New Zealand's Emissions Trading Scheme

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Abstract

New Zealand's liability under the Protocol was estimated at $NZ593 million in 2008 and the current options to meet this liability are either purchasing units on the international market or reducing emissions. In late 2008 New Zealand became the first country to pass into legislation a comprehensive ETS that includes all sectors and all gases. This is a particularly bold initiative considering the uncertainties surrounding climate change. The greenhouse effect is a global public goods problem and the prospect of other countries free-riding on the efforts of others to control their emissions is real. In the international arena NZ can claim the high ground but this will come at a cost. Economic growth and prosperity is heavily dependent on trade, particularly trade in primary sector products. Leakage comes at an economic cost to the economy and can work against securing reductions at the global level. Forestry and agriculture are two important sectors in respect of climate change; forestry because it offers the opportunity for carbon sequestration and agriculture because of its exposure to leakage. To date, no easy solutions have been found to reduce methane emissions from agriculture. Finally the success of NZ's ETS will hinge to a large degree on the emergence of an open, viable, and liquid, international carbon market.

JEL: Q54, Q58

1. Introduction

The schematic framework of climate change used by the Intergovernmental Panel of Climate Change (IPCC) has the following four components: climate process, climate change, impacts and vulnerability, and socio-economic development (IPCC, 2007). Beginning with climate process, two undisputed facts are evident. First, the role that greenhouse gases (GHG) play in trapping energy and making the atmosphere warmer is not disputed. Second, evidence shows that the atmospheric concentration of many GHG has increased markedly as a result of human activity. Global GHG emissions increased by 70% over 1970-2004 and carbon dioxide (CO_2) is the most important GHG and accounted for around 77% of global GHG emissions in 2004 (IPCC, 2007). Other GHG include methane and nitrous oxide. To account for differences in their warming potential gases are expressed through a common metric based on CO_2 *viz.* carbon dioxide equivalent (CO_2-e). For example, methane – which is of particular relevance to New Zealand (NZ) – has a warming potential 21 times that of CO_2.

Beyond these two facts uncertainty arises. Warming of the climate system is evident from observations on increases in global air and ocean temperatures, and rising global average sea level (IPCC, 2007). One uncertainty is associated with the scientific challenge of identifying, and controlling for, natural vis-à-vis anthropogenic drivers of climate change. While the likely consequences of global warming are becoming more clear the frequency, and changes in the spatial patterns, of adverse climate events is uncertain. For example, extreme weather events, such as heat waves, are likely to become more frequent and more intense (IPCC, 2007). The degree of uncertainty further increases as climate change is mapped into impacts on ecosystems, food production, health, coastal settlements, water,

and regions. In the case of New Zealand, the Ministry for the Environment reports that it is most likely that: sea level will rise by 30-50cm by 2010, leading to increased coastal erosion, coastal flooding, and salt water intrusion; average temperature is expected to increase by 1^{o} C by 2030; less rain will fall on the east coast resulting in an increase in demand for water; and, westerly winds will become more prevalent (Ministry for the Environment, 2007).

The main feature of the Kyoto Protocol adopted in 1997 is that it set binding targets for 37 industrialised countries and the European Union (EU) for reducing GHG. While instrument choice is a matter for sovereign governments to decide the Protocol does offer three market-based measures: emissions trading, clean development mechanisms (CDM), and joint implementation (JI) projects. Country-level emissions are monitored and recorded, emission reductions achieved through CDM and JI projects are verified, and an international transaction log tracks trades that occur. New Zealand ratified the Kyoto Protocol in 2002 committing it to reducing average net emissions of GHG over the first commitment period (CP1) 2008-2012 to 1990 levels or to take responsibility for the difference. As at October 2008 New Zealand's obligation was $NZ 593 million (Treasury, 2008).

