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ABSTRACT/RESUME

Green growth and climate change policies in New Zealand

New Zealand, as a resource-based economy anxious to protect and promote its clean-and-green image, appropriately sees green growth as a natural direction for future development. The country's environment is of high quality, and depletion of its abundant natural resources is for the most part not a problem. Nevertheless, there are challenges. With little pricing of water resources, water scarcity is being felt increasingly acutely in some dairy-intensive regions prone to drought. Water-quality degradation is linked to leakage from farming by-products. Agricultural activity also gives rise to nearly half the country's greenhouse gas (GHG) emissions, though electricity consumption and private transport are growing sources of pressure. New Zealand's GHG intensity of output is the second highest in the OECD (after Australia's), not surprising for a resource-rich country. Its unique emissions profile, however, makes for costly mitigation: an exceptionally high proportion of electricity generation is already renewable-based (mainly hydro), and no technology to significantly reduce methane from ruminant animals yet exists. New Zealand is a pioneer in implementing an emissions trading scheme (NZ ETS) covering all sectors and gases. Green growth could best be supported by the greater use of market mechanisms among a range of instruments in natural resource management and by strengthening price signals in the NZ ETS. This Working Paper relates to the 2011 *OECD Economic Review of New Zealand* (www.oecd.org/eco/surveys/NewZealand).

JEL classification codes: H23, Q42, Q48, Q52, Q53, Q54, Q57, Q58
Keywords: New Zealand; environmental policies; resource management; waste management; renewables; climate change; GHG emissions; agricultural emissions; emissions trading scheme; carbon price; Kyoto obligations; water use; water pollution; nutrient trading; mining; biodiversity

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Politiques relatives à la croissance verte et au changement climatique en Nouvelle-Zélande

La Nouvelle-Zélande, dont l'économie repose sur l'exploitation de ses ressources naturelles et qui a à cœur de protéger et de promouvoir son image de pays respectueux de l'environnement, voit à juste titre dans la croissance verte une orientation naturelle pour son développement futur. Le pays bénéficie d'un environnement de qualité et du fait de l'abondance de ses ressources naturelles il n'est guère menacé par le risque de leur épuisement. Néanmoins, des défis se profilent à l'horizon. La tarification des ressources en eau étant peu pratiquée, des pénuries d'eau se font sentir avec de plus en plus d'acuité dans certaines régions de production laitière exposées aux sécheresses. La qualité des eaux se dégrade en raison des infiltrations de sous-produits agricoles. L'activité agricole est par ailleurs responsable de près de la moitié des émissions de gaz à effet de serre (GES) du pays, tandis que la consommation d'électricité et le transport privé pèsent eux aussi de plus en plus. L'intensité de production de GES de la Nouvelle-Zélande est la deuxième plus élevée de l'OCDE (après l'Australie), ce qui n'est guère surprenant pour un pays richement doté en ressources. Son profil spécifique d'émissions, toutefois, rend coûteuses les mesures d'atténuation : une proportion exceptionnellement élevée de la production électrique est déjà basée sur les énergies renouvelables (essentiellement hydrauliques), et il n'existe pas encore de technologies permettant de sensiblement réduire les émissions de méthane des animaux ruminants. La Nouvelle-Zélande est pionnière dans la mise en œuvre d'un système d'échange de quotas d'émission (ETS) couvrant l'ensemble des secteurs et des gaz. Le meilleur moyen de promouvoir une croissance verte serait d'utiliser plus largement les mécanismes de marché, entre autres instruments, pour la gestion des ressources naturelles et de renforcer les signaux donnés par les prix dans le cadre du système néo-zélandais d'échange de quotas d'émission. Ce Document de travail se rapporte à l'*Étude économique de l'OCDE de la Nouvelle-Zélande 2011* (www.oecd.org/eco/etudes/Nouvelle-Zélande).

Classification JEL : H23, Q42, Q48, Q52, Q53, Q54, Q57, Q58
Mots clefs : Nouvelle-Zélande ; politiques environnementales ; gestion des resources ; gestion des déchets ; énergies renouvelables ; changement climatique ; émissions de gaz à effets de serre (GES) ; émissions du secteur agricole ; système d'échange de quotas d'émissions , prix du carbone ; obligations de Kyoto ; utilisation de l'eau ; pollution de l'eau ; échange de quotas sur les nutriments ; industries minières ; biodiversité

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Green growth and climate change policies in New Zealand

By Alexandra Bibbee[1]

According to OECD (2011), green growth involves mutually supportive economic and environmental policies. New Zealand's competitiveness will depend on adopting best-practice economic policies that will encourage innovation and productivity improvements throughout the production chain. This paper will show how this also depends on nurturing a competitive advantage in natural capital.

Green growth – a long-run competitive advantage

New Zealand, even though it is a small country accounting for only 0.2% of world GDP, is highly affected by the global environmental policy agenda. By taking its international obligations seriously, notably under the Kyoto Protocol, it stands to gain a place at the table when accounting rules for the treatment of forestry and agriculture, which concern New Zealand's emissions profile acutely, are discussed. Furthermore, small countries can play significant symbolic roles: by showcasing its own sustainable economic management, and by doing its own fair share, New Zealand encourages others to do the same, thereby moving the system forward. Even though its actions directly contribute little to either causing or reversing global ecological degradation, each tonne of its CO_2-equivalent emissions reduction is as good as any other (Kerr, 2009).

New Zealand has much to gain from the green growth agenda, given that its prosperity depends significantly on its own natural resource heritage, which clearly must be safeguarded. Co-operating on global climate change is likewise in the national economic interest, given New Zealand's susceptibility to its impacts. According to reports from the Intergovernmental Panel on Climate Change, these include water security and drought risks, and increased coastal flooding and storm events. Moreover, the economic value of the "100% pure" global NZ brand should not be underestimated. The brand needs to be carefully honed by enlightened policies that allow exporters to better tap into upscale markets where ethical values are increasingly entering into spending and investment decisions. Consumers and retailers in richer countries are becoming more demanding about the ecological provenance of products ("value chain integrity", including animal welfare).[2] By credible reinforcement of its clean-and-green image,

1. Senior Economist in the OECD Economics Department. This paper reports on background work for the 2011 *OECD Economic Survey of New Zealand*, published under the responsibility of the Secretary General. The author is grateful for the valuable discussions and comments received from colleagues including Calista Cheung, Andrew Dean, Alain de Serres, Balázs Égert, Robert Ford, Peter Jarrett, Andrew Prag and Simon Upton, as well as officials from the New Zealand government. Special thanks go to Françoise Correia for statistical assistance and to Mee-Lan Frank and Maartje Michelson for editorial support.

2. According to C. James ("In search of elusive green growth", *Dominion Post*, 22 March 2010), retail chains are the new regulators. For example, Marks and Spencer, a British chain, has launched a massive "eco and ethical" plan mandating sustainability standards in the food, clothing and home items it sells. Ikea, WalMart, Unilever and others have likewise embraced profit-enhancing green marketing strategies.

New Zealand may be able to forestall action (instigated by either foreign competitors or public interest groups) against its exports of both goods and services (notably dairy and tourism).

Perhaps most fundamentally, adopting environmental policies that internalise the cost of externalities of economic growth can confer a longer-run competitive advantage, leading to greater investment, product differentiation, innovation, etc. (OECD, 2010a). It would better position New Zealand to supply new green-based wants and technologies to a world eager for them, including emerging markets in East Asia. Developing new niches based on value added in the form of human capital linked to the environmental theme may also help diversify and expand exports beyond natural resource exploitation activities, which face physical limits. There is already a strong core of firms in the clean technology area – renewable energy, sustainable biofuels, sustainable agriculture, energy efficiency and sustainable design, hybrid transport and waste minimisation (Oram, 2009) – whose expansion and growth can be encouraged by valuing scarce natural capital and pricing externalities, notably greenhouse gas (GHG) emissions. Such industries will need to stay ahead of the competition.

Sustainable development: growth within limits

Sustainable development is a cross-sector policy approach that seeks to balance material prosperity with avoiding environmental degradation, *i.e.* economic growth that is based on the sustainable use of natural resources. Natural resource management, climate change, water and waste management are widely accepted in New Zealand as being of fundamental significance to its present and future welfare. While environmental quality is still high, worsening performance trends are being seen in a number of key indicators, such as GHG emissions and, in some areas, water quantity and quality. Threats to the nation's unique biodiversity have grown with its increasing integration into the world economy.

Sustainable development has been aptly defined in New Zealand as a pattern of growth that raises living standards without prejudicing future generations. This concept also encompasses broader aspects of well-being for all generations than those captured simply by GDP (*e.g.* Stiglitz *et al*., 2008). New Zealand is one of the few OECD countries with a wide positive gap between subjective well-being as measured by life-satisfaction surveys and net national income per capita. Besides environment and lifestyle, such notions of happiness often incorporate social factors like equality of income and opportunity. In keeping with multiple objectives the OECD has called for growth that is "strong, fair and clean".

The governance framework: the Resource Management Act

The Resource Management Act 1991 (RMA) and planning under it are the principal means through which the environmental effects of economic activities are managed in New Zealand. The core purpose of the Act is to promote the sustainable management of natural and physical resources by safeguarding the life-supporting capacity of air, water, soil and ecosystems. Regional and territorial plans and policy statements must be consistent with national regulations, standards and policies, as determined by National Policy Statements (NPSs) and National Environment Standards (NESs). Under section 32 of the RMA, regions must consider costs and benefits of proposed policies for achieving the desired outcomes, including alternative methods (market-based instruments, information or voluntary action, etc.) when the default option is command and control. The Act also allows further devolution of environmental policy responsibility to communities and stakeholders: for example, conservation covenants with private landowners, voluntary commitments by companies, NGO surveillance, public information and clean-up activities. Public consultation is mandatory in planning and policy development.

In principle, the system of hierarchies imposed by the RMA makes for an *ex ante* robust governance framework. It combines the advantages of national unifying goals and strategic policy direction (technical expertise, political tradeoffs) with those of subsidiarity (local knowledge and accountability, flexibility) in

its implementation. The Local Government Act 2002 (LGA) bolstered local authorities' scope of action under a sustainability mandate. The LGA consolidated a confusing plethora of former laws and bylaws, with the aim of: *a*) enabling democratic decision-making and action by, and on behalf of, communities; and *b*) promoting the social, economic, environmental, and cultural well-being of communities, in the present and in the future.

In practice, however, the system has worked less than smoothly. Regional and district councils implement policies largely by a system of "consents", namely, the granting of permits or permissions to use resources, water or land, in the course of economic activity on condition that the relevant environmental norms are respected. A consent is thus a time-bound entitlement to "take" common-pool natural resources. Full devolution with greater local autonomy has given rise to an inconsistent approach to regional consenting, however, creating regulatory uncertainty and an uneven playing field for business. The quality of regional plans is highly variable. Cost-benefit reports generally suffer from a lack of any quantitative analysis or national government oversight. Market-based instruments, known to be more efficient than command-and-control measures (Sharp, 2002; de Serres *et al*., 2010), are rarely used. The general lack of pricing in resource allocation makes for a contentious and lengthy consenting process. Applicants or third parties may appeal councils' decisions to the Environmental Court, which has had to interpret the RMA. Multiple appeals are used strategically, allowing applicants to redesign their petitions to fit the views of the court until they are approved or finally withdrawn. Third parties can join appeals and often do so for anti-competitive rather than environmental purposes.

