETS by the European Environment Agency (2006) emphasised the importance of transparent, objective and simple allocation rules, as well as consultation and collaboration with industry to identify difficulties and inconsistencies early on.

A general problem with the EU approach to allocation – grandfathering and free allocation – seems to be the iterative nature of such a design. When coupled with fairly short allocation periods, it may be in the interests of some firms to maintain a certain level of emissions in order to receive, or be able to argue for, larger allowance allocations in future. Whether or not this perverse incentive exists depends on the allowance price, but, with a steep forward price curve, there may be a strong incentive for firms to delay action to reduce emissions.

Although grandfathering favours less efficient and more emissions intensive activities, this does not affect the incentives for future efficiency. Historically inefficient firms have more to gain by raising efficiency and releasing allowances for sale. Similarly, although the free historically-based allocation of allowances gives existing firms an advantage over new entrants, existing firms face the same cost at the margin to increase production as new entrants.

B.4.3.2 Market governance

In addressing over-allocation, the European Commission is able to mediate the NAPs of member states. New Zealand has no such equivalent. This is not necessarily an impediment for New Zealand – it may be necessary for the EU only because member states are competing against one another in the context, *inter alia*, of the Burden Sharing Arrangement.

Administrative burden has been of concern in the EU ETS. Spain and the Netherlands found that, in these countries, the EU ETS imposed requirements on a large number of installations that accounted for a small volume of emissions. Furthermore, as at May 2006, four member states, Malta, Cyprus, Luxembourg, and Poland, did not yet have operational registries in place.

B.4.3.3 Prices

Uncertainty has caused considerable volatility in carbon prices. Principal sources of this uncertainty are:

- The future of the Kyoto Protocol Clean Development Mechanism and Joint Implementation mechanism and their volume/supply of credits;
- Timing for the introduction of the International Transaction Log – the Kyoto Protocol mechanism for recording international allowance and credit trading;
- Oil and gas prices – large rises and speculation about their sustainability;
- Perceived illiquidity in the market and market power concentration in some key sectors such as electricity generation; and
- The impact on the EU ETS of the expansion of the EU and the EU ETS membership to Bulgaria and Romania – acceded on 1 January 2007.

Trade in European Union Allowances has resulted in substantial price volatility, with one and two year ahead futures prices fluctuating between 10 and 30 euros over the course of 2005 to 2006. At the time of writing, prices for 2007 were as low as 1 euro. This volatility has been widely attributed to uncertainty about future allowance allocations and potential linking of the EU ETS with other trading schemes elsewhere in the world. Survey findings show that uncertainty about long-run developments in the ETS is seen as the greatest obstacle to liquidity in the carbon dioxide market (McKinsey & Company, 2005). The forward price curve currently steepens considerably for European Union Allowances after 2007, reflecting tighter supply through more stringent reduction targets in Phase II of the EU ETS.

Baron (2005) contends that an emissions market will always have lower liquidity than markets for other commodities, such as oil, due to the infrequency at which allowances are actually required. Hepburn *et al.* (2006) suggests that more frequent auctions would aid in market liquidity. The purported lack of market liquidity may be a particular concern in New Zealand, given our small size.

B.4.3.4 Concerns about windfall gains in the electricity sector

In a report on the assessments of EU ETS national allocation plans, the European Commission confirms concerns about wind-fall profits for electricity producers. This, it is alleged by a report from the High Level Group on Competitiveness, Energy and the Environment, is due to insufficient competitive pressure. The Ministry of Economic Affairs in the Netherlands estimated large windfall profits in the electricity sector due to emission allowances trading.

Windfall profits are possible if:

- Electricity generators have low emissions relative to their initial allocation (for example allowances for old coal-fired plant that would have been replaced with new gas-fired plants anyway);
- Allowances are allocated gratis – even if all these allowances are used to cover recipients' emissions, they are still valued at their market price; and
- The beneficial impact on less emitting generators if power prices are driven up by higher emitting thermal plants that must use emission allowances.

While windfall gains do not in and of themselves affect the efficiency of the policy, there may be concerns about its fairness. Auctioning of credits has been proposed (although that would not 'solve' the indirect' price effect). The EU ETS limits auctioning to a maximum of five per cent of total allowances for the period 2005 to 2007, and a maximum of 10 per cent in the 2008 to 2013 period.

In the first phase of the ETS most countries allocated allowances free of charge (apart from Denmark, Hungary, Ireland and Lithuania). Several others plan to auction the new entrants' reserve. In 2006, Dave Millibrant, the Secretary of state for Environment, Food, and Rural Affairs proposed to set the level of auctioning in the UK at seven per cent. Other countries also indicate some intent to use auctioning.

In further guidance to EU ETS members, following a review of the national allocation plans, the European Commission noted that allocations for power generators had been more restrictive than allocations for other sectors. (This restrictiveness frees up allowances to address competitiveness issues.) In the UK, for example, the power station sector was allocated allowances well short of its expected emissions, on the basis that it faced only limited international competition, and has a relatively large scope for low cost abatement (UK Approved National Allocation Plan 2005).

In as far the electricity generators exceed their restricted allowances, they will need to purchase allowances. While this may negate any windfall gain from initial free allocation, it does not later the beneficial 'price effect' on less emitting generators.

B.4.3.5 Competitiveness

A key element of the EU ETS, as of any ETS, is to manage the transition from an environment without a carbon constraint to one where carbon emissions carry a cost. From the perspective of scheme design and operation, this involves balancing the negative effects on firm costs and potential for emissions leakage with providing effective signals (i.e. accurate prices) for incentivising emissions reductions at least cost, particularly through investment in less carbon intensive technologies.

Arguably, this trade-off has been weighted heavily in favour of the former (firm competitiveness) in the case of the EU ETS. For example, although the economic literature suggests grandfathering in general around 15 per cent of allowances (albeit varying by sector and location) to help to preserve industry profits (Smale *et al.*, 2006), the EC chose to grandfather most allowances and auction only a very limited amount (up to five per cent in Phase I and 10 per cent in Phase II). As the EU ETS was established, many industries argued for output-based targets to prevent negative effects on competitiveness. Like benchmarking as an allocation mechanism, this can introduce the possibility of regulatory capture by industry due to information asymmetry, whereby firms know more about their own production possibilities and needs than do regulators.

McKinsey & Company (2005) conducted a survey of EU ETS stakeholders in 2005 to investigate experiences and opinions of the early stages of the scheme. A key finding from the survey was that around 50 per cent of firms incorporated carbon pricing into their operational decisions and longer-run planning decisions, including decisions on technological development. This indicates a degree of success as responsiveness to, or internalisation of, the carbon price is a necessary precursor to the effective functioning of the market and achievement of the objective of reduced emissions at least cost. The electricity generation sector was, however, an outlier in finding it easier to pass through the cost of carbon. More than 70 per cent of generators surveyed said that they were actively pricing in the cost of carbon in daily operations compared with an average of 36 per cent in other sectors.

McKinsey & Company (2006) also undertook an assessment of the impact of the EU ETS on the international competitiveness of EU firms as part of the EC review of the ETS. This assessment was largely theoretical and based on assumptions about allowance prices and price pass through in the electricity industry. It does, however provide a useful indication of the impact of the ETS on firm and industry costs. In particular, increased marginal costs in some sectors are found to be compensated to only a small extent by the free allocation of allowances. For

example, the pulp and paper sector is said to have experienced net cost increases of between zero and 6.2 per cent, depending on sub-sector and production technology. These net cost increases reflect that, although direct costs are largely offset by the free allocation of allowances, indirect costs from increased electricity prices are not offset. McKinsey & Company (2006) also suggests that the net cost impact masks the impact of increased production costs on firm competitiveness and the extent to which firms may choose to relocate part of their production to avoid the carbon costs. This occurs for two reasons. Firstly, production decisions depend on costs at the margin, not overall cost impacts. Secondly, and related to the first reason, firms can reduce production in the EU and sell surplus allowances, whilst increasing production in countries where there is no carbon cost. The latter can be offset in the longer run when allocations are adjusted at each phase and allowances may be removed if production has fallen. It is not yet clear, however, how allocations will be handled in future phases. Moreover, adjusting allowance allocations in future will not mitigate the impact of allowance prices on marginal costs.