Designing a policy to that satisfies New Zealand's obligations under the Protocol while achieving a modicum of economic efficiency is a significant challenge given the economy's reliance on primary industry and its exposure in international markets. The paper is structured as follows. The second section provides an overview of New Zealand's emission profile and highlights its unique characteristics. The third section describes the emissions trading scheme (ETS) passed into law late 2008. Section four

summarises a number of outcomes from the European ETS and highlights some lessons. The paper concludes with a summary and suggestions for further research.

2. NZ Emission Profile

Table 1 shows the composition of NZ's greenhouse gas emissions as at 2006, compared to 1990. It also shows the 100 year Global Warming Potentials used to convert the different gases into CO_2 equivalent. NZ's production has become relatively more emission intensive and therefore the economic costs of fulfilling its Kyoto obligation could be considerable.

Table 1

Shares of the different gases in 2006 emissions are presented in Figure1 and contrasted with the average shares in Annex I countries.[1] This shows that NZ has a quite different emission profile, with methane (CH_4) and nitrous oxide (N_2O) accounting for 52% of total emissions collectively, compared to only 16% in other Annex I countries.

Figure 1

Figure 2 shows the contribution of different sectors to gross emissions in 2006. As can be seen, unlike other Annex I countries, where GHG emissions from energy (62%) dominate the profile, NZ's highest share is attributed to agriculture (48%), predominately methane and nitrous oxide emissions from livestock and the management of manure and animal waste.

The unique composition of NZ's GHGs stems from its economic structure. Different from other Annex I countries, NZ agriculture plays a significant role in terms of

[1] Annex I countries include 41 industrialized countries and economies in transition.

economic growth and land use. Around 47% of the country's total merchandized export receipts were generated by agriculture at March 2006 and 55% of total land is farmed. Agriculture, forestry and fisheries contributed 6.3% of total GDP and 7.1% of employment in 2006 (Statistics NZ). As shown in Figure 2, 30% of NZ emissions were generated by energy and industrial processes; these two sectors account for around 21% of GDP and 22% of employment. The transport sector generated 19% of NZ's total emissions, accounting for about 5% of GDP and 4% of employment.

Figure 2

3. Emissions Trading Scheme

The Protocol does not prescribe how countries must meet their targets, although it does offer an opportunity to adopt market based mechanisms. Therefore, a country could choose to use a polluter pays tax, regulation, or some other instrument to achieve its target level of emissions reduction. Prior to the government ratifying the Kyoto Protocol the Climate Change Response Act 2002 was narrowly passed with a vote of 61-56 highlighting the political nature of climate change (Yang, 2004). This Act maps key features of the Protocol into legislation *viz*. an acknowledgement of a duty to retire emission units equal to the metric tonnes of CO_2-e human induced GHG listed in Table 1 from energy, industrial processes, agriculture and waste. From the outset, it is clear that the intent of government was to include all gases and all sources. A registry for recording the issue, transfer, retirement and cancelling of units was also established.

In 2002 government proposed a carbon tax set at NZ%15/t initially and capped at NZ$25/t for CP1. Given uncertainty over the benefits to New Zealand this approach is

consistent with the finding of Weitzman (1974). The document calling for submissions on the carbon tax left open the prospect of an ETS replacing a carbon tax (Inland Revenue Department, 2005). The tax was to apply to emissions from fossil fuels, industrial processes, methane, and nitrous oxide. Farming emissions of methane and nitrous oxide were to be exempt from the tax in CP1. It was proposed that tax revenue would be recycled into the economy through the tax system. The tax was seen in terms of a transitional instrument toward full or partial emissions trading if carbon markets developed. The carbon tax proposal met with significant opposition, particularly from the farming lobby, and was abandoned.

Having failed in its first attempt to implement policy directed at meeting its obligations under the Protocol government further cemented its commitment with passage of the Climate Change Amendment Act 2006 which *inter alia* provided a mechanism aimed at allowing landowners to capture the value created by carbon sequestration through the establishment of forest sink covenants. The duration of a covenant was at least 50 years and could be terminated if the landowner chose to become a participant in the ETS before 2010. Covenant forest owners receive Kyoto Protocol Assigned Amount Units (AAUs) based on carbon sequestration and assume liability for loss of carbon. Liability for carbon credits received would be avoided if the owner elected to join the ETS. By August 2008 one covenant had been registered, although the Ministry of Agriculture and Forestry (MAF) had received expressions of interest relating to around 60,000 ha (MAF, 2008).