The Act has been amended twice, in 2005 and 2009, to address such issues (Box 1). Also, in 2010 the government created an Environmental Protection Authority (EPA), a Crown entity focused on environmental policy implementation in matters of national interest (*e.g*. waterways that cross regional boundaries or infrastructure projects with national impact). The creation of the EPA provides hope of a technically skilled and independent administration effectively advocating for the environment. It should set and monitor legal standards (NESs) that are clear and enforceable (Sustainability Council, 2010a), and its Board as the body accountable to the *Minister* (rather than the *Ministry* for the Environment, MfE) should be given the power to control the exercise of its functions (PCE, 2011). The government has also taken the drastic step of intervening directly against a regional council for failing to specify a regional plan and poor water management, replacing the commissioners and taking over water consenting and conservation orders while bypassing the Court. While these interventionist steps can be justified as a last resort, they may undermine incentives for local accountability. It is important that the boundary between national and local interests and competencies be carefully drawn so as to preserve the best of the existing system. But local authorities have complained that the national government does not provide sufficient guidance on what sustainable development really entails (OECD, 2007). It is equally important that co-operation within central government itself advances to the point where broader economic policies integrate and are coherent with environmental goals. This currently seems not to be entirely the case with respect to GHG emissions and biodiversity conservation, as will be seen in the examples of policy implementation below.

Policy issues in water and land management

Emerging resource limits

Water and land management are closely inter-related. Agriculture needs water, especially in sectors of increasing global demand like horticulture or dairy farming. The relative abundance of water, as well as land, in New Zealand thus helps to explain its comparative advantage in agriculture (Figure 1). Nevertheless, recent years' intensification of pastoral agriculture in response to rising world dairy prices – typically by either conversion from sheep and beef to dairy farming or by intensification of existing dairy farms through the subdivision of plots and installation of expensive irrigation systems in drier regions – has exerted unprecedented pressure on water resources (and on rural land prices). At the same time, winter

droughts have occurred with increasing frequency. Limits to water resources are being acutely felt in certain regions, such as the east coast of the South Island, which has both a high concentration of dairy farming and exposure to dry weather.[3] Climate variability also means that heavy rains in other areas, notably the west coast, can give rise to surfeits of water coexisting with shortages elsewhere. Because of New Zealand's geography, featuring mountainous terrain and short river flows, the geographical redistribution of water is difficult. By contrast, Australia tends to have long rivers covering vast catchments suitable for water trading.

Box 1. **The 2009 (Phase I) RMA amendments**

The October 2009 RMA amendments sought to reduce the problem of long delays for consenting and to deter frivolous objections and appeals and anti-competitive behaviour, which greatly reduce regulatory efficiency.

Long delays for consenting

Three main instruments were introduced. First, applicants were given the ability to refer potentially contentious applications directly to the Environmental Court (by-passing the local authority hearing and decision stages). One successful use of this instrument so far (a supermarket application) resulted in a decision within nine months, a saving of more than a year over what might otherwise have been expected. Experience has shown that the main objectors to new supermarkets tend to be competitors, and there appeared to be no objections on competition grounds on this occasion. Second, applications for resource consents may now be made directly to the newly established EPA. Actual applications and those under discussion so far represent a total of NZD 8.5 billion in infrastructure work. The EPA reports that decisions on these projects are on track to be made well within the required nine months of their public notification, as required by the amendments to the Act. Third, regions are required to provide a discount on administration fees when consent approvals are processed late. This seems to have encouraged a review of internal systems and processes to ensure greater compliance with timeframes among regional councils, though it is too soon to observe the impacts on actual processing and approval times.

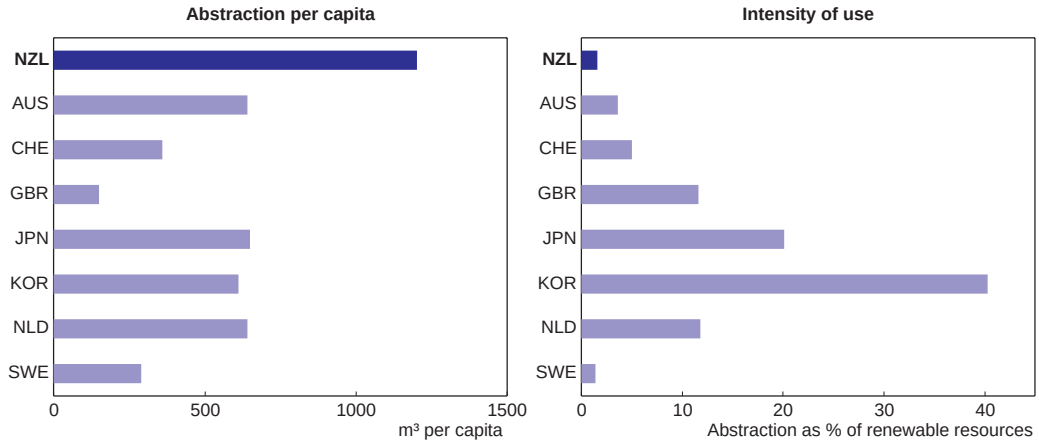
Frivolous objections and appeals and anti-competitive behaviour

Four measures were introduced: *i*) punitive court costs for a finding of anti-competitive behaviour (as proposed by the 2009 *Survey*); *ii*) a narrowing of the range of parties able to join Environmental Court appeal proceedings as a third party; *iii*) explicit restrictions on trade competitors' interventions; and *iv*) the removal of anyone being able to purportedly represent the public interest (a grounds previously used by trade competitors to join appeals). The results of these measures are as yet hard to quantify, especially as transitional provisions mean that appeals by trade competitors of resource consent applicants are still being considered under the pre-amendment provisions. However, anecdotal evidence suggests that anti-competitive behaviour is now less common, as trade competitors are concerned that they may become a test case for the new regime. The depressed economic climate may also be a contributing factor, as fewer resource consent applications are being made, and businesses have given priority to other uses of their resources.

3. Low lying flat land is most suitable for grazing, especially by dairy cattle but in that case also requires higher-quality grass, hence more ample watering, than sheep or cattle for slaughter. Many such areas, such as the Canterbury plains, are intrinsically dry and thus have not been traditional dairy farming regions until lately, as the dairy price surge made it economical to invest in expensive irrigation infrastructure.

Figure 1. **Water resource use**

2009 or latest available year



Source: OECD data from the Environment Directorate.

Water quality is likewise at stake. Nitrogenous effluent from agricultural fertiliser and animal urine seeps through the earth and into surrounding lakes and rivers where it nourishes the growth of algae, which in turn diminishes the quality and aesthetic value of the lakes, while harbouring waterborne diseases. Biodiversity is harmed, as the same nitrogen leaching causes eutrophication of waterways. The impairment of water flow in rivers and of aquifer levels during droughts and increased abstractions from irrigation systems has exacerbated such quality problems insofar as the absorptive capacity of the water decreases. Urban waste water, if not properly treated, may also seep into water tables. Recreational water uses that are fundamental to the tourist industry and vaunted NZ lifestyle alike increasingly collide with agricultural and community uses. Even so, New Zealand's agricultural nitrogen balance, while deteriorating, is still much lower than many other OECD countries on account of the extensive pastoralism practiced and the absence of input subsidies (Figure 2).

Agricultural water use

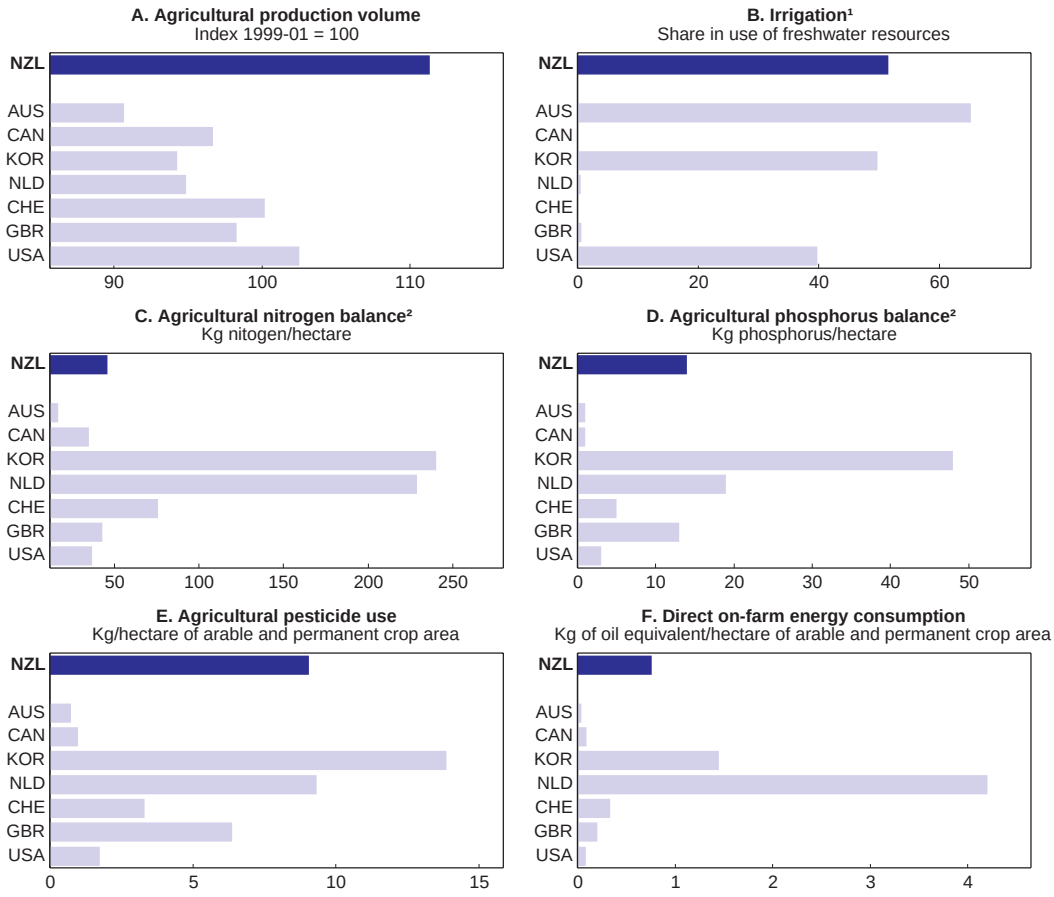
The devolution of powers under the RMA and LGA to territorial and regional levels means that different approaches have been adopted for allocating water. In agriculture, the first come, first served approach to water allocation is used by almost all regional councils and works well in those catchments where water is plentiful but is less efficient where limits are being reached. A system of 'water consents' under the RMA enables farmers to extract specified quantities of water for agricultural purposes for varying durations up to a maximum 35 years, often for 15 years, with no automatic right of renewal but applications from prior consent holders do go to the head of the queue for reconsenting. Indeed, there is often a presumption of renewal if significant investments in water infrastructure have been made. The role of irrigation has shifted from drought-proofing to a means of diversifying agricultural production. Thus, consents enable farmers to change the nature of production, notably from sheep grazing to arable farming or to dairy. However, the consents are often attached to the property and can be traded only with difficulty unless explicitly provided for by the Council in regional plans.[4] Water rights can sometimes be "rented" for a time, such as during periods of drought. This means that one does not observe prices for agricultural water in New Zealand. Nevertheless, in regions where water has become scarce, a positive shadow price must exist. In such cases, the sale price of property embodies the scale and duration of the water consents

4. Partial trades, *i.e.* selling unused parts of entitlement, have been allowed since 2009.

attached to it.[5] Property valuations for tax (council rate) purposes may also reflect this shadow price insofar as they reflect the full value of the farm (discounting the present value of extra net farm income due to the consent).

Figure 2. **Selected agricultural indicators**

2002-04 average or three latest available years



1. 2006 or latest available year.
2. Balance between the quantities of nitrogen/phosphorus inputs (*e.g.* fertilisers) into, and outputs (*e.g.* crops, pasture) from farming.

Source: OECD.stat and OECD (2008), *Environmental performance of agriculture in OECD countries since 1990*.