McKinsey & Company (2006) notes that the overall impact of the ETS on industry margins in the EU is minimal so far, but there are large increases in marginal production costs in some industries. For example, it is suggested that primary steel production and cement production experience marginal production cost increases of, on average, between 17 per cent and 37 per cent.

Of relevance to margins, member states have adopted different approaches to compliance, such as how allowances are classified for tax purposes. Some member states, including UK, Germany and France, treat the transaction of allowances as a supply of service and therefore subject to VAT. Other member states consider profits and losses from transactions to be subject to corporate taxes. This kind of inconsistency in application is problematic, especially for firms operating across national boundaries.

With regard to scheme coverage, Buchner and Carraro (2006) contends that "inclusion of small installations was not worth it" (p.5) due to data problems and transaction costs from including small installations that are considered large relative to the small amount of emissions that "small" installations contribute. "For instance, in the UK, 20 per cent of the sites account for 94 per cent of emissions…". Apparently "Similar statistics are found in every Member State". Baron (2005) notes that 55 per cent of installations covered by the ETS emit only three per cent of total emissions covered by the scheme (p.74).

Finally, EU ETS new entrant and plant closure rules tend to keep high cost electricity generators in the market, which can raise electricity prices. In many member states this is reinforced by strong market power in this sector. In particular, the loss of allowances upon plant closure can provide perverse incentives for carbon intensive production to remain in operation via an implicit subsidy to production of carbon dioxide.

B.4.3.6 Time horizon

A common theme in many assessments of the EU ETS is that it provides insufficient balance between short-run and longer-run objectives (i.e. productive versus allocative and dynamic efficiency). This is exemplified in operational decisions being unaffected by whether new entrants receive free allocations or pay for their allocations. The scheme has a short-run bias in that allowance allocation lasts only five years. In surveys, firms have conveyed a preference for longer-run certainty in the scheme, including allocation periods of 10 years or more to facilitate investment planning (McKinsey & Company, 2005).

One implication of the inability of the EU ETS to manage short and long-run objectives is that, by definition, the scheme cannot yet be assessed on whether or not it has adequately performed its function of increasing the rate of adoption of less carbon intensive production technologies. Barron (2005) assesses that allowance prices would need to be "high" to encourage technology switching. It is not precisely clear what price constitutes "high", but scenarios are often evaluated at 10 euros per tonne of carbon dioxide, suggesting that "high" would be above this price.

Nor can the success of the initial phase be measured in terms of emissions reductions, as it is a transition phase and the targets do not represent drastic emissions cuts (Baron, 2005). Clearer signals are needed of long-run emissions reduction targets.

B.4.4 Some case studies

B.4.4.1 Cement sector

This section draws on a case study from the 2007 Holcim report, *Creating a Good Atmosphere*, which Holcim made available for this study.

The allocation of allowances for UK sectors included in the EU ETS is detailed in the United Kingdom's National Allocation Plan (NAP). The allocation process works from the national level through the sectoral and finally the cement manufacture installation level.

The UK national level allocation is based on its Kyoto protocol commitment and the Burden Sharing Agreement. All sectors were allocated allowances equivalent to their projected emissions, with the power station sector allocated the remainder (deliberately well short of its projected emissions). A New Entrants Reserve was subtracted from the forecast emissions for the sector, with the remainder being allocated to incumbents.

Table 5 shows that the cement sector was allocated 15.7 per cent more allowances than their total 2003 actual emissions, and of the cement sector total, 9.6 per cent of allowances were allocated to the New Entrant Reserve.

At the installation level, the allocation methodology was based on historical emissions, utilising data from 1998 through to 2003 (the baseline period) for the years in the base line period where the installation was in operation, but excluding the lowest year's emissions. These 'relevant emissions' were used to determine each installation's share of the sector's allowances.

Table 5 Comparison of historic emissions and annual allocations

	Annual allocation before subtracting NER	% of sector total allocated to New Entrant Reserve (NER)	Annual allocation to existing installations (i.e. after NER)	Average annual emissions (1998-2003)	Annual emissions (2003)	% change between annual emissions in 2003 and total allocation
	MtCO2	%	MtCO2	MtCO2	MtCO2	%
Power Stations	136.9	4.6%	130.6	155.01	174.37	-21.5%
Refineries	19.8	2.0%	19.4	17.74	18.03	9.8%
Offshore	19.1	8.1%	17.5	16.62	17.47	9.1%
Iron & Steel	23.7	15.6%	20.0	18.33	19.85	19.4%
Cement	11.2	14.3%	9.6	8.84	9.71	15.7%
Chemicals	10.4	8.8%	9.4	9.02	9.41	10.0%
Pulp & Paper	5.1	2.2%	4.9	3.66	4.53	11.6%
Food, Drink & Tobacco	3.9	3.7%	3.8	3.08	3.95	-1.3%
Non-Ferrous	3.1	2.1%	3.0	2.72	2.80	9.1%
Lime	2.7	1.4%	2.6	2.29	2.22	20.3%
Glass [1]	2.2	7.9%	2.0	1.72	1.92	13.9%
Services	2.1	2.9%	2.0	1.78	2.03	1.6%
Other Oil & gas	1.9	18.3%	1.6	1.42	1.92	1.5%
Ceramics	1.8	4.3%	1.8	1.73	1.79	3.4%
Engineering & Vehicles [2]	1.3	2.7%	1.3	1.08	1.19	8.6%
Other [3]	0.4	10.5%	0.4	0.34	0.38	4.7%
TOTAL	245.43	6.3%	229.85	245.37	271.55	-9.6%

Notes: (1) http://www.defra.gov.uk/Environment/climatechange/trading/eu/nap/approved.htm

Source: DEFRA, Approved National Allocation Plan

Access to the New Entrants Reserve allowances was not restricted solely to new installations. Extensions to existing installations or new equipment may qualify too, if it raises capacity.

For the UK Phase II allocation, all sectors other than power generators will be allocated allowances equivalent to their projected business as usual emissions (but also taking into account the technological potential to reduce emissions), and the deduction for new entrants. For all installations, this allocation is 98 per cent of 'relevant emissions', which for all but one installation is the same or somewhat more than the Phase I allocation.

The UK allocation process in Phase I and Phase II highlights how:

- Historical data has been used in setting allocations;
- Industrial sectors (including cement) are largely insulated from the emissions reduction target adopted by the UK – the burden was placed on the electricity sector;
- Allowance has been made for growth in emissions – the use of business as usual as the basis for sectoral allocation; and

- Allowance is made for new entrants or extension of existing site capacity.

B.4.4.2 Electricity sector

The European Commission noted recently that in most national allocation plans, the allocation for power generators had been more restrictive than allocations for other sectors.

In the UK, for example, the power station sector was allocated allowances well short of its expected emissions (see Table 5). The rationale was that the power sector faces only limited international competition, and has a relatively large scope for low cost abatement (UK Approved National Allocation Plan 2005). Similar arguments are used in other plans: this restrictiveness frees up allowances to address competitiveness issues in other sectors – a point not unnoticed by the European Commission which raised concerns this could be interpreted as going against state aid and international trade rules.

One of the exceptions is the Netherlands, which allocated allowances proportionately across all sectors, based on target emission reduction of six per cent compared to the reference level (or 10 per cent in terms of the domestic emissions quota) – deemed burdensome for the Netherlands as it already had a relatively energy and emission efficient industry. (The marginal abatement costs are double that of the average of the EU.)

The domestic emissions quota is divided among sectors on the basis of sector targets at 2010. These targets take account of anticipated economic growth and past energy efficiency agreements. Industry (including the energy sector) has 51 per cent of the allowances. (And those that have done more than their agreements specified will get credits, thus also rewarding early action). On an installation basis, the allocation is calculated as the product of: historic emissions (2001-2002), sector growth (2003-2006), a relative energy efficiency factor, and a factor to scale the allowances to the total quota. For power generators a fixed energy yield factor was used in place of the relative energy efficiency factor (usually an international benchmark).[20]

The case study illustrates:

- The potential for different allocation methods to work side-by-side within one trading scheme;
- The propensity, in the EU at least, to load the burden onto a sector that is relatively sheltered from the competition (but disregarding flow-through effects); and
- The contrasting allocation approach used when there is an expectation of relatively large and low cost abatement (as in the UK) compared to a situation where marginal abatement costs are relatively high (as in the Netherlands).