New Zealand's ETS was established by the Climate Change Response (Emissions Trading) Amendment Act 2008. Like its predecessor the proposal was controversial and was passed into law with a vote of 63-57, just two months before the general election.

The structure of the ETS is designed around four core pillars. First, participants have an obligation to hold, and surrender, emission units that match their annual emission levels. The scheme operates within the global cap on emissions set by the Protocol. Second, the ETS includes all major sectors and the six GHG identified in Table 1. Third, a New Zealand Unit (NZU), fully comparable with Kyoto Units, is the primary domestic unit of trade. Market liquidity is enhanced by allowing both sales to and purchases from international markets. Fourth, forest landowners derive credits for forestry activities that lead to carbon sequestration and face liability for subsequent release of carbon into the atmosphere.

When introducing a cap-and-trade regime into the economy policy makers had to grapple with the problem of setting initial entitlements. Grand-parenting based on existing emissions is one option, auctions are another. A unique feature of New Zealand's ETS is that it is designed to include all sectors. Thus, in addition to the method of allocation, the time at which each sector is included in the scheme is of economic significance, particularly if the objective is to achieve reductions in New Zealand's liability at least cost. Table 2 outlines the progression from forestry being introduced in January 2008 through to agriculture in January 2013. Scheduling forestry early seems sensible because it offers the potential to generate emission credits. Agriculture on the other hand is more problematical and delaying its introduction to 2013, beyond CP1, would appear to be a sensible hedge considering the lack of progress at the international level beyond CP1. However, there appears to be no evidence that these superficial observations were supported by rigorous analysis.

Table 2

The inclusion of forestry at the outset is significant. Over 7% of NZ is covered in planted forest and around 25% is covered in indigenous forest. Forestry has the potential to generate emission credits thereby reducing NZ's liability under the Protocol. In 2008 forest products exports were NZ$3.6 billion, accounting for 10% of total merchantable exports. Over 20,000 people are employed in forestry and the first stage of processing (New Zealand Institute of Forestry, 2008). As the legislation now stands, if a pre-1990 forest land owner deforests more than 2 hectares in any five year period, participation in the ETS is compulsory. As participants, they will have to calculate and report their deforestation emissions and surrender an equivalent number of emission units.

If pre-1990 forest landowners do not deforest any land covered by the ETS, they do not become a participant in the ETS. Normal harvesting followed by replanting does not carry any requirement to join the ETS. Government will allocate 55 million NZUs within CP1 to owners of pre-1990 forests under a Forestry Allocation Plan. The first tranche of 21 million can be used immediately by any participant to meet emissions obligations, or to be converted into emissions units internationally-tradable under the Kyoto Protocol and sold offshore. A further tranche of 34 million NZUs was allocated at the same time, but post-dated so that they cannot be used to meet national emissions obligations, until a specified date after 2013.

Participation in the ETS by post-1989 forest land owners is voluntary. Owners of post-1989 forest land can voluntarily join the ETS, and in doing so become participants are entitled to receive NZUs for the increase in carbon stored in their forests as they grow. Those NZUs can be sold in NZ or converted and sold internationally. Participants may choose to register part or all of their post-1989 forest land, additional forest areas can be

added at any time. Participants have a legal obligation to report at least once every five years on the carbon stocks in their registered forest area and surrender emissions units if the carbon stocks in their registered forest area fall below a previously reported level. However, their liability will not exceed the emissions units transferred for the area of forest. Landowners have until the end of CP1 to decide whether to register for that period. If they do, all carbon sequestered since 1 January 2008 would earn NZUs. After 2012, they can still register, but only carbon sequestered from 1 January 2013 will earn NZUs. If landowners do not register, the gains or losses in carbon stocks in their forests are retained by the government.