The main economic impacts from the current resource consent process are that: *a*) water is not necessarily going to its highest valued use; and *b*) in areas where demand outstrips supply, some highly valued community uses (such as domestic water supply) can face a lack of availability because of existing allocations to other uses. The volume of rural water abstraction is limited only by minimum water flow levels per unit period and over time, and actual use is not measured. Minimum water flows themselves are

5. Grimes and Aitken (2008) find that based on sales price equations, reasonable variation in the size of water rights and farm characteristics can give rise to a positive irrigation premium of up to 50% relative to similar non-irrigated properties. The net return to irrigation would be negative for many farms after investment costs are taken into account. Since the shadow price of water varies significantly with farm characteristics, water may be misallocated.

poorly and inconsistently defined and enforced, due to the basic lack of national measurement and quality standards. Some farmer groups have vigorously resisted efforts at water abstraction measurement as a prelude to charging, which would not only raise their production costs but also reduce the value of their land, even if it would yield obvious efficiency and distributional gains. The need to measure water use and quality as a condition for better management is receiving high-level attention (Box 2). Water metering regulations were introduced in 2010 and will be phased in over the next few years, beginning with the largest takes.

Box 2. **Evolving NPSs and NESs for water**

Many New Zealanders do not understand the limits of water resources because information about how much water they use is incomplete. It is the task of central government to establish long needed National Policy Statements (NPSs) and National Environmental Standards (NESs) for water. They could help fill such information gaps and provide guidelines to local government as they implement water policies. New Zealand has an NES for ecological flows and water levels under development, but no specific standard for freshwater quality *per se*. It also has an NES for Sources of Human Drinking Water 2007. The Ministry for the Environment is investigating how to strengthen its role in monitoring the implementation of NESs. An NPS for freshwater management was submitted to an appointed Board of Inquiry in 2008, with the policy intent to improve water quality, including managing allocation and contamination, and protecting wetlands. In January 2010 the Board reported back to the Minister recommending an alternative (stronger) NPS. A Land and Water Forum has been set up to engage stakeholders and communities in the design of the new policy under the Fresh Start for Freshwater Programme (FSFP) (Land and Water Forum, 2010). The FSFP includes projects on how to develop options to ensure information reported at all levels is collected in a consistent and dependable way, in order to make better management decisions. The Forum called for more government investment in water research in order to deliver both the knowledge and the tools required by decision makers. Some preliminary thinking has also been undertaken by the Forum on various options for water pricing. However, no decisions have yet been made about either pricing or the system of local rates.

The 2005 RMA amendments were intended to provide regional councils with more flexibility in how they allocate water. This included allocation amongst competing uses and transfer of water use rights (within individual catchments). This new flexibility is hardly being used, however, suggesting that incentive structures facing local governments, rather than the institutional framework *per se*, are the problem. Some regional councils are seeking to incorporate different approaches in their next round of planning to encourage flexibility and/or transferability, although many are not. Reasons cited are the risks of costly legal challenges, public acceptability issues and the current structure of water permits. Apparently, local development and property interests still take priority over the environment in much local decision-making. In regions where farm interests may be pitted against environmental interests – notably in Canterbury with a more balanced urban-rural population split than elsewhere – decision gridlock can occur. The exceptional case where market mechanisms have been applied, namely in the Lake Taupo catchment, was the result of the unusual leadership, capacity and foresight of the regional council, as well as special geological circumstances (Box 3). Also adversely affecting both water- and land-use allocations is the lack of incentives for efficiency in processing consents, which however was addressed by the 2009 RMA amendments.

Box 3. **Nutrient trading in the Lake Taupo area**

The origin of nutrient trading

Following over 20 years of scientific research, it was concluded that Lake Taupo, the largest lake in the Southern hemisphere and a major NZ tourist attraction, was in danger of degradation mainly due to diffuse unseen inflows of agricultural effluent and to a lesser extent urban sewage, even though water in the lake is still regarded as almost pristine. A key factor in the risk of future deterioration was the type of subsoil in the region, made of volcanic pumice stone, which is porous and uneven, greatly facilitating the flow of nitrates from the soil into the lake, but with very long lags before the full effects become apparent. The severe winters in the region also make for accelerated effluent flows during the long months of no grass cover. As the pristine blue quality of the lake has an almost iconic status and lies at the heart of a booming regional economy with a significant tourist sector, the decision was made some eight years ago to implement trading in nitrogen pollution rights, with an initial free allocation of permits made on the basis of the last five years' average nitrogen emissions, serving as a firm cap: new entrants or those wishing to expand their production would have to buy existing permits from (initially grandfathered) holders.

This economic intervention was supported by the introduction of a regulatory requirement for all farms in the catchment area to have a resource consent to farm that limits and controls the maximum amount of nitrogen each farm can emit. This is assessed by Environment Waikato (the regional council for the catchment) working with farmers and assessing nitrogen emissions using stock numbers, stock type and various other parameters that are the passed through a computer modelling tool to provide a maximum nitrogen benchmark level that has to be met. This is the first time for New Zealand that this type of regulatory approach has been used.

Initially there was fierce opposition from the farmers, which was driven in part by a perception that nutrient caps would limit the potential for land-use conversion to dairy, thereby lowering property values. They were likewise slow to accept the linkage between their farming activity and leaching into the lake, especially when found at some distance from the farm. The only way to establish the linkage was via scientific modelling. In the end, a compromise was reached. Following a decision by the Environmental Court on an appeal filed by local farmers, each farmer was given a top-up equivalent to the gap between his/her own year peak and the average during the five-year period (thereby rewarding heavy polluters). Farmers, as traders, have adjusted surprisingly rapidly to the new regime, although they have preferred dealing in face-to-face markets, rather than the internet-based trading that had been initially established.

The Lake Taupo Trust

A target of a 20% reduction in nitrogen leaching by 2018 (153 tonnes annually) was also set as necessary to maintain the lake's existing water quality and to reduce the effect of predicted future higher nitrogen flows. As the last five years' average cap on the number of allocated permits (plus top-ups) greatly exceeded this target, another mechanism had to be pursued. Thus, in 2003 the Lake Taupo Trust was set up in order to achieve this reduction by various means, including purchasing farms and on-selling with nitrogen restrictions in place or agreeing with landowners on permanent reductions in nitrogen which would then be compensated by the Trust. In both cases nitrogen reductions are secured by contracts and land covenants lasting 99 years. The Trust was funded 40% and 60% by national and regional/local governments, respectively, in the total amount of NZD 81 million, which in turn was calculated as the targeted reduction in nitrogen emissions, divided by per hectare average emissions intensity (sheep, dairy or forested land emitting, respectively, 15, 35 and 3 kg per hectare), times the average price of a hectare of farmland, which around eight years ago was NZD 5 000.

Around the same time, however, there was an emerging bubble in global dairy prices, which greatly increased the return to dairying and encouraged conversions from sheep and beef farming (which had been the prevalent mode of production, given the type of soil and climate) to dairying. This had two seriously adverse impacts on the ability to achieve the objectives of the programme: *i*) the average price of farmland shot up to NZD 15 000 per hectare and that for dairy farms to NZD 35 000 per hectare (beef and sheep farm land values also appreciated due to substitution effects); and *ii*) the amount of nitrogen emissions per hectare of farmland was increasing due to the effect of the more nitrogen-intensive dairying. The upshot was that the Trust would have needed a significant boost to its resources, which was neither foreseen nor planned.

The saviour of the programme appeared unexpectedly in the form of the emissions trading scheme (ETS). The Trust was able to leverage ETS forestry credits into target-compatible nitrogen emissions reductions using only its limited budget, in the following way. Major GHG emitters in the region were keen to establish their green credentials but also to lock in a long-term GHG emissions permit price upon their entry into the ETS in 2010. The Trust brokered innovative agreements between farmers and such companies, who agreed to an attractive long-term price (including a security premium) for ETS credits that are generated by the partial conversion of farms into forest cover. This has most often occurred in beef and sheep farms, which tend to have less productive (usually hilly) land suitable for forestry. The Trust then paid farmers for the reduction in nitrogen emissions, at the same time that they were receiving income from forestry credits. The monetary gains to farmers were significant, while allowing them to continue farming as a profession and also diversify their risk by becoming part-time foresters. Economic efficiency is being served insofar as a natural asset has been given a value in a way that tips the balance in favour of less polluting land uses. Using these techniques the Trust has been able to achieve over 50% of its target over a very short period of time.

Environment Waikato is now looking at further applications of these approaches in the region. It could serve as leader in market mechanisms to maximise the benefits and synergy between controlled forestry on more marginal agricultural land where benefits of conversion to forestry could not only provide environmental benefits but also a higher economic return to farmers. As all these schemes involve new plantings and considerable initial expenditure they are heavily dependent on the long-run viability of the ETS. It is crucial that the government make a firm commitment at the next review to maintain the scheme independent of other countries' actions.

The role of Māori

Section 6 of the RMA outlines matters of national importance that must be recognised in respect of water allocation including "the relationship of Māori and their culture and traditions with their … water… and other taonga ('tangible or intangible treasures of great value')". Lake Taupo holds special significance for "Iwi with tangata whenua" ('people of the land') in the catchment. The first joint agreement involving carbon and nitrogen was completed among the Trust, Mighty River Power and Puketapu and Oraukura Māori Authorities in March 2010. This agreement achieved a reduction in nitrogen of 22 000 kg through conversion of 550 ha of land to forestry and by major changes to farming practices involving holding stock numbers and wintering animals outside the catchment. Since both custom and law governing Māori land inihibit Maori land being sold (although it can be bought), such co-management regimes may be well suited to the values of water and guardianship attributed to them under the RMA.

Allocation of water rights is complex and of particular concern to Māori, who have not yet developed much of their agricultural land, as it is being progressively acquired under treaty settlements, which have greatly accelerated under the present government. They therefore stand to receive only limited allocations of the right to pollute/produce if allocations are made on a historical output basis, effectively cutting off the prospect of development. This suggests that a means of compensating for loss of land value other than grandfathering may need to be found. Simple water-quality trading, *e.g.* using proxies such as livestock densities and nutrient surplus at the farm level, has potential as a transfer mechanism. The auctioning of water rights may be the most efficient way forward (Business NZ, 2010).

Source: Information largely based on discussions with Graeme Fleming, CEO, Lake Taupo Trust.

A particular concern relates to the difficulty in obtaining consents for new water storage facilities.[6] Storage is being promoted as a win-win solution for agriculture. It is argued that the major explanation for inefficient water use is the uncertainty associated with its availability. A farmer is likely to use water up to his or her entire allocation unnecessarily, merely as a precaution against possible future shortages. Storage would serve a variety of interests: *i*) farmers would be more willing to pay for water if it comes with greater reliability of supply; *ii*) environmentalists may be coming round to the idea that "ruining" one river in the catchment by building a new dam and storing diverted water in a reservoir could improve the quality of all the other rivers by creating greater stability of flow and hence greater water volumes and lower pollutant concentrations; and *iii*) power companies may help in funding insofar as a new hydro plant could piggy-back on a new dam, which would also reduce GHG emissions.[7] One project, the Opuha dam, has also shown that economic efficiency can be served by issuing a single consent at the level of the irrigation company – obviating the need to issue many small consents with a vast saving in administration – while shareholders in the company trade water under the global consented cap, allowing it to be channelled to its most efficient uses. Nonetheless, there may be unknown long-run environmental effects of building new dams. Also, by facilitating the expansion of dairy production and resulting methane and nitrous oxide emissions, extra storage may be incompatible with Kyoto targets. To that extent, the feasibility of new storage dams may depend on the uncertain emergence of new agricultural GHG mitigation technologies.

6. One company in the Canterbury region reportedly spent 10 years and NZD 11 million in seeking a water consent including the right to build a new storage facility. The consent was finally granted but the storage facility denied.