[20] http://www.senternovem.nl/mmfiles/Dutch%20allocation%20plan040820_tcm24-110316.pdf

B.5 United States of America

Despite the US government's apparent reluctance to embrace Kyoto Protocol style emissions reduction targets and trading systems, emissions trading instruments have been applied to environmental issues in the USA since the 1970s. They have evolved over this time, due in part to adaptive management and experience gained, offering insights on the design elements that are likely to be effective in restraining greenhouse gas emissions.

B.5.1 Early trading examples

In the 1970s, the Environmental Protection Agency (EPA) allowed organisations to earn credits for reductions in emissions of various pollutants into the air beyond the standard required on their permits, and trade these credits with other organisations. In areas with sub-standard ambient air quality, the EPA's offset policy required new and expanding sources to secure sufficient emissions credits to offset their increase in emissions. The EPA began treating all emissions from an organisation with multiple discharge points within the same air-shed as if in a single "bubble", such that it is the total emissions within the bubble, not emissions from each discharge point, that is subject to control.

In the 1980s, a trading regime was used in phasing out lead from gasoline. A fixed quantity of lead rights was allocated to refiners, allowing those who did not need their full allocation to sell their surplus to those who needed more than their allocation. As the scheme aimed to eliminate lead, entitlements would in time lose value, hence refiners had an incentive to reduce their lead requirements quickly to free up rights for sale. The scheme allowed banking between years, which increased the refiners' flexibility in implementing their own phase-out of lead. The scheme has been estimated to have saved industry US$265 million relative to a phase-out without trading – a modest saving compared with a net benefit from resulting public health improvements of around US$30 billion (Tietenberg, 1999).

Trading was also used to accelerate the phase-out of ozone depleting chemicals following the Montreal Protocol in 1988 and its associated London Accord, which in 1990 set a target of complete phase-out of halons and CFCs by 2000. EPA allocated annual allowances to major US producers based on historical use, set at 100 per cent in the first year and progressively reduced to lower levels in successive years. The rights to surplus allowances were vested in producers and tradable, even across national borders with prior EPA approval. Congress imposed a new tax to soak up any windfall rents for producers whose historical allocation exceeded their initial needs.

B.5.2 More recent examples of emissions trading

B.5.2.1 Sulphur dioxide trading

Generally regarded the most successful emissions trading programme to date is that created under Title IV of the Clean Air Amendment Act 1990, which was

designed to reduce acid rain (another cross-border issue). Under this programme, EPA allocated allowances to older electricity generators and other sulphur emitting plants, setting a cap on total emissions to ensure reductions in emissions over time. EPA withholds 2.24 per cent of allocated allowances each year, which are auctioned off by the Chicago Board of Trade with the intention of facilitating new entrants to acquire allowances as well as providing a public forum for setting and disclosing the price of the allowances. This scheme allows banking of unused allowances to subsequent years, but not borrowing against future entitlements.

By 1995, US sulphur emissions had dropped by 30 per cent from 1980 levels. In these early years (1990-95) relatively few trades were made, yet the costs of compliance with emissions reductions were less than had been anticipated – industry had predicted allowance prices from US$600 to US$1,000 per ton; government had predicted US$400 to US$600 per ton; but the market experience was that, after an initial flurry around US$300 per ton, the price settled around US$125 per ton through the late 1990s (Saile, 1998, p.87).

The limited need to purchase allowances has been attributed to the regime achieving two improvements in regulation – a move towards performance standards and formal allowance trading, the first of which enabled improvements in cost effectiveness and dynamic efficiencies even in the absence of much trading (Burtraw, 1996). It was also assisted by fortuitous circumstances at the time, such as increased supplies of low sulphur coal becoming available at low cost due to coincidental deregulation of rail transport (OECD, 1998).

B.5.2.2 RECLAIM

In the early 1990s California established a Regional Clear Air Incentives Market (RECLAIM) to reduce emissions of nitrogen oxides and sulphur from stationary sources. Industrial polluters were allocated annual RECLAIM Trading Credits on the basis of their historical peak levels, with decreases in total allowable emissions in successive years. This scheme allows neither banking nor borrowing and experienced extreme price volatility at the time of the California electricity crisis in 2000, when unusually high temperatures increased demand for power and necessitated new generation sources brought into the market needing to acquire allowances quickly. In the event, the market broke down and regulators intervened with a fixed non-compliance fee, which capped the price of allowances.

B.5.2.3 Ozone Transport Commission

Twelve states in the New England and Mid-Atlantic region have co-operated on this scheme to reduce smog. This involves allocating allowances for nitrous oxide emissions during the control period to individual fixed sources. These allowances are saleable, bankable and tradable between states.

B.5.2.4 Emissions Reduction Market System for Volatile Organic Materials

Less well known than the sulphur dioxide trading scheme is the Emissions Reduction Market System for Volatile Organic Materials (VOMs) run in Chicago and Illinois. Allowances were given to stationary point emitters of VOMs with a view to using trading to encourage reductions. In the first years of operation, emissions were below the annual cap set and allowance prices much lower than expected. This has been attributed to aspects of the baseline-setting processes, which inflated the cap with provisions for extreme eventualities, the additional impact of new hazardous pollutant regulations introduced prior to the cap, and the shut-down of many emitting facilities which reduced emissions even further (Evans and Kruger, 2006). This points to the inherent unpredictability in setting a cap, the need for accurate and reliable data in setting emissions baselines and projections, and the need for robust mechanisms to address uncertainties and to make mid-course adjustments if necessary.

B.5.3 Current sub-national interest in carbon emissions trading

B.5.3.1 Chicago Carbon Exchange

The Chicago Carbon Exchange is a voluntary, legally-binding self-regulatory programme for reducing and trading greenhouse gases, with members in the USA, Canada and Mexico and involvement of carbon offset providers in Brazil. Exchange members with direct emissions commit to reduce their carbon dioxide equivalent emissions of all six Kyoto Protocol greenhouse gases by one per cent per year over 2003 to 2006, relative to baseline average emissions in 1998 to 2001, with further annual reductions planned over the 2007 to 2010 period. Exchange members reducing emissions below their required level can sell their surplus allowances on the exchange or bank them for use in future years. Exchange members unable to reduce their own emissions can purchase allowances from other members or purchase project-based offsets from methane destruction or carbon sequestration.

The exchange has an internet-accessible trading platform for real-time trading in its Carbon Financial Instruments. This is linked with the exchange's registry of members' emissions data and entitlements and serves as the recording and transfer mechanism for all Carbon Financial Instrument trades, both those that are cleared through the exchange and those that are reached through off-line negotiation between members.

Firms participate and make voluntary commitments because of the opportunities this offers for building capacity in greenhouse gas trading, for positioning themselves should a more formal regulated market arise, and to enhance their standing with customers, employees, government and their communities.

B.5.3.2 Regional Greenhouse Gas Initiative

Nine states in New England and the Mid-Atlantic region are currently in the process of designing a regional cap-and-trade mechanism for greenhouse gases. Intended initially to cover carbon dioxide from power generation plants, it will provide a uniform approach to facilitate inter-state trading and, if successful, be extended to other sectors and sources. The first compliance period starts in January 2009 and the initial cap will be set at 1990 levels for the period 2009 to 2014, falling to 10 per cent below 1990 by 2018. The cap is applied regionally, but each state receives an initial share of allowances. The compliance periods are planned to be three years in duration. Project-based emissions reductions or carbon sequestration achieved beyond the electricity sector may be used for compliance, but only up to a limit of 33 per cent of reported emissions for any generator subject to the Regional Greenhouse Gas Initiative.