New Zealand is in a unique situation because almost 70% of its electricity is generated from renewable sources, mainly from hydro power. Stationary energy emissions come mainly from energy sourced from non-renewable fuels, such as coal (20%), gas (23.3%) and geothermal (0.01%). Stationary energy includes all fuels used in electricity generation and in the direct production of heat in the industrial, commercial, and residential sectors. It does not include energy used for transport or emissions from industrial processes. The stationary energy sector enters the ETS on in 2010. No free allocations will be made to energy producers who will have to acquire emission units on the market or invest in emission offsets. The average household electricity bill is expected to increase by about five percent.

Liquid fossil fuels include petrol, diesel, aviation spirit, jet fuel, light fuel oil and heavy fuel oil. Major oil companies and firms importing more than 50,000 litres of obligation fuel are mandatory participants. From 2011, participants will have to collect data and calculate emissions. Participants will be required to monitor the volume of each

obligation fuel when removed from a refinery or when imported. Regulations, yet to be developed, will provide a standard emissions factor for each type of fuel. No free allocations will be given to the liquid fossil fuels sector.

The agricultural sector is scheduled to enter the ETS in 2013 and includes GHG from pastoral agriculture, horticulture and arable production. At this stage the point of obligation for agriculture emissions is at the processor level although government has signalled a possibility that this could change this to farm level. The method for estimating emissions has not yet been determined and will depend on whether processors or farmers participate in the scheme. The agriculture sector will be allocated an undetermined number of emissions units from 2013 through to 2030. From 2013 to 2018, the annual allocation will equate to 90 percent of the sector's total 2005 emissions. The allocation will phase out gradually from 2019 to 2030.

Including agriculture in the ETS is significant on a number of fronts. First, NZ is the only country yet to include emissions from agriculture. Second, agriculture dominates New Zealand's profile of exports. For example, in 2007 the dairy industry generated more than $8.4 billion of export receipts, accounting for 25% of NZ's total merchandisable trade. The NZ dairy sector alone had 5.26 million dairy cattle as at 30 June 2007. From 1990 to 2007, the number of dairy cattle increased by 53%. Globally, NZ is the 8th largest dairy producer (MAF, 2007). The combined value of beef, wool and lamb exports is in the order of $4.6 billion.

At the same time, the number of dairy farms has been continuously decreasing. In 1990, there were 14,595 dairy farms in NZ, by 2007 the number was 11,630; a 20% decrease. Dairy farms have become larger and more intensified. The average size of dairy farms

nearly doubled since 1990, from 159 dairy cows, and 67 hectares to 337 dairy cows, and 121 hectares in 2007. There were about 2.4 cows per hectare on average in 1990, but nearly 2.81 cows per hectare of farm land by 2007. This trend towards more intensive farming results in increased nitrous oxide (N_2O) emissions, which are mainly from chemicals and fertilizers used in pasture production, brought-in concentrates, feed and supplements.

Between 1990 and 2005, the amount of nitrogenous (N) fertilizer used in NZ increased by 824%, and the amount of phosphate (P) fertilizer used increased by 121%. From 1992 NZ became a net importer of N fertilizer, and in 2005, 72.5% of N fertilizer used was imported. In addition to CH_4 and N_2O emissions, the NZ dairy industry also directly contributes to CO_2 emissions, 23% of the national agricultural energy use is for dairy farming only (Barber and Pellow, 2005). Dairy farms use fossil energy directly as diesel and gas for heating, and they use electricity for milking machines and refrigeration of milk. Dairy farms also apply inputs that contain fossil energy at an earlier stage in the production chain. This energy is referred to as indirect energy. For instance a lot of energy is used to produce nitrogen fertilizer. Also concentrates contain an implicit amount of fossil energy.