7. In Environment Canterbury, a new Water Strategy is under development and may involve the building of up to five new dams in order to allow agricultural production to increase by a targeted 50%.

Urban water use

Urban and industrial water use is currently charged by either volume (targeted user charges) or rating (either a flat rate or using land value as a proxy), with the exact mechanism decided by local councils. The water charges are earmarked to funding new and maintaining existing infrastructure. Targeted user charges are primarily promoted to encourage water conservation and so minimise infrastructure costs, rather than to serve environmental goals *per se*. However, experience in Auckland indicates that the installation of meters, even with subsequent changes in pricing, has had little effect on consumption behaviour. Price changes have been modest and incremental, as there has been little political will to impose higher water charges in the context of higher rates and council charges for a number of services. There may be a need to bring urban water management under the jurisdiction of the RMA, so as to ensure the environmental integrity of urban and infrastructure planning. This is in fact the intention of the so-called Phase II RMA reform currently under discussion.

Marine and coastal resources

New Zealand's long coastline and vast Exclusive Economic Zone make coastal and marine resource management of critical importance. The 2004 Foreshore and Seabed Act was until recently the governing framework for access rights to shore and seabed (it nationalised them). This Act has recently been replaced by the Marine and Coastal Areas Act 2011 to better accommodate obligations to Māori under the Treaty of Waitangi. The new draft has given rise to controversy, as Māori have the possibility of property rights attached to "sacred spaces and customary usage being recognised. The NZ public is accustomed to unrestricted access to beaches and shores, even on private property, via easement and other rules. This access is to be protected under the Marine and Coastal Areas Bill. In the fisheries sector, New Zealand does not provide any trade-distorting or environmentally harmful subsidies; is a leading advocate for elimination of fisheries subsidies in the WTO; and since 1986 has had in place a highly successful and widely copied quota-trading system for sustainable fisheries management. An interesting outcome of this system has been the spontaneous emergence of new derivative products based on the primary quota-trading market, adding to its overall efficiency.

Waste management

Management strategies for hazardous waste, solid and liquid waste treatment and disposal, and recycling/recovery are driven by a range of legislation. The 2008 Waste Minimisation Act provided a new range of tools including a national levy (user charge) of NZD 10 per tonne (+ GST) on all waste disposed of in landfills, and a requirement for territorial authorities (cities and district councils) to draw up waste management and minimisation plans. The Act has changed price signals associated with waste disposal and has thus increased internalisation of environmental objectives, though the levy is not presumed to fully reflect the external costs that disposal imposes on the environment, society and the economy and was primarily designed to generate funding to help local government, communities and business reduce the quantity of waste. A user-pay approach is becoming more common throughout the country. In most districts households are charged for waste services on a fully or partially user-pays system; very few authorities still use a fully general ratepayer-funded approach.

The RMA governs land contamination from waste activities, although hazardous-substance management is also governed by the Hazardous Substances and New Organisms Act. Discharges into the environment such as from waste disposal are controlled by regional councils. Land-use activities, such as the location of facilities for hazardous waste, are controlled by the territorial authorities. The RMA does not contain any explicit pricing mechanism to internalise environmental objectives in this area but does not rule out their development at the local level. As with water, the current framework is mainly command and control, nevertheless. There has been a welcome trend toward increased access for the community to

information on potentially contaminated sites. This can raise awareness amongst purchasers and others who may face liability and resale issues. Funding is also being provided by the central government to assist in clean up.

The NZ ETS (see below) calls for voluntary reporting of methane emissions from waste disposed of in municipal landfills and full obligations for landfill operators to surrender units (NZUs) as of 2013. It is expected that the cost of these units will be passed to customers through increased prices for waste disposal. Internalisation of the carbon cost will encourage landfill operators to install and operate efficiently any landfill gas-collection system and to separate organic from non-organic waste. It is unclear if the waste-disposal levy will be retained once the ETS is operative in the sector, or if it will be needed. The new EPA is best placed to administer the Waste Management Act as it already has been given responsibilities for the Hazardous Substances and New Organisms Act and for the ETS (PCE, 2011). This would allow for a coherent approach to interlinked policies of national significance.

Biodiversity and the quality of ecosystems

New Zealand boasts unique and remarkable flora and fauna that emerged from its long geological isolation from the rest of the world. The two major waves of human settlement (Māori and European) originally caused major (over 90%) loss of indigenous forests and wetland ecosystems, habitats and species, which continues with economic development to this day, if less dramatically.[8] The more immediate menace arises from expanding trade in goods by ocean shipping and the movement of people via tourism and immigration, which have led, at an accelerating rate, to the introduction of non-native species: possum, rats, rabbits, deer, various pests and weeds, and these have expanded rapidly because of the lack of natural predators. Biosecurity is of great concern, since any new pest or disease could potentially have a huge effect on the biosystem and economy. The government has stepped up border inspections of goods and people and made fines more dissuasive.

There is also a major role for conservation strategies. The protection of biodiversity on public land is governed by the Department of Conservation (DoC), and on private land, by the RMA.[9] New Zealand faces its main challenges in monitoring the drivers of pressures on biodiversity on private land. An NPS on Indigenous Biodiversity is currently under development. A main instrument of conservation on private land has been the negotiation of conservation trusts, involving monetary compensation for activities like trapping and poisoning invasive species or keeping them out by fencing, restoration of aquatic ecosystems (*e.g.* wetlands, ponds) and tree plantings in flood plains. Greater government monitoring of such voluntary efforts may nevertheless be required. A new reporting system is being put in place to greatly improve the quality of monitoring (pest and weed pressure levels, the condition and evolution of natural lands, and effectiveness of interventions), though more metrics and indicators may be needed. The public good value of biodiversity is often undervalued in the market, and the OECD is looking into possible economic instruments to correct this failure (OECD, 2011).

8. Both the original Māori people and the European colonists made huge changes over a relatively short time. Māori burned forest and practised agriculture using plants they brought from tropical Polynesia. The Europeans logged and burned off a third of the forest cover to convert land to pastoral farming. Relief workers in the 1930s planted vast areas of non-native radiata pine. Land conversions were stepped up after the abolition of agricultural subsidies in the mid-1980s. Some 90% of the nation's original wetlands has been destroyed (OECD, 2007).

9. Land Information New Zealand (LINZ) manages almost three million hectares of Crown land for farming and forestry, including 1.6 million hectares of high country pastoral land in the South Island and Crown forest land in the North Island, with the objective of putting this land to most efficient use.

The government has reopened the sensitive issue of exploiting mineral resources on public land. According to the new plans, the DoC must share responsibility with the Ministry of Economic Development (MED) for granting mining access rights to conservation land.[10] As the DoC has full accountability for the environmental integrity of such land and the MED issues all mining permits in the country, but primarily within a development perspective, there is a question of a conflict of interest and a possible weakening of the DoC in the new arrangement. Mining has also been put on a more privileged level than other commercial activities on public land. Commercial activity is flatly denied access if it in any way compromises environmental objectives, whereas mining activity can proceed only "with regard to" these same objectives. Assuming that projects go ahead – and this would be on the basis of a national interest cost/benefit analysis including environmental and economic considerations (Box 4) – the issue of public recapture of some of the associated rents becomes relevant and is two-fold. First, the royalties charged for taking the minerals (which belong to the public) are extremely low in New Zealand. Second, charges for access to conservation land (as distinct from taking the minerals out of the ground) should be levied at a high enough level to provide (along with negotiated remedial activities) a net benefit to the environment, notably to allow the DoC to improve its surveillance and research activities (PCE, 2010a).

Box 4. **Untapped mineral wealth**

New Zealand sits atop significant mineral wealth, including major coal reserves (that in terms of energy content per capita are larger than Saudi Arabia's oil reserves), as well as offshore oil and gas. Coal exports have increased dramatically in recent years, though in the future will be disadvantaged by carbon pricing policies. Rare earths are also to be found. At current rates of production most reserves should last decades if not centuries. Most resources lie under Crown-held land, and any gold, silver, uranium or oil lying under private land is declared to be Crown property as well. New Zealand's exclusive economic zone (EEZ) covering 4.3 million km^2 of surrounding ocean, some 15 times its land size, is the fifth largest such zone in the world, most of it unexplored and very deep. A recent study concluded that the production of oil and gas, metals, industrial (non-metallic) minerals and coal could be much greater than at present if it were properly developed, helping to deliver improved export performance and more efficient support to other industrial sectors, in turn significantly boosting long-run potential GDP (Barker, 2008). More R&D is needed to upgrade industrial minerals and find global markets for downstream products (as was done successfully for fine china clay). Whereas exploration activity has increased worldwide, given increased demand and rising minerals prices, in New Zealand the rate of expenditure on exploration has been declining. According to a recent global ranking of mining policy attractiveness, in 2008 New Zealand ranked 33rd out of 72 jurisdictions, behind all Australian states and Canadian provinces, with Quebec, New Brunswick, and Finland the top three (McMahon and Cervantes, 2010).

Climate protection

New Zealand's emissions profile

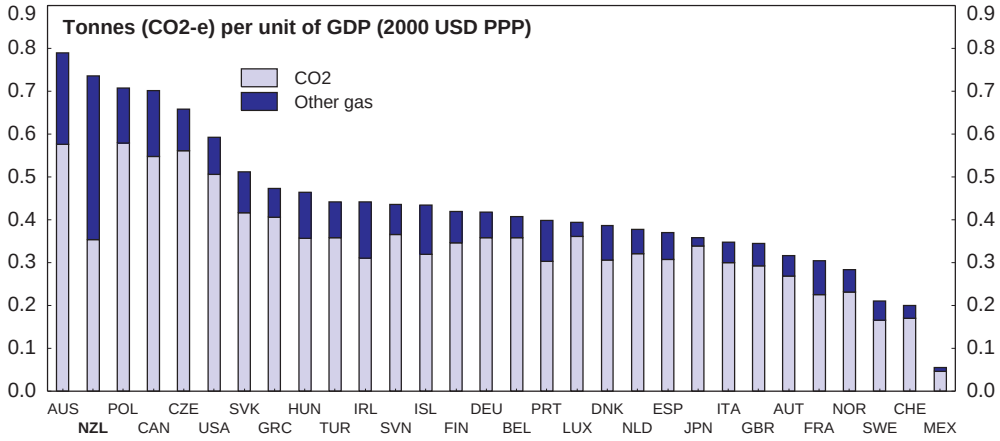
New Zealand is a heavy GHG emitter in relative terms, ranking second only to Australia among OECD countries in its output intensity of emissions (Figure 3), and it is the 12th highest per capita emitter in the world. In absolute terms, New Zealand contributed 0.4% of total Annex I emissions in 2008 (including those by economies in transition). Its emissions profile is very different from that of the average OECD country. Because of its unusually large economic weight, agriculture accounts for almost half of total emissions compared with 10% or less in other Kyoto Annex 1 countries, with correspondingly larger shares of methane and nitrous oxide (the main by-products of agriculture) in emitted GHGs (Figure 4).

10. The current proposal applies to the 60% of the conservation estate (which totals 8.5 million hectares) where mining can currently occur, that is, land that is not listed on Schedule 4 of the Crown Minerals Act. An earlier proposal would have allowed mining access to Schedule 4 land, including all national parks, with heightened protections. However, the public outcry was so great that the government quickly retreated (PCE, 2010a).

Elsewhere in the OECD, energy and carbon dioxide emanating from fossil fuel-based energy use dominate. New Zealand's total emissions trend is also subject to greater fluctuations than elsewhere in the developed world, mainly reflecting its vulnerability to weather patterns, notably drought, which increases the proportion of non-renewable electricity generation, affecting CO_2 emissions, and decreases agricultural productivity and livestock numbers, leading to corresponding declines in nitrous oxide and methane emissions (MfE, 2010). Finally, New Zealand makes far greater use of forest sinks to capture carbon, which offset nearly 40% of its agricultural and industrial emissions. Other Annex 1 countries offset only a small amount, and in this respect New Zealand is much more similar to many developing countries.