Table 6 US trading schemes

	Sulphur dioxide trading	RECLAIM	Ozone Transport Commission	ERMS for Volatile Organic Materials	Chicago Carbon Exchange	Regional Greenhouse Gas Initiative
Coverage	All USA Power generators	California Industrial point sources	New England and Mid-Atlantic states Industrial point sources	Chicago and Illinois Industrial point sources	All USA, Canada and Mexico Exchange members with emissions	New England and Mid-Atlantic states Power generators May be extended to other sectors and sources
Gases	Sulphur dioxide	Nitrogen oxides and sulphur	Nitrous oxide	Volatile organic materials	Kyoto Protocol six greenhouse gases	Carbon dioxide
Point of obligation	Point source operators	Point source operators	Point source operators	Point source operators	Point source operators	Point source operators
Emissions cap (target)	Cap-and-trade	Cap-and-trade	Cap-and-trade	Cap-and-trade	Cap-and-trade, plus credit offsets	Cap-and-trade, plus credit offsets
Permit allocation	Grandfathered	Grandfathered	Grandfathered	Grandfathered	Grandfathered	Grandfathered
Credit for early action						
Competitiveness						
International linkage						
Offsets					Carbon reduction projects and sequestration	Carbon reduction projects and sequestration
Trading period duration	Annual	Annual	Annual	Annual	Five years	Three years
Banking and borrowing	Banking but no borrowing	No banking nor borrowing	Banking but no borrowing	Banking but no borrowing	Banking but no borrowing	Banking but no borrowing
Penalty						
Market ownership and governance	EPA and private exchange	State oversight	Joint state oversight	State oversight	Private exchange	Joint state oversight

Source: Various, see references in Appendix C

B.5.4 Performance

The US emissions trading experience has been summarised by Pew Center on Global Climate Change (2003):

- Emissions trading has been successful in its major objective of lowering the cost of meeting emissions reduction goals;
- Emissions trading has enhanced, not compromised, the achievement of environmental goals, with many programmes showing faster than expected Emissions reductions;
- Emissions trading works best when the traded unit is clearly defined and tradable without case-by-case pre-certification (a hindrance with some emissions reduction credit schemes);
- Banking has played an important role in improving the economic and environmental performance of emissions trading programmes; and
- Initial allocation of cap-and-trade allowances has enabled equity and political concerns to be addressed without impairing the operation of trading.

B.5.4.1 Reduction credits or emissions allowances

Early emissions trading entailed the creation of emissions reduction credits, but later schemes have involved allowance trading. Credit trading depends on the existence of pre-determined emissions standards; exceeding these creates credits that the emitter can later trade. Entitlements are denominated as flows per year, and credit schemes do not necessarily involve a limit on total emissions, such that they can result in emissions continuing to increase even though trading lowers the cost of abatement (because there is a monetary gain from sale of the credit to offset the cost of abatement). Allowance trading is genuine cap-and-trade, with entitlements defined in discrete terms (e.g. tonnes) and an absolute limit in the quantities available in the trading period. It requires allocation of allowances, which presents both challenges and opportunities for addressing distributional issues.

In practice, credit trading has not worked as well as allowance trading due to high transaction costs in the creation and transfer of credits (Ellerman, 2005). In credit systems, the final decision on credit eligibility rests with the regulator, which may attract further costs through special interest pleading. It can also create uncertainty over whether a reduction receives credit. Under allowances, the decision is devolved to firms themselves, and once the overall cap has been set, the regulator's role reverts to that of enforcement and special pleading becomes uneconomic. Allowance trading provides greater flexibility for firms and is likely to be more efficient.

B.5.4.2 Downstream and upstream

Practical experience of emissions trading in the USA has been entirely for downstream points of obligation – stationary sources like power stations and

factories. The need to extend coverage of greenhouse gas emissions trading to numerous small and/or mobile sources like automobile drivers, households and small businesses implies high transaction costs, so incorporating upstream points of obligation is likely to be more cost-effective.

The US experience to date gives little guidance on what is required of the "hybrid" schemes likely for greenhouse gas emissions trading, such as a mix of upstream and downstream points of obligation, and a mix of capped allowances and uncapped credits (such as those created by the Kyoto Protocol's Clean Development Mechanism). There may also be some as yet unresolved issues in designing a partial system based on downstream obligations and capped allowances as a first step in evolving a more comprehensive mixed system covering more emissions sources.

B.5.4.3 Permit allocation

US schemes have all favoured allocation by grandfathering to existing emitters for almost all allowances, with minimal provision for withholding allowances for new entrants. Suggested potential problems, such as market power being used to manipulate allowance prices and/or exclude competition, have not emerged. As a form of *gratis* allocation, grandfathering creates incentives for sources to identify themselves, but also for opportunistic lobbying (Stavins, 2005). If it is necessary to grandfather to gain widespread support for emissions reductions, the cap-and-trade approach would be the preferred form of emissions trading (Ellerman, 2005, p.91).

Although the preference for grandfathering has its roots in political economy and the building of support for introducing the scheme, this approach would be more contentious in schemes with wider coverage. It has been estimated that as little as 10 per cent of US carbon allowances grandfathered to existing emitters would be sufficient to offset impacts on competitiveness (Gouldner, 2000).

The sulphur dioxide trading scheme includes auctioning a small amount each year and a set-aside of allowances that government can sell if need be, specifically to counter any sign of anti-competitive behaviour. Even in the early years when there was limited trading, auctioning has been attributed with reducing transaction costs by clarifying the prices and exchange values of allowances – lowering the spread between the highest bid and the clearing prices (Tietenberg, 1999). Few schemes to date have made much use of auctioning, despite its efficiency advantages in providing revenues, which can be used to reduce distorting tax or to compensate cases of distributional disadvantage (Morgenstern, 2005).

Some schemes have allowed voluntary opt-in of new emitters once the schemes are up and running. Unsurprisingly, these exhibit signs of adverse selection – those who benefit opt-in, those who do not stay out – but this may be a necessary price to pay for broadening the schemes.

B.5.4.4 Banking and borrowing

All the more recent US schemes other than RECLAIM allow banking and have shown it can lead to significant acceleration of emission reduction, as well as dampen price volatility. Banking provides temporal flexibility to firms – effectively a form of inventory to be used in meeting unexpectedly high demand in the following year, thereby dampening allowance price fluctuations. The sulphur dioxide trading scheme, which has greatest flexibility in allowing nationwide trading and unlimited banking, has experienced a ratio of highest price to lowest price of no more than three-to-one. The corresponding ratio for the more restrictive RECLAIM programme is 60-to-1 (Ellerman, 2005, p.85).

Banking appears to be an important part of these differences between programmes. The arguments against banking – that it may create temporal or local "hotspots" of excessive concentrations of emissions – are relevant for local air quality issues, but not for a uniformly mixed stock pollutant like greenhouse gases, whose global reach and longevity mean that any variations in annual flows caused by banking have minor overall environmental effect.

The arguments against borrowing are less easy to dismiss for international emissions trading. Whereas a national authority can enforce and recover infringements in borrowing rules domestically, it would be more difficult to monitor and enforce recovery of entitlement amounts borrowed in earlier years from different sovereign states. Constraints on borrowing entail some loss of flexibility, but this is an inevitable trade-off against the longer term savings in future enforcement.

The US experience also shows how the pre-existing regulatory environment, together with external events, can affect the performance of schemes and their costs, creating challenges for setting meaningful caps that create sufficient scarcity for market trades to emerge (Stavins, 2005). An economic instrument such as emissions trading has advantages over more prescriptive regulatory approaches, such as standards, where cost structures are highly variable across the regulated organisations, as is likely in greenhouse gas emissions.

B.6 Canada

Canada has operated two voluntary pilot ETSs in the past. These were the Ontario-Quebec Pilot Emissions Reduction Trading scheme (PERT), which ran from 1996 to 2000, and the Greenhouse Gas Emission Reduction Trading scheme (GERT), which was a collaborative initiative between the Federal Government, provinces, industry, and labour and environmental groups and operated between 1998 and 2001. Both schemes were project based, for earning and trading credits. PERT covered greenhouse gases and other air pollutants. GERT covered greenhouse gases.

Ontario also has a cap, credit and trade style ETS, which combines elements of both baseline-and-credit and cap-and-trade approaches. It currently covers nitrous

oxide and sulphur dioxide and has been operating since 2001. The objective of the scheme is to reduce smog-causing emissions rather the greenhouse gases *per se*, although extension to greenhouse gases is being considered. It covers seven large industrial sectors – electricity, iron and steel, cement, petroleum refining, pulp and paper, glass and carbon black – which are required to reduce their emissions in stages. Emissions allowances were initially allocated free of charge and administered by the Ministry of the Environment. Allowance allocations are based on requests from firms according to their expected emissions. The total amount of emissions allowed is capped and the Ministry of the Environment determines the distribution of allowances after considering requests by firms. In addition, firms can receive emissions reduction credits through project-based initiatives for emissions reductions based on approved processes and technologies. Firms must apply for these separately. The use of emissions reduction credits is constrained relative to reductions in emissions through use of allowances. Constraints vary according to emissions, but are in the range of one-in-ten to one-in-three emissions reduction credits to allowances.