In practice, the economic impacts on dairy industry will come in two tranches (MAF, 2008). The first tranche starts at 2010, when stationary energy and industry process emissions are brought into the scheme, followed by liquid fossil fuels. There can be no doubt about the fact that the dairy industry will face significant increases in input costs. And it is unlikely that the dairy sector will be able to pass on all of the increased cost to downstream consumers, because this implies the industry's competitive advantage in the

international market will be reduced with the possibility of losing market share to overseas producers in countries not committed to Kyoto and/or receive subsidies from their governments. The second tranche occurs in 2013 when methane emissions from livestock and nitrous oxide emissions from nitrogenous fertilizer enter the scheme

MAF (2008) conducted an illustrative "static" analysis of the potential impacts of the NZ ETS on farms using its 2006/07 model farm budgets.[2] It assumes that input price changes caused by the NZ ETS will have no impact on farm-level output and consumption of electricity, fuel, fertilizer and other non-carbon inputs, in other words, the implications of those price changes on farm management practices are not modeled,[3] with the exception of using nitrification inhibitor as a mitigation tool. Field trials show that the use of nitrification inhibitors can lead to significant reductions in nitrous oxide emissions in the dairy sector, provided soil temperatures are not too high nor the soil too wet. Reductions are conservatively estimated to amount to at least 20%. MAF (2008) therefore analyzed the impacts of the proposed ETS based on the assumptions that the international recognition of nitrification inhibitors as a mitigation tool is achieved and farmers use inhibitors to the maximum extent. Table 3 below summarizes the Ministry's estimates of the impact on the model dairy farm profits.

Table 3

[2] By "model farm", it means an average dairy farm, having dairy cows and land areas approximately equal to the national mean values.

[3] The MAF did indicate the need and importance of such a dynamic modeling.

4. Carbon markets

The European carbon market is the world's largest GHG emissions trading scheme and is the most visible result of early regulatory efforts to mitigate climate change (Capoor and Ambrosi, 2008). European Union Allowance units are equal to one metric tonne of CO_2–e and are identical to the NZU. Trading in EUA units during Phase I (2005-2007) highlighted the importance of market design. In May 2006 the EU announced an overall surplus of units which caused both the spot and futures market to plunge. Prices were further affected by a limit on carrying over unused units into Phase II. Allowance banking was permitted in Phase II thereby improving market continuity. The biggest determinants of pricing in the Phase II market have been market expectations of, and decisions by, the European Commission with respect to the cap allowed for each country and the limit on the import of credits from CDM and JI projects (Caspoor and Ambrosi (2007). The scope of the EU ETS was broadened to include aviation in Phase I. In December 2008 the EUA price closed at €15.67. Carbon market analysts have projected that EUA will likely trade at or above €25, reaching €30-35 by end of CP1 and at €40 when the second commitment period starts. Project based markets – for example CDM – are also active in the EU. In 2006 about 90% of project based credits came from CDM activities. China was the main seller, UK firms and utilities were prominent on the demand side. Price in the project based market is typically €10-€15 less than EUA.

The unit of trade NZU in the NZ carbon market is one tonne of CO_2-e and is identical to the EUA. As with the EU market, the NZ carbon market can be mainly into two subgroups, the allowances markets and the project-based markets. In the allowances market, NZUs originate from forestry activity and government allocation, either free of

charge or by auctioning off. In the project-based markets, carbon credits are derived from CDM projects in developing countries, JI projects together with other industrialized nations, and voluntary emission reductions outside of regulatory requirements by an entity.

In principle, the driving factors behind the supply and demand in NZ carbon market can be categorized into (1) policy and related issues, such as the explicit trading rules, the linkage of the NZ ETS with the market of project-based mechanisms and the government's initial allocation plans, and (2) market fundamentals that directly concern the production of GHGs, for instance, weather, fuel prices and economic growth. Firms requiring permits to cover emissions will have three broad options to acquire NZUs: auctions; through forestry activity; or buying credits from the project markets. Given that the scheme proposes to give no free allocation to the upstream points of obligation in the liquid fossil fuel and stationary energy sectors (including electricity generators) and landfill operators, these sectors will certainly be among the major buyers in NZ carbon markets.