Figure 3. **GHG-emissions intensity excluding LULUCF**

Gross emissions, 2008 or latest available year



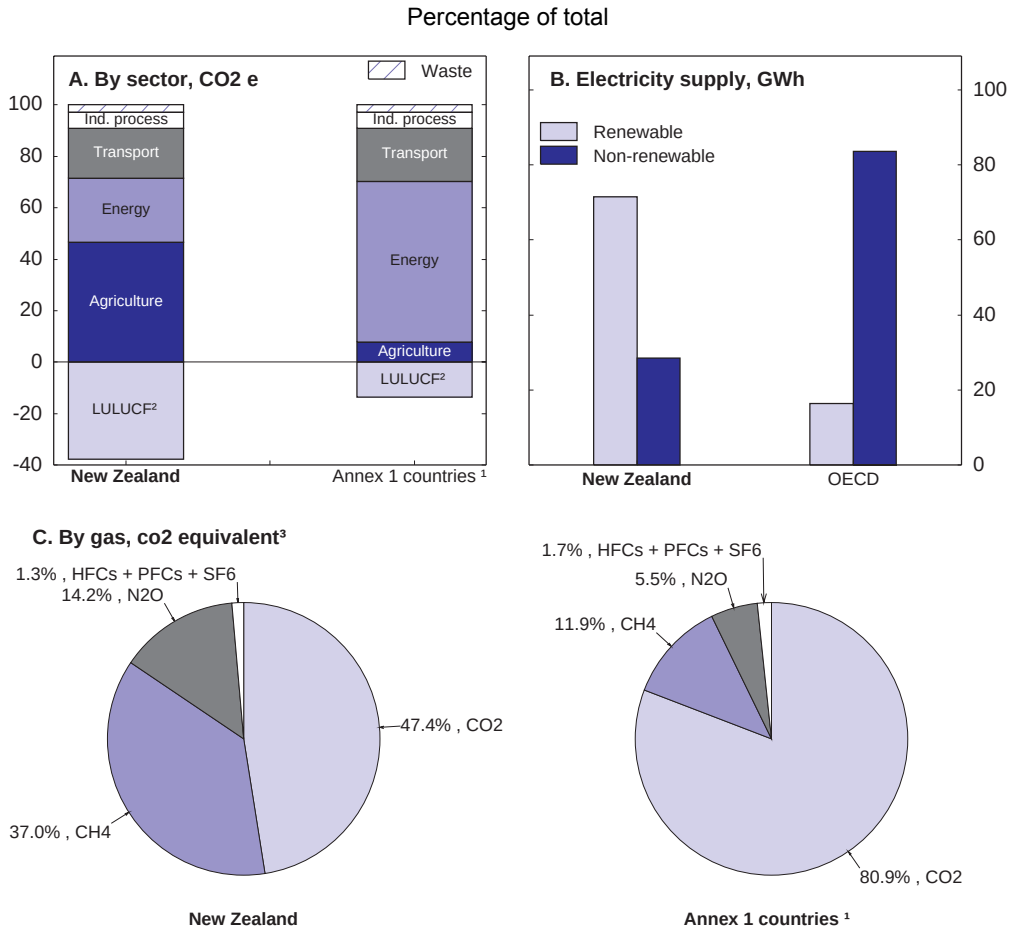
New Zealand faces particular challenges in reducing its total greenhouse gas emissions and its emissions intensity. Agricultural emissions reflect methane, produced by enteric fermentation (ruminant belching) and nitrous oxide, released by nitrogen-based chemicals and animal waste (partly as ammonia) into agricultural soils (Figure 5). The relatively high proportion of methane reflects the country's comparative advantage in intensive pastoral farming. However, there is no cost-effective way to substantially mitigate methane emissions. While a technology exists to control nitrous oxide emissions, so-called nitrification inhibitors, these may not be economically viable except on very intensive farms, though there is some debate (see below).

In the energy sector, emissions are relatively low but rising fast, mainly because of growing electricity use and automobile transport. Factors like low fuel excise taxes, an old car fleet, one of the OECD's highest car ownership rates, underuse of road charging and inadequate public transport infrastructure all make transport in New Zealand relatively carbon intensive. New Zealand is moreover experiencing substantial population growth by OECD standards. The population has grown by 25% between 1990 and 2007, the second highest rate amongst Annex 1 countries. The dispersal of the currently small population (just 4.4 million) and over an area similar in scale to countries with much larger populations (such as Britain or Japan), also reduces the potential for economies of scale and makes addressing transport emissions complex.

Policies could still help encourage mitigation opportunities, though they are hampered by New Zealand's low population density and geographic isolation. Demand for car transport also tends to be relatively inelastic with respect to price. Electricity generation is already relatively "clean", with about 70% produced from non-emitting sources, mostly hydro, but also some geothermal; nuclear energy

is not used and has little public support[11] (see Figure 4, Panel B). Whilst positive for New Zealand's total emissions profile, this reduces the potential to reduce emissions in future through fuel switching at reasonable cost. Nevertheless, there is expanding interest in geothermal, solar, wind and ocean-wave power despite the lack of subsidies of the sort as offered in many other OECD countries. Also, the access to forestry offsets compensates, at least for a time, for the relative lack of abatement opportunities in electricity compared with other Annex 1 countries.

Figure 4. **GHG emissions profiles, 2009**



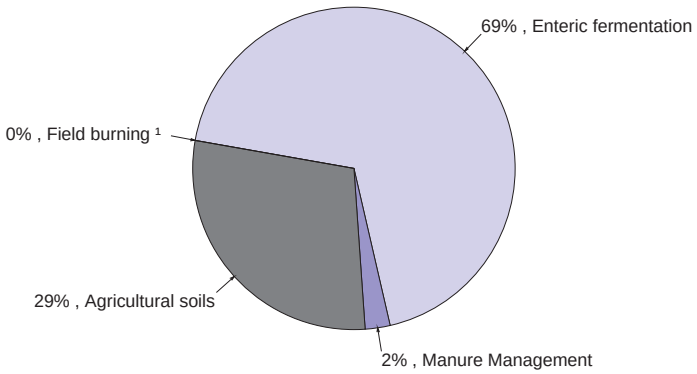
1. UNFCCC Annex 1 includes OECD and Eastern European countries but where OECD excludes Chili, Israel, Korea and Mexico (see Annex 1 at http://unfccc.int/essential_background/convention/background/items/2853.php).
2. Land use, land use change and forestry.
3. CO_2: carbon dioxide; CH_4: methane; N_2O: nitous oxide; SF_6: sulfur hexafluoride; PFCs: perfluorocarbon; HFCs: hydrofluorocarbons.

Source: Ministry for the Environment (2011), New Zealand's Greenhouse Gas Inventory 1990-2009 and United Nations Framework Convention on Climate Change and International Energy Agency database.

11. Nuclear energy is not prohibited. The NZ Nuclear Free Zone, Disarmament and Arms Control Act 1987 only precludes the use, production and transit of nuclear weapons, as is the use of nuclear propulsion. Nuclear explosions are also prohibited.
See: http://www.legislation.govt.nz/act/public/1987/0086/latest/DLM115116.html.

Figure 5. **GHG emissions in agriculture, 2009**

Carbon dioxide equivalents



1. Field burning of agricultural residuals and prescribed burning of savannas (negligible).

Source: Ministry for the Environment (2011), *New Zealand's Greenhouse Gas Inventory 2000-2009*.

Meeting Kyoto obligations

Under the Kyoto Protocol, New Zealand is committed to return its annual GHG emissions to 1990 levels during the first commitment period CP1 (2008-12) by reducing emissions, using emission credits from its post-1989 forests or buying international allowances (AAUs) or project-based credits (CERs/ERUs) on the international market. The NZ Emissions Trading System (NZ ETS), which came into effect in 2008, will be New Zealand's main policy tool to deliver on its international commitments. At the 2009 UN climate change conference in Copenhagen, New Zealand pledged a conditional target of 10-20% reduction from 1990 levels by 2020. However, the hoped for international agreement providing clarity on a post-2012 framework, including a Kyoto second commitment period (CP2, 2013-20), has not yet been reached. Like some other countries' commitments, New Zealand's is contingent on comparable efforts by other countries and on some other conditions relating to forestry accounting rules.

In 2008, New Zealand's GHG emissions as accounted under the Kyoto Protocol were 59.2 million tonnes CO_2-e, compared with 60.8 Mt CO_2-e gross emissions in 1990. Excluding net forestry removals under the Kyoto Protocol, New Zealand's gross emissions in 2008 were 23% above their 1990 level. This increase (the third highest in percentage terms in the OECD) was mainly accounted for by the energy sector, where emissions growth was three times greater than that in agriculture (the two sectors together accounting for 90% of total NZ emissions) and largely caused by increased use of motor vehicles and electricity generation (Table 1). Emissions peaked in 2007, coming down in 2008 as drought cut agricultural output and the economic recession reduced industrial and road transport emissions of carbon dioxide, with a partial offset from increased use of coal in power generation due to the drought. Also, with the entry of forestry into the ETS in 2008, deforestation began to reverse in that year.

Under internationally agreed Kyoto (as opposed to national) accounting rules for purposes of CP1, the government's projections for 2008-12 show the country to be in net surplus *vis-à-vis* the Kyoto target, so that it can meet its CP1 target through "own reductions" with no need to buy offsets abroad (Table 2). Though the ETS price signal is too weak to put much of a dent in gross emission rates during CP1 (see below), and average gross emissions in 2012 would still be 22% above their level in 1990, this gap will be more than offset by forest plantings (net of deforestations) since 2008, which have been supported by the

ETS.[12] However, decisions by NZ ETS participants, *e.g.* foresters exporting their units as Assigned Amount Units (AAUs) or greater deforestation/fewer plantings, could reduce New Zealand's overall headroom.

Table 1. **Trends in gross and net national GHG emissions, 1990-2009**

	Emissions ('000 Gg CO_2 equivalent)				Change (per cent)	
	1990	2007	2008	2009	1990/2007	1990/2008
By gas						
CO_2	25.0	35.0	35.7	33.4	40.0	33.8
CH_4	25.3	26.4	26.0	26.1	4.3	3.3
N_2O	8.2	12.1	10.3	10.0	48.2	23.0
HFCS	n.a.	0.9	0.8	0.9	n.a.	n.a.
PFCs	0.6	0.0	0.0	0.0	-93.4	-92.7
SF_6	0.0	0.0	0.0	0.0	-0.9	29.9
Total	59.1	73.2	72.8	70.6	23.8	19.4
By source						
Energy use[1]	23.4	32.6	33.6	31.4	39.4	34.3
Industrial processes and solvents	3.4	4.7	4.3	4.4	37.2	27.7
Agriculture	30.3	33.9	32.9	32.8	11.8	8.4
Waste	2.1	2.1	2.1	2.0	1.6	-1.6
Gross emissions	59.1	73.2	72.8	70.6	23.8	19.4
Land use changes and forestry	-21.5	-21.5	-29.4	-26.7	-8.5	13.8
Net emission	36.7	51.7	43.5	43.9	45.1	23.1
Carbon sinks (per cent)	39.7	29.3	40.3	37.8		

1. Includes transport, thermal electricity generation and manufacturing and construction.

Source: Ministry for the Environment (2011), *New Zealand's Greenhouse Gas Inventory 1990-2009*.