B.6.1 Canadian Emissions Trading Scheme

Canada has also signalled interest in introducing a nationwide scheme of allowance trading. The previous government's 2005 proposals are summarised in Table 7, below. A new government came into power in 2006, which is reconsidering this proposed design, but has indicated that it is seriously considering implementing an ETS for the purpose of addressing both air quality and climate change.

B.6.1.1 Design

Table 7 Canadian Emissions Trading Scheme

Coverage	National Planned to commence in 2008, including transitional phase for 2008 to 2012 Large final emitters in mining, manufacturing, oil, gas and thermal electricity sectors In principle, any sectors can be involved in project-based offset credits
Gases	Kyoto Protocol six greenhouse gases
Point of obligation	Installation/facility; the facility operator is directly responsible for reporting compliance Large final emitters in sectors that emit an annual average of eight or more kilo tonnes of carbon dioxide equivalent or an annual average of 20 kilograms or more of carbon dioxide equivalent per CA$1,000 gross production From 2006, large emitters must report their annual emissions
Emissions cap (target)	Not yet set. However, according to the gazetted announcement in 2005 of an intention to regulate large final emitters, there is an overarching objective to reduce emissions by 45 mega tonnes of carbon dioxide equivalent for the period 2008 to 2012 Under the current Climate Change Plan for Canada, the Federal

	Government has set a target of reducing large final emitter emissions intensities by 15 per cent from 2010 levels for the Kyoto Protocol period of 2008 to 2012, which is expected to deliver 55 mega tonnes in reductions Longer-term targets will also be set Reduction targets are zero for fixed process emissions and 15 per cent for all other emissions, subject to the limit that the target reductions will not exceed 12 per cent of total emissions The notice of intention to regulate also notes that targets will be based on sectoral emissions intensity Proposed emissions targets for new facilities or transformed or expanded facilities will be based on benchmarking
Permit allocation	Not yet determined
Credit for early action	Firms investing in R&D may be eligible for emissions credits, capped at nine mega tonnes total
Competitiveness	Competitiveness issues have not yet been dealt with in detail, although the potential disadvantage to Canadian firms relative to US firms (especially as the US has not ratified the Kyoto Protocol) has created considerable opposition to an ETS in some sectors
International linkage	The scheme allows the purchase of international Emission Reduction Units, Certified Emission Reductions and eligible Assigned Amount Units Canada is also considering explicit links with other Kyoto Protocol parties PEW Center on Global Climate Change (2005) considers it doubtful that the Canadian scheme would be able to link with the EU ETS, largely because of its "lax" system of having an effective cap of CA$15 per tonne of carbon dioxide (see "penalty")
Offsets	Includes project-based offsets Proposed projects include demand management by utilities and reforestation Activities covered by regulations governing large final emitters cannot be considered as offsets; for example, only cogeneration outside the large final emitter system could be eligible for offset credits Sources or sinks covered by offsets include those in the Canadian greenhouse gas inventory for the Kyoto Protocol, plus measures not in the inventory if they meet other criteria such as being verifiable quantifiable reductions from business-as-usual
Trading period duration	Not yet determined
Banking and borrowing	Offset credits are tradable and bankable
Penalty	No penalty 2008 to 2012; cost of compliance (i.e. credit purchase price) is guaranteed not to rise above CA$15 and it appears that the Canadian government will be offering credits at this price (or less) Post 2012, the notice of intention to regulate large final emitters notes that penalties will not be greater than (and suggests that they may be precisely) CA$200 per tonne
Market ownership and governance	Not yet determined, but an important aspect of the Canadian ETS is the role of the government in acting as a central bank for emissions allowances; in combination with the price cap, the role of the government will be akin to that of a central bank operating a fixed exchange rate

Source: Various, see references in Appendix C

B.6.1.2 Performance

According to Baron (2005), Canada's previous province level schemes, PERT and GERT, resulted in very few trades, as a consequence, at least in part, of participation and emissions constraints being voluntary.

In progressing development of a national scheme, an expert workshop with stakeholders was held in December 2006 to discuss the design of an ETS for Canada (International Institute for Sustainable Development, 2006). This highlighted that the most critical requirement for an ETS is a set of enforceable regulatory restrictions on emissions to create scarcity and therefore benefits from trading. It emphasised the importance of transparency, integrity, price discovery, allocation and trading rules, and other compliance mechanisms to ensure that the market operates efficiently, with sufficient liquidity and depth and without undue price volatility, uncertainty or cost risk.

B.7 Australia

Under the Kyoto Protocol, Australia's commitment would be to limit its greenhouse gas emissions to 108 per cent of 1990 levels by the initial target period of 2008 to 2012. This compares with business-as-usual projections of 130 per cent. The Federal Government has refused to ratify the Kyoto Protocol in advance of effective longer-term global action on climate change, but has committed to the above emissions target, which it had accepted as part of the Kyoto Protocol negotiations.

Australia's position on greenhouse gas emissions trading is still evolving, from Federal Government opposition to emissions trading in the absence of an effective global response, to State and Territory Governments launching their own design initiative for a national scheme, to, as recently as December 2006, the Federal Government announcing a review of emissions trading with a view to designing a global scheme in which Australia could participate.

In addition to having both federal and state levels of government, other features of Australia influencing its attitude to emissions reduction are its abundant reserves of coal, gas and uranium and the relatively high contribution to the economy, including the future growth potential, of energy intensive industries (e.g. aluminium and alumina, iron and steel, cement and cement products, non-metallic mineral products and non-ferrous mining). These features present Australia with a challenge in contributing to a global reduction in greenhouse gas emissions without unduly surrendering the advantage of its resource endowments or handicapping its economy.

Two national, one global and three state-level trading scheme initiatives are summarised below:

- Mandatory Renewable Energy Target
- National Greenhouse Gas Emissions Trading Scheme

- Australian proposal for an Asia-Pacific Partnership based emissions trading regime
- Greenhouse Gas Reduction Scheme and other state level schemes.

B.7.1 Mandatory Renewable Energy Target

The Mandatory Renewable Energy Target (MRET) was introduced in 2001 to encourage the development of a more sustainable renewable energy supply industry (Australian Government, 2006a). Its specific objectives are to encourage greater generation of electricity from renewable sources, to reduce emissions of greenhouse gases and to ensure that renewable energy sources are ecologically sustainable.

MRET aims to increase Australia's annual renewable energy generation by 9,500 gigawatt hours by 2010. It imposes a legal liability on large electricity retailers and buyers of wholesale electricity to support renewable energy electricity generation, through requiring them to acquire and surrender Renewable Energy Certificates (RECs) in proportion to the amount of electricity they buy.