In the absence of international demand for NZUs, if more permits are supplied on the NZ market than are needed to cover emissions, they may not find buyers and could become virtually worthless (Castalia, 2007).[4] On the other hand if demand for permits outstrips the supply of NZUs - as the design of the NZ ETS sets no cap on the price of emission permits, and there is no limit on the amount of project-based Kyoto protocol carbon credits that can be used to meet domestic obligations - a formal link between the NZ ETS

[4] Every NZU allocated by the Government will be "backed" by an Assigned Amount Unit (AAU) on the Government's Kyoto registry. In theory, this should allow NZ firms to supply NZUs onto an international AAU market, but such a market hasn't emerged yet.

and EU ETS is likely to prevail and there would be an effective price floor implicitly set by the international price of carbon. Because New Zealand's total emissions were already 26% above its 1990 levels in 2006 the most likely scenario is that the supply of NZUs will be consistently insufficient to meet demand and therefore the carbon price will be consistently set by the international price.

The EU carbon market is quite volatile. A time series of EU futures contracts – delivery December 2009 - is illustrated in Figure 3. A unit root augmented Dickey-Fuller test on these data, with an intercept, shows that the null hypothesis of a unit root for the settlement prices in December 2009 cannot be rejected at the 5% level of significance. This result implies that spot prices were non-stationary and follow a random walk.

Figure 3

Trading patterns in the EU's ETS highlight the prospect that NZ firms requiring credits will be exposed to the irregular and unexpected carbon price fluctuations, which could leave them in a vulnerable position, especially if these enterprises face competition in the international market. Therefore, fair and sufficient amounts of free allocations of emission permits by government for those facing competitiveness risks, allowing for banking and borrowing into future, as well as setting a domestic price cap are seen as essential ingredients of a sound policy design.

5. Concluding Comments

The NZ ETS, as legislated, stands out on the international stage as the first comprehensive market based mechanism applied to GHG. The ETS is a standard cap-and-trade approach to externalities that has its origins in the early work of Coase (1960)

and Dales (1968). While laudable in terms of design principles the mechanism must operate in an uncertain scientific and economic environment. At the international level progress toward CP2 is slow and will, most probably, be affected by the current global economic downturn. The greenhouse effect is a global public goods problem and the prospect of other countries free-riding on the efforts of others to control their emissions is real. While NZ might claim the high ground in the international arena this comes at a cost. Economic growth and prosperity is heavily dependent on trade, particularly trade in primary sector products.

New Zealand is the first country to incorporate emissions from land-based industry in an emissions trading scheme. Over time, this may lead to reductions in GHG from agriculture but unless other countries include agriculture the comparative advantage of New Zealand agriculture will diminish with little if any reductions in global emissions. Leakage comes at an economic cost to the economy and can work against securing reductions at the global level.

New Zealand's liability under the Protocol was estimated at $NZ593 million in 2008 and the current options to meet this liability are either purchasing units on the international market or reducing emissions. Government estimates of the economic costs vary, depending on the price of carbon. A study by The Treasury, using computable general equilibrium models, shows that a price of $13 NZD per tonne and $51 NZD per tonne would see GDP fall by 0.04% and 0.24% by 2010, respectively (Whitehead, 2008). The validity of these estimates has been contested by others (Castalia, 2007; NZIER, 2007).

Forestry and agriculture are two important sectors in respect of climate change; forestry because it offers the opportunity for carbon sequestration and agriculture because of its

exposure to leakage. To date, no easy technical solutions have been found to reduce methane emissions from agriculture. The dairy sector is a key component in solving the challenge of reducing NZ's agricultural emissions. Introducing forestry early into the ETS makes sense but it will not solve the problem of government's liability in the short run. In the long run there is an opportunity to increase the supply of emission credits from increased forest planting on less profitable farm land. Policy could focus on creating incentives for this to occur.