Depending on the nature of the post-2012 framework, the 2020 target may have to be met using a mixture of own reductions and forestry via the ETS and purchases of emissions credits abroad. However, the policy challenges are significant. Any credible international agreement is likely to require more stringent global 2020 targets than put forth heretofore. According to OECD analysis, the set of national targets tabled at Copenhagen will not be sufficient to reach the 2050 Kyoto goal of keeping atmospheric GHG concentrations to 450 parts per million, even at the ambitious end of target ranges (Dellink *et al*., 2010). A failure to tighten emission reduction targets during CP2 would imply greater efforts after 2020. Also, the lifetime of a plantation forest being about 30 years, the maturation and harvesting of the forests planted since 1990 (and which are now being encouraged by incentives in the NZ ETS) will produce a sharp rise in NZ net emissions starting around 2020 and spiking around 2030. This highlights the fact that plantation forest sinks are not a permanent solution (OECD, 2007), though increased forest establishment, and the storage of carbon in wood products, will lower atmospheric carbon over the long run. The projected peak in forestry liabilities around 2030 will sharply widen the emissions gap (Figure 6). This consideration implies that New Zealand will have to focus on reducing gross emissions, which are generated primarily by energy use and agriculture, supplemented if need be by accessing abatement options through the international carbon market.

12. Kyoto accounting allows 2008-12 performance as measured by *net* emissions to be apparently compared with a *gross* 1990 baseline emissions target. The treatment of pre-1990 forests, which eliminates their continuing carbon removal activity as of the baseline year, effectively sets 1990 net emissions equal to 1990 gross emissions. However, Kyoto accounting formally starts only in 2008.

Table 2. **Projections of net emissions and Kyoto accounts, 2008-12**

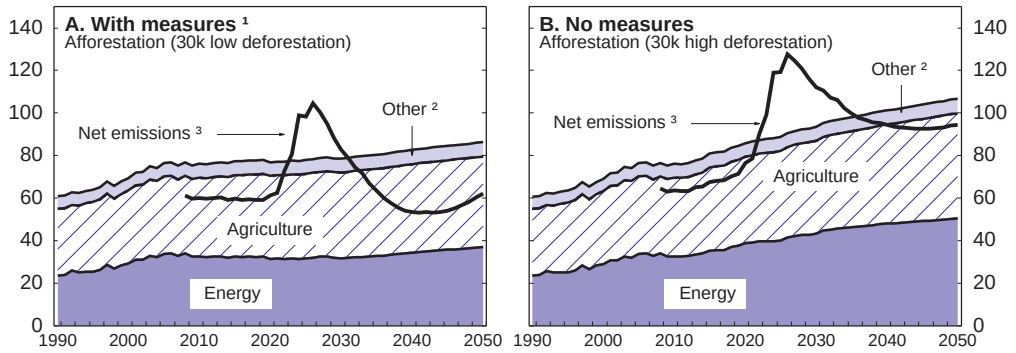
	Emissions (millions of tonnes of CO_2 equivalent)					
	2008	2009	2010	2011	2012	Total
Energy (including transport)	34.3	31.5	32.8	32.8	32.9	164.3
Stationary energy	20.7	18.2	19.4	19.2	19.1	96.6
Transport energy	13.6	13.3	13.5	13.6	13.8	67.8
Industrial process and solvents	3.9	4.0	4.2	4.3	4.3	20.7
Agriculture	34.5	34.5	35.5	36.2	36.9	177.6
Waste	1.7	1.6	1.6	1.6	1.6	8.2
Forestry						
Gross removals	-17.5	-17.6	-17.8	-18.0	-18.3	-89.1
Deforestation	2.4	2.4	1.5	1.5	1.5	9.2
Net removals	-15.1	-15.2	-16.3	-16.5	-16.8	-79.9
Total	**59.2**	**56.5**	**57.94**	**58.0**	**59.0**	**291.0**
Kyoto accounts						
Initial Kyoto Assigned Amount Units (AAU)						309.6
Less: Net transfers of AAUs						-2.1
Kyoto Protocol Units projected to be granted						-5.1
Total net emissions						-291.0
Equals: New Zealand's projected net position						+11.4

Note: Forestry figures in this table refer to net emissions and removals under Article 3.3 of the Kyoto Protocol, which excludes continuing removal, but includes deforestation, activity of pre-1989 forests. Positive numbers refer to emissions of greenhouse gases, and negative numbers refer to removals/sequestration of greenhouse gases. Initial AAUs equals the level of 1990 emissions times 5.

Source: Ministry for the Environment (2010), *Net Position Report*, 15 November.

Figure 6. **New Zealand's projected emissions through 2050**

Millions tonnes of carbon dioxide equivalent



1. The with-measures case is derived as follows: 1) Economic growth is based on the Treasury's Long Term Fiscal Modelling; 2) New Zealand's population reaches 5.5 million by 2050; 3) Historical rates of energy-efficiency improvements continue; 4) A carbon price of NZD 25 per tonne to 2013 and NZD 50 per tonne to 2050; 5) Oil prices reach USD 129 barrel by 2030 (International Energy Agency's World Energy Outlook mid-case scenario).
2. Industrial processes and waste.
3. Includes removal from post-1989 afforestation; excludes pre-1990 forest removals according to Kyoto forest definitions. Kyoto accounting only strictly applies for the period 2008-12.

Source: Ministry for Environment.

The current NZ ETS

System overview

The NZ ETS is a bold initiative by the government to proceed with a market-based, economy-wide approach to meeting its international obligations. Due to the fact that major trading partners have not introduced such schemes and with concerns amplified by the current economic situation, the ETS has been modified from its original (2008) version to: *i*) phase in the full carbon price signal for energy and industrial processes more slowly while further delaying the entry for agriculture to allow more time for sectoral adjustments; *ii*) move to an uncapped, intensity-based system of free allocations to shield trade-exposed heavy industry and agriculture from carbon leakage and competitiveness losses, which will greatly increase the level of allocations to those qualifying (Box 5).[13] The transitional measures blunt the carbon price signal, as some major emitters with the greatest likely abatement potential are exempted. During CP1, gross emissions will be reduced by only an expected 0.7% from business as usual projections, although the ETS will create an incentive for bigger reductions in gross emissions to 2020 and beyond if the scheme is implemented as currently legislated.

The New Zealand government has launched a review of the NZ ETS this year. This review will consider how the design of the ETS should evolve beyond 2012. A key consideration is the continuing uncertainty about the future of the international framework. If there is a binding and ambitious Kyoto-style agreement, it may well become vital to strengthen the pricing signal and its efficient economy-wide incidence. However, if there is a weak framework, or continued uncertainty, it may be in New Zealand's interest to maintain flexibility. In this latter scenario, striking the right balance between short-term flexibility and long-term risk reduction will be critical.

The NZ ETS is a solid basis upon which to build an efficient, fair and effective carbon pricing scheme, which the government has stated to be its goal. Indeed, the New Zealand experience may show that the "go slow" approach could be the best way to ensure political acceptability of an emissions trading scheme, thereby paving the way for its implementation. What may be more important right now is to provide correct incentives at the margin to habituate economic actors to the pricing of environmental consequences of their behaviour, rather than forcing major transitions. Nevertheless, the broader social acceptability and political durability of this highly complex new financial scheme and major economic reform will be an ongoing challenge.

The current ETS maintains some key attractive features of the founding 2008 legislation, namely an innovative and flexible approach to integrating with world carbon permit markets without the need for a cap on the allocation of permits, as supported in OECD (2009). This may give New Zealand more scope to expand its (efficient) agricultural sector in line with global food price signals. But eventually, the carbon price signal needs to be a disciplining tool. It should be applied equally across sectors to ensure that the lowest-cost abatements occur. The uncapped NZU (that is, emission permit) allocations to large industry and agriculture, modelled on a former Australian scheme, significantly reduce the carbon price signal in the short term. Ultimately, a cap on emissions and NZUs that is consistent with New Zealand's post-2012

13. For industry, allocations are more generous to those who qualify to receive them (being intensity based). But the revisions to the ETS also made it much more difficult to qualify – with strict emissions intensity thresholds on the face of the legislation. As a result, after the transition phase there will be lower levels of allocation to industry in the period 2012-18 than was predicted under the previous scheme. For agriculture, allocation is more generous overall. But, as agriculture emissions are not projected to rise significantly, the projected difference in levels of allocation compared with the pre-amendment ETS is small to 2018. Beyond 2018, allocations overall do become more generous compared to the previous version of the scheme given the divergence in phase out rates, though regular review clauses in the NZ ETS could change matters once there is more certainty about the action to be taken by major competitors.

international commitments would need to be imposed if the ETS is to be an effective means of meeting those commitments.

Box 5. **The NZ ETS**

On ratification of the Kyoto Protocol in 2002, New Zealand developed a proposal for a carbon tax on fossil fuels, which was due to start in 2007 as the main policy tool underpinning its Kyoto obligations. However, in late 2005 the tax proposal was withdrawn, owing to concerns about the impact on industry and a lack of support in parliament. The alternative chosen was a broad based emissions-trading scheme, passed into legislation in 2008 and to be phased in over a period of several years. However, with a new government, which had campaigned on a promise to amend the ETS, a "moderated ETS" was passed in late 2009. It softened the price signal for emitters during a transition period, delayed the entry of agriculture and provided potentially long-lived allocations to emissions-intensive, internationally exposed sectors patterned on Australia's planned scheme (which itself has not been adopted). Key elements are:

- Obligations for the forestry sector began in January 2008 and those for stationary energy (electricity production, heating), transport fuels and industrial-process emissions (gold, aluminium, cement, clinker, etc.), in July 2010. Synthetic gases and waste will enter in January 2013 and agriculture in January 2015. Hence, all gases and sectors will be covered, even agriculture which is not included in emissions trading schemes in any other jurisdiction.

- Obligations are placed on emitters to surrender 1 eligible NZU (New Zealand unit) for every tonne of CO_2e emitted. Where possible, obligations are set upstream – *e.g.* on fossil fuel suppliers/importers rather than end users. It is expected that, in most cases, the carbon price will be passed through by participants into energy and product prices, so that final users will face the full carbon price whereas upstream producers are the point of obligation. There are no limits on banking units, though borrowing from future periods is not possible.

- The scheme has strong links to international markets: participants can import and surrender eligible Kyoto units (CERs and ERUs), convert NZUs to AAUs and export, and the government has the power to accept units from other ETSs. There is no cap on the number of units the government may allocate: NZUs may be allocated without limit. However, there is a requirement for the NZ government to hold an AAU or other eligible Kyoto unit for every NZU it allocates or auctions. If the government allocates or auctions more NZUs than the AAUs and other Kyoto units it holds, it will need to purchase any shortfall. Introducing a cap would alter incentives for new and expanded production. Under an intensity-based system of allocation firms face exactly the same carbon cost and incentives for each unit of production. Under a capped historical allocation, firms face higher costs for each additional unit of production over and above the historic year. However, as carbon leakage concerns apply equally to existing and new capacity, New Zealand has chosen not to differentiate the incentives between existing and new production.

- The price is capped at NZD 25 until the end of 2012 (see Hood, 2010). ETS participants have the option to buy NZUs at that price but can also buy units from international carbon markets. The current trading price of NZUs is about NZ$20, still below the price cap. In this sense the NZ ETS could be seen as a *de facto*, yet flexible, carbon price.

- A transition phase as from 1 July 2010 to 31 December 2012 consists of: a 50% obligation (*i.e.* to surrender only 1 unit for every 2 tonnes of CO_2e emitted) for stationary energy, industrial processes and liquid fossil fuels; participants have the option to purchase units from the government at a fixed price of NZD 25 per unit; exports of units from non-forest sectors are not permitted for the duration of the transition period. Forestry continues to face the full carbon price signal and remains free to export units in exchange for AAUs.