B.7.1.1 Design

Table 8 Australian Mandatory Renewable Energy Target

Coverage	National 2001 to 2020 Large wholesale electricity buyers and electricity retailers
Gases	Indirectly through greater generation of renewable energy
Point of obligation	Majority of electricity retailers and wholesale electricity buyers on liable grids exceeding 100 megawatts Buyer of wholesale electricity must surrender Renewable Energy Certificates (RECs) in proportion to the amount of electricity bought Each REC represents one megawatt hour of eligible renewable electricity Electricity purchases are multiplied by the Renewable Power Percentage (RPP), which is specified in regulations each year and determines the number of RECs that must be surrendered (e.g. RPP for 2006 is 2.17 per cent) Mandated through legislation
Emissions cap (target)	Aggregate target increase in annual generation of renewable energy of 9,500 gigawatt hours by 2010 Interim annual targets set for smooth transition to final target
Permit allocation	RECs can be acquired from eligible renewable energy power stations and other eligible renewables or other REC sellers Renewable energy power stations, once accredited, can create RECs from generation in excess of the power station's 1997 level of generation Deemed output systems (eligible solar water heaters and small generation units) can create RECs, according to the amount of electricity that they displace in the case of solar water heaters, or the size of small generation unit and amount of time it is deemed to generate electricity
Credit for early action	

Competitiveness	
International linkage	MRET was initiated within the context of Australia's Kyoto Protocol negotiations
Offsets	Not applicable
Trading period duration	Scheme commenced 2001, ends in 2020 Annual target to be achieved by 2010 Transitional interim targets set by calendar year
Banking and borrowing	Once registered, RECs can be banked indefinitely by purchasers in anticipation of an increase in market price Penalty system equivalent to allowing borrowing up to three years in advance through state.
Penalty	Liable parties are required to pay the shortfall charge for each megawatt hour of liability for renewable energy for which they do not acquire and surrender RECs Shortfall charge is AU$40 per REC Leeway of 10 per cent allowed before penalty applies, but must be made up within three years Penalty can be redeemed if required number of RECs are surrendered within three years of payment of penalty
Market ownership and governance	Central registry, publicly accessible on internet, records creation, transfer and surrender of RECs Regulator appointed to ensure requirements of MRET are met, including enforcing legislation through penalties and conducting audits Annual reporting requirements, financial and administrative

Source: Various, see references in Appendix C

B.7.1.2 Performance

MRET was subject to an independent review in its third year, 2003/04 (Australian Government, 2006b; Kent and Mercer, 2004). As a consequence of this review, the government reconfirmed its commitment to MRET, but also announced improvements to the scheme's operational and administrative efficiency. These improvements include enhancing market transparency, improving business certainty and increasing opportunities for bio-energy and solar technologies. These improvements were implemented under the Renewable Energy (Electricity) Amendment Act 2006, commencing September 2006.

MRET is arguably an industry development initiative rather than, directly, an emissions reduction initiative. As such, it is complementary to a national ETS. MRET's mandating of particular technologies is equivalent to the government "picking winners" potentially at the expense of more efficient solutions. In contrast, emissions trading is technology neutral, allowing market forces to direct the adoption of the most efficient ways of achieving a given emissions reduction target.

Much effort has been expended in interpreting what MRET was intended to achieve and whether it has succeeded. This points to the need for such schemes to

have clear objectives, for both identifying their intention and measuring their success.

In measuring success, it is unclear how much of the additional investment in renewable energy that has occurred is due to the scheme and how much would have occurred anyway. The latter raises the question of whether the target set was too low, given that this sector was already growing strongly.

MRET was subject to an extensive review after only two years of operation, which is relatively early and may have provided insufficient time for it to be fully tested and its strengths and weaknesses to emerge. Furthermore, the review's deliberations were based on stakeholder submissions, which were difficult to evaluate, based more on assertion than evidence and coloured by the perspective and interests of submitters.

B.7.2 National Emissions Trading Scheme

State and Territory Governments have been working together to design a National Emissions Trading Scheme (NETS) without Federal Government support, indeed in the face of Federal Government opposition on grounds of possible impacts on energy prices, employment and economic growth (Warnken Ise, 2006). State and Territory Governments see development of an ETS to be essential as the most flexible, efficient and least-cost mechanism for achieving emissions reductions. A discussion paper was released in August 2006 on the approaches proposed (National Emissions Trading Taskforce, 2006).

B.7.2.1 Design

Table 9 Australian National Emissions Trading Scheme

Coverage	National Proposed to start in 2010 Sector based Initially, the stationary electricity sector (including electricity, gas and coal) Designed to allow extension to other sectors over time
Gases	Kyoto Protocol six greenhouse gases Some are not emitted by the liable participants, but could be relevant through offset credits
Point of obligation	Initially, electricity generators with capacity over 30 megawatts Flexibility to introduce other participants, such as proposed to extend scheme at end of first five years to large stationary energy users that emit more than 25,000 tonnes of carbon dioxide equivalent per year and fugitive emissions from gas pipelines From 2015, gas would be included with upstream point of obligation; gas retailers should hold allowances for imputed emissions from gas sales to customers (excluding those already covered) Participants would be required to submit a permit for each tonne of carbon dioxide equivalent they emit
Emissions cap (target)	Designed to achieve a 60 per cent reduction in greenhouse gas emissions by

	2050 Cap not yet determined, but two indicative caps are presented in consultation material; 176 mega tonnes in 2030 (2000 level of electricity generation emissions) and 150 mega tonnes in 2030 (15 per cent reduction from 2000 levels) Would be adjusted if scheme enlarged Would be revised according to international comparative performance To give investors certainty, targets would be fixed for the first 10 year period and indicated for the subsequent 10 year period; each year, a fixed target would be set for 10 years hence, to continue to provide investors with a 10 year period of certainty; the target for the subsequent 10 year period would be revised every five years
Permit allocation	Permits would be allocated free to adversely affected electricity generators and trade-exposed energy-intensive firms Remaining permits would be auctioned Auction proceeds would be distributed amongst states and territories according to differing impacts of the scheme (could be used to fund assistance for others such as low income households and small businesses)
Credit for early action	It is planned to include mechanisms to allow a transition for participants who have taken early abatement action, but not yet determined how
Competitiveness	Permits would be allocated free to adversely affected electricity generators and trade-exposed energy-intensive firms, at least until competing nations are subject to equivalent emissions constraints Proposed that there be no free permits for new entrant generators, but that new entrant trade-exposed, energy-intensive firms and major capacity expansions of existing plant would be eligible for a free permit allocation, although based on a baseline set at best practice energy intensity using commercially viable technology, given that new entrants can decide what technology to install
International linkage	Cap would be revised according to international comparative performance Principal objective is to establish a strong domestic market, although acknowledged that bilateral linking might be desirable in the longer run Unilateral linking with the Clean Development Mechanism is proposed, to allow firms to surrender Certified Emission Reductions towards their domestic obligations whilst preventing double counting of reductions
Offsets	Offset credits could be created through forestry, carbon capture and storage, reduced industrial process emissions and methane destruction, provided that they meet additionality, permanence and measurement criteria Offsets could not be created through generation of renewable energy (i.e. RECs under MRET – see above – are not interchangeable with NETS permits)
Trading period duration	Both long- and short-run (annual) permits
Banking and borrowing	Permits could be banked and banked permits can be traded No borrowing against future permit allocations to discharge current liabilities
Penalty	Penalty for non-compliance and to set price ceiling for permit market
Market ownership and governance	Ideally administered by the Commonwealth Government Alternatively, States and Territories could establish a Ministerial Council or Forum, Scheme Developer and Scheme Regulator

Source: Various, see references in appendix

B.7.2.2 Performance

NETS is in the design stage, with implementation planned for 2010. There is therefore not yet experience of its application and performance.

There have, however, been modelling studies of its potential economic impacts, both for the stationary electricity sector and the national economy.

Modelling of the potential impacts on electricity markets (McLennan Magasanik Associates, 2006) suggests that substantial abatement is possible at a permit price of less than AU$35 per tonne of carbon dioxide equivalent. In this modelling, abatement to 2020 is driven by fuel switching, improved energy efficiency and increased renewable generation. Beyond 2020, the level and cost of abatement are driven principally by the cost and rate of adoption of low emissions technologies. Emissions trading is shown to have lower impacts if combined with energy efficiency policies, government and industry support for development of low emissions technologies, and inclusion of low-cost offset options.

The macroeconomic modelling involved several scenarios (The Allen Consulting Group, 2006). Impacts vary by region and industry, but the overall conclusion is that national impacts are modest relative to business-as-usual – by 2020, up to 0.5 per cent reduction in annual GDP, up to 0.7 per cent reduction in annual private consumption and up to 0.1 per cent reduction in employment. The size of impact on the economy is strongly correlated with the number of sectors included in the scheme, with a moderate ETS for solely the stationary energy sector having a very small impact on the economy. Complementary polices for improved end use energy efficiency and uptake of forestry offsets could significantly reduce the economic impacts of meeting a given emissions target. By sector, renewable electricity generation, gas-fired electricity generation and the forestry products industry experience increased growth. Growth is slower than otherwise in coal-fired electricity generation and services linked to overall levels of economic activity and new investment, such as transport, building products and cement manufacture.

Although NETS is not yet in operation, analysis for the design stage has provided some useful findings.