Finally the success of NZ's ETS will hinge to a large degree on the emergence of an open, viable, and liquid, international carbon market. The ability to freely trade credits among participating will enhance efficiency. Linking and integrating the NZ market internationally will enable trading in carbon futures, inter-market arbitrage opportunities and, importantly, the transmission of inter-market information. This is unlikely to occur unless parties to the Kyoto Protocol make progress on committing to action beyond CP1.

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Tables

Table 1: Composition of New Zealand's GHG Emissions

	100 year Global Warming Potential	1990	2006	Change from 1990 %
CO_2	1	25.4	36.4	**43%**
CH_4	21	25.5	27.5	**8%**
N_2O	310	10.4	13.3	**27%**
HFCs	140-11,700	-	597	
PFCs	6,500-9,200	0.6	0.1	-86%
SF_6	23,900	0.012	0.013	7%
Combined total		**61.9**	**77.9**	**26%**

Note: Mega tonnes CO_2-e per year

Source: NZ Climate Change Inventory Data

Table 2: Entry of Sectors into the ETS

Forestry (includes deforestation of pre-1990 forest and afforestation post-1989)	1 January 2008	31 December 2009 (first compliance period is 2 years)
Stationary energy (includes coal, natural gas and geothermal)	1 January 2010	31 December 2010
Industry process (non-energy) emissions	1 January 2010	31 December 2010
Liquid fossil fuels (mainly transport)	1 January 2011	31 December 2011
Agriculture (includes pastoral and arable farming and horticulture)	1 January 2013	31 December 2013
Waste	1 January 2013	31 December 2013
Other sectors	1 January 2013	31 December 2013