- Temporarily free allocations will be made to firms conducting energy-intensive, trade-exposed (EITE) activities in industry and agriculture. This is designed to mitigate the cost increases associated with the ETS and avoid carbon leakage. There is no cap on the number of units that can be allocated; allocations will be made on an output-intensity basis: "moderately intensive" EITE sectors will receive 60%, and "highly intensive" ones and agriculture 90%, of the allocative baseline (equal to the average emissions intensity over the three financial years 2006/07, 2007/08, 2008/09) times the amount of output for a given year. Starting in 2013 and 2016 for industry and agriculture, respectively, free allocations will be phased out by 1.3% of the level of assistance per year(the 2008 legislation had a much shorter phase-out at 8% per year, but starting from 2018). For equity reasons, and reflecting the fact that carbon leakage risks apply to new investment as well as existing capacity, New entrants conducting eligible activities will also qualify for allocations.

- Owners of post-1989 (Kyoto) forests may opt in to the system, having until 2012 to decide and, if they do so, will receive credits for carbon-removal activities and must surrender units for deforestation. Opted out forests neither earn sequestration credits nor incur future liabilities. Due to Kyoto definitions, pre-1990 forests are not acknowledged as carbon sinks, and therefore owners of these forests cannot opt into the ETS and will receive no

credits for any ongoing post-1989 removal activity. But, they will still have obligations for deforestation. This Kyoto treatment gave a marked incentive to de-forest trees planted pre-1990 in the period between the ratification of the Kyoto Protocol and forestry's entry into the ETS, *i.e*. 2002-08, and then heavily replant. A one-time compensation to pre-1990 forest holders for losses to the value of their property will be made in the form of free allocations for two years, totalling 21 million units.

- The scheme will be reviewed in 2011 and at least every five years.

The way forward

Macroeconomic, distributional and efficiency aspects

Competitiveness losses and leakage effects under the current ETS are intended to be reduced in the short-to-medium term by extensive free allocations to energy-intensive trade-exposed (EITE) industry and all of agriculture. But since the cost of free allocations is shifted to the general taxpayer, there is an efficiency cost of raising revenues, estimated at NZD 1.40 per NZD 1 (Kerr, 2009). An internal wealth transfer also takes place: households and small businesses will bear an increased percentage of the cost of emissions (Table 3). This looks to be an inefficient way to prevent carbon leakage. The New Zealand government should consider whether, with no cap on the allocation of permits, there is a sufficient constraint on emissions with satisfactory corresponding economic, fiscal and distributional burdens.

Table 3. **Per cent of carbon costs incurred, by sector**

Sector	2011-12	2013	2015
Pre-1990 forestry	100	100	100
Post-1989 forestry	100	100	100
Household and other sectors	50	100	100
Moderately intensive activities	20	40	43
Highly intensive activities	5	10	13
Agriculture	0	0	10
Waste	0	100	100

Modelling analysis has suggested that free allocations to emissions-intensive, trade-exposed sectors together with purchases of credits from countries facing lower abatement costs would maximise output (NZIER and Infometrics, 2007). However, this may miss important efficiency and dynamic gains. The price signal (incidence of the carbon tax) has been shifted from sectors with the largest amount of low-cost competitive abatement potential, or equivalently high elasticity of demand, namely industry, to those with the lowest amount of short-term abatement potential, or low elasticity of demand, namely transport and household energy use (Bertram and Terry, 2008). This is the usual strategy for tax policies designed to maximise revenues but should not be for environmental policy measures that take the form of Pigouvian taxes intended to alter behaviour. According to the OECD green growth policy framework (de Serres *et al*., 2010), the main drawback of providing free allocations to prevent carbon leakage and reduce competitiveness concerns is that it comes at the expense of weaker incentives to reduce the production of carbon-intensive goods, while still encouraging firms to shift production to countries where there is no carbon price via the opportunity cost of permits. The decision to make forestry face the full price signal, on the other hand, was wise, as it clearly discouraged deforestation (even if some was shifted forward to before 2008) as a low-cost, high elasticity early-abatement option. Sectoral abatement cost curves would be useful in assisting with the determination of domestic mitigation potential and climate change policy (Gleisner, 2007).

Efficient resource allocation requires that everyone pay the market price for permits. Auctioning initial permits would provide the strongest price signal and would generate revenue that could be used to offset other, less distorting, taxes (New Zealand stands to gain up to 4% of GDP in auction revenues by 2020, according to de Serres *et al*., 2010). Unless allocations are delinked from actual emissions, the price signal will be strongly moderated in the short term. International competitiveness issues could be addressed by recycling revenues back to competitively disadvantaged firms on a different basis from that on which it is collected (OECD, 2010a), *e.g.* through compensation for stranded assets or for emissions-reducing investment or input costs. If New Zealand faces challenging and binding targets in the longer term, and wishes to meet these targets via the ETS, the transition measures will probably have to be phased out if these targets are to be met efficiently. A cap on overall emissions permits consistent with New Zealand's international obligation (but still allowing the possibility of purchasing emissions rights from abroad) should at the same time be imposed. New entrants should not receive allocations, since this would effectively raise the cap. The price of permits will have to clear the market, although mechanisms should be put in place to deal with price spikes or transitory market shortages. Depending on expectations for a post-2012 international framework, it may be appropriate for the government to reconfirm its intention to lift transition measures at the end of the first Kyoto commitment period.

Inflation and property values

As stationary energy and liquid fuels sectors receive no free allocations, they will pass at least part of the costs of buying permits into final prices, which will provide the desired price signal. The ETS was estimated to result in a 5% increase in the price of energy (electricity, liquid fuels, heat) and to add about 3 cents to the litre price of petrol in 2010 (following entry of these sectors in July), and should do so by an equivalent amount again in 2013 once the 50% discount expires (NZIER and Infometrics, 2009). The impact on CPI inflation would be only on the order of ½ per cent or so, depending on the extent of further pass-through. The way the electricity market works implies large windfall gains to hydroelectric companies, which will raise their own prices merely by taking advantage of the situation in which thermal generators are forced to raise theirs.[14] While seen by some as unfair, with households and small business paying the full subsidy to renewable energy (EITE industry and agriculture receiving NZU allocations to compensate for their electricity price increases), this is the proper incentive to encourage clean energy. Another mitigating factor is that most hydro plants are government owned, which may benefit the taxpayer, although the impact may be reduced if partial privatisations are pursued and the sales price does not embody the full benefit to the purchaser (see Conway, 2011).

Property values are affected by the introduction of emissions trading, as they would be by any tax that affects the returns to property. The differential treatment of pre-1990 and post-1989 forestry in the scheme has come in for criticism for diminishing property values. This is again an artefact of the Kyoto agreement that treats forests differently on the basis of an arbitrary start year, rather than the result of deliberate choice by the designers of the ETS itself. The government has therefore decided to provide one-time compensation to pre-Kyoto forest owners. The government has also provided compensation to Māori owners who receive their forests only under Treaty of Waitangi settlements after the commencement of the first Kyoto commitment period. The eventual inclusion of agriculture in the ETS will drive down the value of farms as well, perhaps significantly, depending on the future carbon price.

14. It was estimated that the pass through of energy costs would imply a NZD 750 cost to consumers per metric tonne of CO_2 reduction to consumers (largely reflecting the cost of windfall profits to hydro companies) at a NZD 30/tonne permit price for thermal energy companies (Bertram and Terry, 2008). This cost would be roughly half as much under the weaker carbon price signal decided in 2009 for CS1.

Agricultural sector

The delay until 2015 for the entry of agriculture into the scheme may arguably have made it more costly for the economy to reach its target. This may slow adjustment and cause the sector to miss significant abatement opportunities. On the other hand, the net benefits of bringing agriculture into the ETS are unclear because so long as proven and cost-effective mitigation technology does not exist, controlling agricultural emissions amounts to reducing output, which is not obviously in the global interest, given New Zealand's high level of productive efficiency. It has also been argued that no other country has included agriculture in its trading scheme, nor apparently intends to, so New Zealand should not either; indeed, doing so would subject it to the double competitive disadvantage of having to pay for emissions, even as it is not given any producer subsidies largely still enjoyed abroad. However, in no other country is agriculture such a major contributor to emissions. If New Zealand faces binding international obligations after 2012, excluding agriculture could impose a disproportionate burden on all the other sectors of the economy.

There is some debate about how costly mitigations in the sector in fact are. It has been estimated by its advocates that greater use of nitrification inhibitors could both reduce nitrous oxide emissions and increase farm profitability, although this observation raises the question of why farmers have not widely adopted such technologies already. The Ministry of Agriculture considers that the full adoption of nitrification inhibitor technology in the dairy sector is not possible, as it can only be applied at certain times.[15] It is also possible that farmers could increase stocking rates through use of some inhibitors, and thus increase both CH_4 and N_2O emissions. Methane reduction technology research lags that for nitrogen and is in an experimental stage. Current mitigation options are also likely to be commercially viable only with a positive carbon price as they would require farmers to spend more on inputs (various plants and grasses and even spices for methane-reducing animal feeds, new methods of soil management to sequester carbon, etc.).

It has been argued that measuring agricultural emissions could be so costly that it negates the advantages of trading (NZIER and Infometrics, 2009). For the same reason, it may be difficult to measure and obtain international recognition for the effectiveness of agricultural emissions-mitigating technologies. Furthermore, as meat and dairy processing firms will be the point of obligation for the sector, it may be both hard for the individual farmer to perceive the carbon price incentive and unrealistic for the food processor to monitor individual farms. Overcoming such problems has required the development of meaningful proxies for emissions.[16] The government also intends to improve the accuracy of the proxies and to recognise mitigation through "unique emissions factors" and payments for "removal activities". Fonterra, for example, would have to withhold dairy pay-outs to farmers failing to satisfy objectives. New computer software to help farmers monitor their nitrogen budgeting and emissions (OVERSEER) should be more widely adopted and used for centralised data gathering purposes to advance these efforts.

Fiscal impacts

The government has emphasised the fiscal neutrality of its scheme, but it faces considerable contingent liabilities and hidden risks. Forestry liabilities could fall to government if forestry owners were to go bankrupt upon harvesting. The Treasury has, appropriately, included contingent Kyoto forest liabilities in the 2010-11 budget, estimated at NZD 1.7 billion for CP1 based on the current carbon price, but not for later years. It also cites the 2011 review of the ETS and inability to predict foresters' behaviour

15. Research shows that if all dairy land were treated, New Zealand would save between 1.85 and 5.28Gg of N_2O in 2010, or 0.573 to 1.6Mt CO_2e.

16. Proxies have been developed: see http://www.maf.govt.nz/agriculture/agriculture-ets/regulations-for-agriculture-in-the-nz-ets.aspx.

during CP1 as specific risks. In addition, there are significant fiscal risks attached to open-ended free allocations, without an emissions cap and sunset clause. Another, albeit perhaps second order, risk to the fiscal accounts may arise from Joint Implementation (JI) projects allowing investors in other Annex 1 countries to invest in NZ abatement projects and so earn credit for their own countries which must be paid for in "hard currency" AAUs held by the New Zealand government, and which in turn may have to be replaced by the NZ taxpayer in order to meet the final commitment (which must be paid in AAUs). Such investors might cherry pick low-cost mitigation options in New Zealand.[17] Foresters choosing to trade their NZUs for foreign AAUs could have similar results. This increases a risk that the government will have to purchase units if it provides a domestic price cap below the world price. It may also increase the price that domestic emitters face, but this will occur only if the world price is greater than the domestic price.