An emissions trading approach is particularly suited to sectors where emissions can be estimated and reported accurately at low cost, there is a reasonable number of liable parties and the transaction costs are moderate. The greater the number of sectors covered by such a scheme, the lesser the distortions between emitting activities, but also the greater the scheme's complexity and therefore possibly lower its practicality. Narrow coverage may, however, be a starting point for incremental implementation, expanding over time as the scheme is refined for lessons learnt from its operation and as attitudes change with demonstration of its workability and benefits.

Emissions trading can encourage abatement activities in markets influenced by price signals. It is technology neutral. It is flexible to adjusting targets for changes in international obligations, evolving scientific understanding of climate change and development of low emissions technologies. Target and allocation periods should, however, be sufficiently long to provide a reasonable degree of investor certainty, especially given the long term of electricity generation investments. Depending on their specifications, schemes can include mechanisms for providing adjustment assistance, through the method of initial allocation of permits, as well as allowing for future new entrants.

Schemes can include a penalty not only to encourage compliance, but also to set an upper limit to the market price of permits, which can be used to ease transition and to provide investors with certainty as to the maximum costs they will face.

Banking provides participants with compliance flexibility, encourages early emissions reductions and reduces compliance costs, whilst enabling a smooth transition path for permit prices.

B.7.3 Australian proposal for an AP6 based emissions trading regime

Although the Federal Government has expressed opposition to Australia adopting emissions trading in the absence of an effective global response, it has indicated that, under such a response, it would consider least-cost approaches to constraining emissions (Australian Government, 2004). It has acknowledged that these would include market-based measures such as an ETS, given the efficiency and flexibility of this approach.

In December 2006, the Federal Government established a joint government-business prime ministerial task group on emissions trading to report back by end of May 2007 (Prime Minister of Australia, 2006a). This group has been tasked with advising on the nature and design of a workable global emissions trading system in which Australia could participate.

This followed the Government's announcement in November 2006 that it had allocated AU$60 million to 42 collaborative projects with other members of the Asia-Pacific Partnership on Clean Development and Climate, AP6 (Prime Minister of Australia, 2006b). AP6 comprises the USA, India, China, Australia, South Korea and Japan, which in total generate more than half the world's greenhouse gas emissions and have come together to advance clean development and climate objectives, given the overriding international goals of development and poverty eradication (Australian Government, 2006c). AP6's objective is to enhance co-operation to meet increased energy needs and associated challenges, including air pollution, energy security and greenhouse gas intensities.

B.7.4 Greenhouse Gas Reduction Scheme

The Greenhouse Gas Reduction Scheme (GGAS) was one of the first mandatory greenhouse gas ETSs in the world (Greenhouse Gas Reduction Scheme, 2006). It was established at state level in New South Wales and subsequently extended to the Australian Capital Territory. It aims to reduce greenhouse gas emissions associated with the production and use of electricity by creating an incentive to undertake emissions abatement projects.

B.7.4.1 Design

Table 10 Australian Greenhouse Gas Reduction Scheme

Coverage	State-wide New South Wales – commenced 1 January 2003 Australian Commonwealth Territories – commenced 1 January 2005 Buyers and sellers of electricity Mandatory for electricity retailers
Gases	Greenhouse gases
Point of obligation	Large electricity users (load greater than 100 gigawatt hours) and people undertaking State significant development can elect in
Emissions cap (target)	Annual state-wide target set – the "benchmark" Allocated between participants according to their share of the electricity market Initial NSW target set at 8.65 tonnes of carbon dioxide equivalent per capita, dropping to 7.27 tonnes in 2007, where it will remain until 2012 (represents a five per cent reduction from Kyoto Protocol baseline year of 1990)
Permit allocation	Certificates are created for undertaking eligible project-based emissions reduction activities, including low emissions electricity generation or improvements in emissions intensity of existing generation activities, activities that result in reduced consumption of electricity, activities carried out by elective participants that reduce on-site emissions not directly related to electricity consumption, and capture of carbon from the atmosphere in forests Each abatement certificate represents abatement of one tonne of carbon dioxide equivalent greenhouse gas emissions Participants meet their allocation of the state-wide target by surrendering abatement certificates (whether created from their abatement activities or purchased from others), effectively offsetting a portion of the emissions associated with their electricity purchases Participants can also claim the emissions reduction associated with the surrender of RECs under MRET (see above)
Credit for early action	Abatement certificates have no expiry date once created, but must be registered within six months of the end of each calendar year's abatement activities
Competitiveness	
International linkage	
Offsets	
Trading period duration	Annual target for emissions allocations Abatement certificates may be created up to 30 June for abatement activity

	undertaken in the previous calendar year Abatement certificates have no expiry date once created
Banking and borrowing	Certificates can be banked indefinitely; oversupply in the early years of the scheme can assist in meeting future demand
Penalty	Penalty for failing to surrender sufficient abatement certificates – in July 2006 this was AU$11 per tonne of shortfall 10 per cent shortfall allowed without penalty, provided that shortfall is made up the following year
Market ownership and governance	NSW scheme administrator and compliance regulator is the Independent Pricing and Regulatory Tribunal of NSW, which monitors performance against benchmark Registration and transfer of certificates created from abatement projects are recorded in the Greenhouse Registry

Source: Various, see references in Appendix C

B.7.4.2 Performance

Since GGAS commenced, a total of 97 organisations have been accredited as abatement certificate providers for 206 abatement projects. 51 per cent of projects have focused on reducing the emissions intensity of electricity generation and 46 per cent of projects on energy efficiency and demand management. In 2005, over 10 million abatement certificates were created.

GGAS has demonstrated the value of allowing banking. In the first three years of the scheme, 2003 to 2005, more abatement certificates were created than needed. Projections suggested a surplus for 2006 also. With forecast growth in population and demand for electricity, annual demand for abatement certificates is projected to exceed annual supply from 2007. Given that abatement certificates do not have expiry dates, it is projected that the surplus accumulated to date will be sufficient to meet demand to 2009, after which time demand may exceed available supply.

B.7.5 Other state level schemes

Other state level trading schemes, introduced more recently, are the Victorian Renewable Energy Target Scheme (VRET) and the Queensland 13% Gas Scheme.

VRET takes effect from 1 January 2007 (Essential Services Commission, 2006). It aims to increase the generation of electricity from renewable sources by 10 per cent by 2016. Interim targets aim to ensure smooth progress towards the 2016 target. All electricity retailers and wholesale buyers in Victoria must meet their obligation of contributing towards the generation of renewable energy by acquiring tradable Victorian renewable energy certificates (VREC) in proportion to the amount of electricity they purchase, like MRET, above.

The Queensland 13% Gas Scheme also follows a similar form to MRET, but focuses on boosting the state's gas industry, as a means to reduce greenhouse gas emissions (Queensland Government, 2006). It commenced on 1 January 2005, running for 15 years. It requires Queensland's electricity retailers and other liable

parties to source at least 13 per cent of their electricity from gas-fired generation, as evidenced through surrender of tradable gas energy certificates (GEC). As in MRET, certificates can be banked, but in this case have a limited life of three years.

B.8 The experience with initial permit allocation

Emissions trading schemes that have been implemented in practice have usually allocated most of their emission units on a gratis basis. This appears to be primarily aimed at gaining political support for emissions trading by minimising impacts on cash flow and profit for those most directly affected by its introduction. In some cases the rate of gratis allocation is also adjusted specifically to counter concerns of risks to competitiveness for more trade exposed sectors – for instance, the UK's allocations under the EU ETS were more stringent to electricity generators because of their limited competition and high ability to pass the emissions cost onto prices.

Where auctioning is allowed it is used sparingly. The EU ETS limited auctioning of allocated entitlements to five per cent in its Phase I, and 10 per cent in Phase II, but in neither phase have countries auctioned close to these limits. The US sulphur to aid price discovery and provide some liquidity for new users.

Where gratis allocation has been used, they have predominantly been based on historical emission levels. This is the case in the EU ETS, the UK and Danish emissions trading schemes that preceded it, and in the Norwegian scheme that has been designed to align with it. In the case of the EU ETS, in which each country has some flexibility in setting its National Allocation Plan, there has been some use of forecast activity and emissions to adjust the allocations to particular sectors.