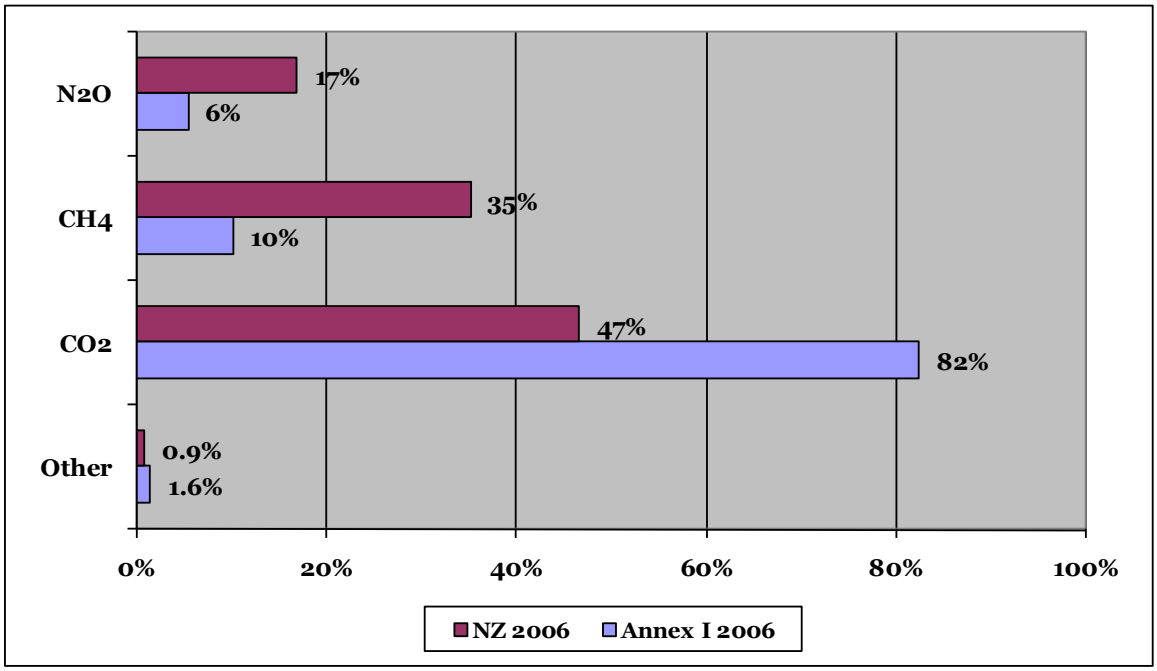
Table 3: Impact on dairy farm profit

	Allocation of 90% 2005 emissions			**Full liability**		
Carbon Price	$15	$25	$50	$15	$25	$50
1. No inhibitors	-12	-20.4	-40.7	-36.8	-61.6	-123.1
2. inhibitor + no increase in output	25.3	17.9	0.3	2.6	-19.9	-75.3
3. inhibitor + 10% output increase	30.1	21.9	2.3	4.7	-20.3	-82.2

Source: Ministry of Agriculture and Forests (2008)

Figures

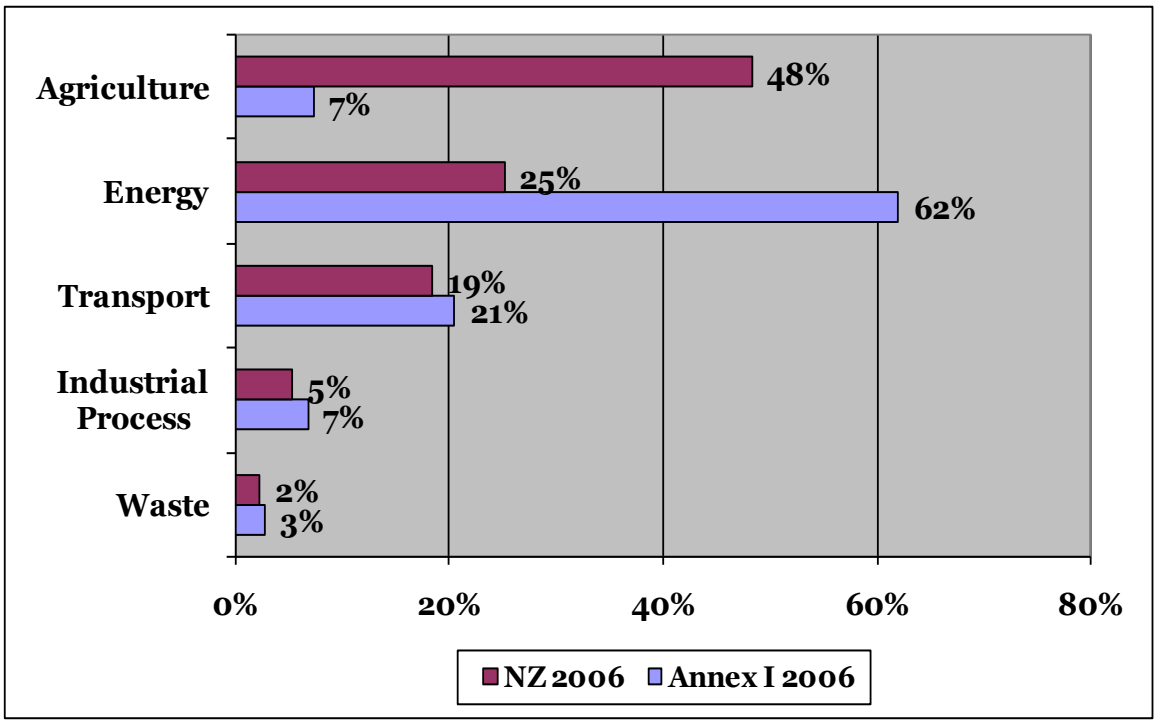
Figure 1: Greenhouse Gas Emissions by Gas



Note: CO_2-e basis

Source: UNFCCC GHGs Data

Figure 2: Greenhouse Gas Emissions by Source



Source: UNFCCC GHGs Data

Figure 3: EU futures contracts