Performance-based or benchmarked approaches to allocation were tried in some countries in the EU ETS but found difficult to apply due to data limitations. They remain more frequently applied to new entrants into emissions trading schemes (e.g. in the Norwegian scheme). Details of emissions reported under the EU ETS Phase I have alleviated data problems and made performance based allocation more feasible for at least some industries in future.

The regulatory control of allocations depends on the integrity of the reporting systems in place and the stringency applied by the regulatory body. In the EU ETS, the Phase I allocations appear in hindsight to have been greater than many industries needed, suggesting limitations in overall control of a process devolved to different countries' National Allocation Plans, and also some industry capture of the process. For the Phase II allocations the European Commission appears more inclined to challenge National Allocation Plans and apply greater stringency to the process.

In most schemes there has been limited scope for ex-post adjustment of allocations, other than through the reallocation that is required for successive

emission accounting periods. The Norwegian scheme specifically allows adjustment within the accounting period if the conditions on which allowances were based should change, but only in a downward direction (i.e. to lower allocations).

Because of the prevalence of allocations on a historical basis, existing emitters have a cost advantage over new entrants, which paradoxically may deter investments in newer, more emission-frugal equipment and processes. Some schemes have therefore withheld allocation in a reserve available for expansion of emissions from new entrants and existing players. Conversely, in some schemes allocated permits are cancelled if an entity's production contracts or ceases. Without the ability to cash in on unused permits, less efficient operators may be deterred from closing down.

The practical experience on allocation suggests:

- The majority of emission permits need to be given away gratis, rather than auctioned;
- The basis for gratis allocations depends on local circumstances:
  - Grandfathering on historical emissions depends on the existence of reliable records of past emissions at the sector and plant level;
  - Performance based allocation using benchmarking may be feasible in industries that are technically similar wherever they occur;
  - Where firms or industries have difficulty establishing benchmarked performance, because of the technical distinctiveness of their local operation or because of high transaction costs, they should be able to opt for one or other approach according to which is most feasible;
  - Expectation of allocations could be used to incentivise firms to position themselves for participation in an ETS, e.g. a basic allocation for those with neither reliable emission records nor benchmarks, a higher allocation for those who establish verifiable records, and a higher allocation for those able to demonstrate compliance performance-based benchmarks;
- Regulatory stringency is required to exercise control over the level of allocations, and is likely to become more critical the broader and more comprehensive an emissions trading scheme is;
- Some allocation is desirable to provide for new emissions, from either new entrants or existing entrants (available to each on the same basis);
- If an industry is characterised by old and inefficient plant, encouraging exit of least efficient operators may be assisted by allowing them to sell the allowances they do not need on closure.

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Appendix D Glossary

Baseline-and-credit – individual emitters are set a baseline of emissions over a given period and awarded credits for reductions in emissions below this level. These credits can be sold to other emitters to pay for emissions above their baseline.

Biofuels – any (generally liquid) fuel derived from plant or animal sources.

Cap-and-trade – a cap or limit is placed on total emissions over a given period. The quantity of allowable emissions is unitised and allocated between emitters. Emitters subject to emissions obligations are then required to surrender emissions units against all of their recorded emissions over the period.

Carbon capture and storage – a technology under which carbon dioxide is extracted from the flue gases of power plants or industrial facilities and injected back into geological structures, such as depleted oil and gas reservoirs, unminable coal beds or deep saline aquifers.

Carbon dioxide (CO_2) – a naturally occurring gas, as well as a by-product of burning fossil fuels and biomass and land-use changes and other industrial processes. It is the most important man-made greenhouse gas.

Carbon dioxide equivalent (CO_2-e) – measures the combined climate change potential of emissions of all greenhouse gases. Emissions of each gas are converted to the amount of carbon dioxide that would cause the same climate change impact.

Carbon sequestration – a process for removing carbon dioxide from the atmosphere, whether natural (such as forestry) or artificial (such as carbon capture and storage technology).

Carbon tax – a tax applied to carbon dioxide equivalent emissions of specific major greenhouse gases.

Clean development mechanism (CDM) – a Kyoto Protocol mechanism that allows emissions reduction and afforestation/reforestation projects with sustainable development benefits to be implemented in developing countries that have ratified the Kyoto Protocol. CDM projects earn Kyoto Protocol units, which an Annex I Party can put towards meeting its Kyoto Protocol commitment.

Competitiveness-at-risk (CAR) – where bearing a price for greenhouse gas emissions significantly impedes a firm's ability to compete, whether in export markets or domestically, with firms in countries that have less stringent climate change policies.

Downstream – point of obligation where emissions are released.

Efficiency – productive efficiency – the extent to which production occurs at least cost (i.e. resources are not wasted); allocative efficiency – the extent to which resources are allocated to their most valuable uses; dynamic efficiency – the extent to which investment and innovation occur to reduce costs or increase value over time.

Economic welfare (or well-being) – that part of human welfare that results from consumption of goods and services, comprising the sum of economic surpluses associated with particular patterns of consumption and production.

Emissions – the intentional and unintentional release of greenhouse gases into the atmosphere.

Emissions (or carbon) leakage – the shift in emissions from one country to another through the displacement of economic activity from one country to another. If reduced production (and emissions) in one country results in increased production (and emissions) in a competing country, then there is no global emissions benefit.

Emissions trading – an emissions trading scheme (ETS) creates a responsibility for a defined group of emitters to hold tradable units or allowances to match some or all of their greenhouse gas emissions over a defined period. Emitters subject to the scheme can either reduce their own emissions or trade units or allowances to meet their obligations.

Emissions unit, entitlement or allowance – a tradable unit representing the right to emit one tonne of carbon dioxide equivalent emissions.

Externality – where an activity impacts, either negatively or positively, on parties not directly involved in the activity and these impacts are not reflected in the cost or price of the activity or goods and services produced.

Fossil fuels – coal, natural gas, liquefied petroleum gas (LPG), crude oil and fuels derived from crude oil, including petrol and diesel.

Fugitive emissions – emissions from leaks in industrial process systems.

Global Warming Potential (GWP) – a factor describing the radiative forcing impact (amount of warming) of one unit of a given greenhouse gas relative to one unit of carbon dioxide.

Grandfathering – the allocation of emissions units or allowances to emitters according to their historical levels of emissions.

Greenhouse gases (GHG) – atmospheric gases, both natural and anthropogenic, that absorb and re-emit infrared radiation. The Kyoto Protocol counts six gases in assessing anthropocentric greenhouse gas emissions – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), two groups of synthetic gases, known as

hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6).

Joint Implementation (JI) – a mechanism that allows emissions reduction and removal projects to be implemented in Annex I Parties that have ratified the Kyoto Protocol. JI projects earn Kyoto Protocol compliance units known as Emission Reduction Units (ERU), which an Annex I Party can put towards meeting its Kyoto Protocol commitment.

Kyoto Protocol – a 1997 international agreement under the United Nations Framework Convention on Climate Change (NZFCCC) to address climate change, which requires ratifying countries listed in its Annex B (industrialised nations) to meet greenhouse gas reduction targets over the period 2008 to 2012.

Offset – an activity that reduces emissions, which is not directly related to the emissions source, such as planting forests to absorb carbon dioxide. In some emissions trading schemes, offsets can be traded like emissions credits.

Opportunity cost – the next best use of an asset/resource; the highest value use forgone.

Pareto optimal allocation – where there is no possible reallocation that would make at least one individual better off without also making another worse off.

Marginal cost/revenue/value – the increase in total costs/revenue/value as one more unit is produced/consumed.

Point of obligation – where responsibility is imposed to report emissions and to demonstrate that sufficient entitlements are held against those emissions.

Renewable energy – a form of energy that can be produced indefinitely without depletion, including solar, wind, hydro, biomass, tidal, wave and ocean current sources. Geothermal energy is considered renewable, although geothermal fields can be depleted if fluids are extracted at a higher rate than they are replenished.

Sinks – natural processes, such as growing forests, wetlands, soils or oceans, that actively absorb greenhouse gases from the atmosphere.

United Nations Framework Convention on Climate Change (UNFCCC) – an agreement negotiated in 1992, which aims to stabilise greenhouse gas concentrations at a level that avoids dangerous human interference with the climate system.

Upstream – point of obligation where sources of emissions originate.