Political economy challenges

A lesson appears to be that an ETS, for all its efficiency advantages, requires strong governance institutions in order to ensure transparency, simplicity and low transactions costs. The ETS, as it stands, is complex and its long-run fiscal and distributional consequences unclear, despite efforts at transparency. The thresholds for eligibility and the formula for granting allocations is set in legislation, but, unlike explicit tax expenditures that are listed clearly in the fiscal accounts, the amounts involved and final risks to taxpayers remain unclear. Major substantive amendments to the NZ ETS were made in the run-up to the 2009 Copenhagen meeting and passed through Parliament, with limited time for public consultation or proper consideration of public comments on the draft law, and with no supporting analytical reports, unlike for the original (2008) ETS proposal. As a result, criticisms in civil society and the international press were unusually strong.[18] The lack of bipartisan support suggests that there is a risk of reversal, which raises uncertainty. Making the reform work and stick will require a much higher degree of public understanding and support. Further increasing the role of the EPA – as an independent agency – in the running of the scheme could help by depoliticising issues like permit allocations.[19]

Allocations to EITE industries are designed to be temporary and to be withdrawn as soon as consistent actions by trading partners are taken. However, they may prove to be hard to reverse politically. The Regulatory Responsibility Bill has been invoked by some as increasing this risk. However, the continuing right to emit GHGs into the atmosphere should not be viewed as a property right and this is not the intention of the Bill (Conway, 2011). Free allocations provided for political economy or competitiveness reasons should be strictly time-bound, in accordance with OECD best-practice principles under the green growth strategy.

Consistency with other measures

Other policies may effectively tax or subsidise GHG emissions and should be re-evaluated for their consistency with ETS objectives. They may distort the intended carbon price signal, often violating

17. There are a total of 26 projects in the PRE programme. Only seven of these have opted to become Joint Implementation projects to date. This involves half (2.7 million) of the total 5.4 million units being converted to ERUs and being sold offshore. The remaining 2.7 million AAUs from PRE projects will be sold domestically and some will be sold back to the Crown. Four PRE projects have sale and purchase agreements with the Crown.

18. The Parliamentary Commissioner for the Environment stated that the modified ETS will actually raise emissions (PCE, 2009d).

19. The EPA will take on administration of much the scheme from October, including the Registry and the processing of allocations. The fact that, for example, thresholds and formulae for allocation are in legislation makes it easier for them to do this independently. A major problem with a more usual system of *ad hoc* or discretionary allocations is of course be the potential for lobbying by the politically connected.

neutrality of pricing across sectors and activities, unless there are clear and specific market failures that they can be shown to address, while regulations rarely show large enough benefits to justify often high implicit abatement costs. Conversely, the ETS might inadvertently intrude on other environmental goals.

Road transport policies

The use of environmental taxes in New Zealand is one of the lowest in the OECD (OECD, 2010b). This mainly reflects light taxation of motor fuels and vehicles, by far the largest environmental tax base in OECD countries, in part because of low population density and consequent lack of public transport. With the advent of the ETS (a sufficient approach to GHG emissions control), motor vehicle regulations should be removed, unless justified by environmental externalities not otherwise addressed by a carbon price (*e.g.* local pollution). Indeed, the earlier new vehicle fuel efficiency standard, which in any event was an inefficient and poorly targeted regulation (NZIER, 2007), was repealed as a duplicative policy when the ETS came into force. The NZ fuel excise tax (topped up by a modest Accident Compensation Commission fuel levy intended to fund accident compensation) can, on the other hand, be seen as a tax on a proxy for exhaust emissions, containing a range of air pollutants (such as particulates) other than carbon monoxide, and as such, should be retained and even could be raised. Road charging could reduce congestion, and thereby also reduce emissions, especially if it varied according to the fuel efficiency of the vehicle. As the ETS carbon price signal strengthens, such taxes could be phased out in part. The tax break on diesel fuel, which is primarily used by commercial entities should be withdrawn as an environmentally inefficient way to assist truck drivers, farmers and boat operators. Even with carbon pricing, diesel deserves Pigouvian excise taxation because of the carcinogenic nature of the particulate emissions involved.

Energy policies

Energy policy has been aligned with the ETS with the abolition of both the biofuel sales obligation and the moratorium on new base load thermal generation. In other respects, it may still work at cross-purposes with Kyoto objectives. A case in point is the proposed development of two lignite plants, involving a major energy SOE and at least one private partner. The business plan features the conversion of lignite (a low-grade coal widely used in Australia for electricity generation) into synthetic diesel fuel by means of a process that is itself extremely energy intensive, with around double the emissions intensity of diesel made from conventional crude oil. It has been estimated that even if just the smaller of these two plants were to go into production New Zealand's GHG emissions gap would be 20% higher due to the higher emissions intensity of producing diesel in this way (PCE, 2010b). Even if the diesel is used domestically, the fact that it is an internationally traded product makes it eligible for free ETS allocations at the 90% level (given that it is a highly energy intensive EITE industry as well), though it is not clear how the last three years' sector-average emissions intensity level should be defined for purposes of the allocation. Allowing such new production to access free allocations may be at odds with the spirit of New Zealand's international commitments and the OECD's green growth strategy. In the end, however, this issue reflects the fact that the quantity of ETS permits (NZUs) is not now capped. Once it is, then lignite can be brought under the cap, the producers will have to acquire permits and the economic decision (based in part on the price of permits) can be made about whether or not to continue production.

Electricity metering that allows monitoring of real-time consumption would transmit carbon price signals to households. The large scale installation of new meters is underway; yet these meters will not contain the essential final piece of technology that makes them "smart", namely displays in the home that would show the price of electricity at the time of usage. Companies refused to install these even if the customer agreed to pay, while finding the meters up to that point useful for their own data-gathering purposes (PCE, 2009c). The electricity regulator should mandate this feature, which is in the clear interest of the consumer and environment. Ultimately, the introduction of time-varying pricing to reduce peak load demands would help consumers minimise their energy outlays.

Increasing so-called fuel poverty is an often overlooked problem internationally. Environmental taxes are highly regressive insofar as energy bills in some countries are now upwards of 20% of poor households' budgets and sometimes larger than food bills. Low-income household energy assistance may therefore be warranted (as under the US LIHEAP), especially as the carbon price rises. Smart metering along with weatherisation programmes and upgrading inefficient old appliances would also help poorer households to better manage their energy costs. But a key problem in this domain is that poorer people tend to live in older, low-cost rental units lacking insulation, where the landlord has little interest in undertaking heat-loss mitigating investments that would benefit only the tenant, and therefore will be indifferent to the price signals in the ETS. Mandating such investments may succeed only in raising rents. What is ultimately needed is a co-ordinated approach that integrates home energy and housing policy (Hernández and Bird, 2010). Enhanced energy information and education may also be required. Existing weatherisation schemes assisting middle class families (as income tax deductions) should, on the other hand, be phased out as the carbon price signal strengthens. The Warm Up NZ Heat Smart programme has made some progress in incentivising the landlords of low-income tenants in particular to invest in insulation and heating.[20]

Innovation policy

While subsidies to clean-energy technologies might be justified because of the large up-front costs and risks of R&D that has clear social benefits, New Zealand has been careful in their use, instead putting primary emphasis on the ETS. For example, there are no "feed-in" tariffs to green energy development as elsewhere in the OECD. The biofuels sales obligation on motor fuel has been cancelled with introduction of the ETS, in view of the questionable value of first-generation biofuels, and replaced by a 42.5 cents per litre subsidy on domestically produced biodiesel which is more environmentally friendly than imported biodiesels (being based on tallow, rapeseed and used cooking oil rather than palm oil). Such policies are in the spirit of imposing a uniform price on carbon emissions. Nevertheless, modest support (*e.g.* R&D credits) for second-generation, wood-based biodiesel should be considered, given its estimated 90% lifecycle reduction in GHG emissions compared with fossil fuel diesel, local abundance of the raw material and the importance of diesel fuel as a production input (in agriculture, trucking) (PCE, 2009c).

There is an even stronger case for public assistance to the development of technologies for agricultural GHG mitigation, given the country's emissions profile. An agricultural emissions research levy was at first proposed but encountered opposition from the farming sector and was abandoned. A joint industry-government funded Pastoral Greenhouse Gas Research Consortium was formed in 2006 as an alternative to imposing the levy on farmers. The Consortium has done promising, world-class research. In 2010 the Government supported the establishment of the Agricultural GHG Research Centre, with 100% government funding. The Centre leads New Zealand's research contribution on livestock for the Global Research Alliance on Agricultural Greenhouse Gases, which was initiated by New Zealand at the margins of the 2009 UN Copenhagen conference. The government's decision to play a leading role in fostering international co-operation in agricultural GHG mitigation research is productive and welcome. It may still be necessary to amend the 2002 Hazardous Substances and New Organisms Act to allow experimentation with new genetic strains of livestock and feeds that could enable lower ruminant methane emissions. New Zealand should envisage becoming the leading exporter of agricultural emissions mitigation technology to the world, supplying a global public good. Agriculture everywhere will face significant challenges in meeting a dramatic increase in world food demand while also reducing its contribution to GHG emissions.

20. See: http://www.energywise.govt.nz/node/18453.

Biodiversity management

Incentives to reforest, both for commercial and native forests, are being provided by price signals in the ETS as well as grant schemes. The government estimates that these schemes will lead to 30 000 hectares of afforestation per year by 2020. Besides sequestering carbon, forests have a significant environmental benefit in curbing soil erosion on marginal high-country land. Tree roots contribute to stability of forested slopes by holding the soil together. Trees also remove soil moisture, thereby preventing slips. Sloping land under production is at risk between harvesting and replanting, although "continuous cover" forests systems are becoming more attractive under carbon pricing (10 000 hectares have already applied to join the permanent forest sink initiative). Forests also provide valuable erosion control in some pastoral farming areas, where sediment carried into waterways through erosion contains phosphorous and also contributes to the problem of declining water quality.[21] Plantation forests, if properly managed, may also contribute to the conservation of biodiversity by providing habitat for indigenous species and helping to protect boreal forest remnants.

The ETS may also have unintended effects. Exotic trees, *e.g*. California radiata pine, sequester carbon faster than indigenous species, but indigenous forests sequester more carbon over the long term. Indigenous land cover provides other valuable services, such as clean air and water, soil conservation, products like honey and fine wool production, and unique biodiversity. There is a risk that low-stature indigenous scrub (*e.g*. grasslands), which may not be counted as forest, will be cleared to make way for fast growing radiata pine plantation forests. Wilding pines may also be allowed to spread into indigenous grasslands, potentially earning credits while harming biodiversity.[22] There is a need to balance the immediate need for fast carbon sequestration against the long-term benefits of potentially greater carbon storage and preservation of indigenous biodiversity, by protections in legislation and accounting rules (PCE, 2009a). Whereas afforestation grants on top of the full carbon price signal might at first glance seem redundant, the need to control soil erosion and promote indigenous forest plantings could argue for maintaining them so as to give value for various forest activities over and above their capacity to store carbon.

Box 6. **Recommendations for greener growth**

Improve governance arrangements for sustainable development policy

- Further improve horizontal co-ordination of sustainable development policy, including energy and transport, and Kyoto objectives across the numerous ministries involved.
- Improve vertical co-ordination. Central government should provide national policy statements and set national environmental standards, as required for effective and consistent regulation by local authorities. It should also help provide them with technical training and expertise to set environmental goals and implement policies to achieve them most efficiently.
- Ensure that the new Environmental Protection Authority has sufficient independence and analytical capacity to act as overseer of policies to achieve environmental goals in an economically efficient manner.
- As the EPA takes over resource consenting where warranted by national interests, clearly define the boundaries between national and local competencies so as to maintain the benefits of subsidiarity, which are considerable in the case of environmental policy.
- The Resource Management Act (RMA) should be further amended to carry forward the proposed reforms to integrate urban and rural land- and water-use planning and also to better clarify and further facilitate the possible uses of market-based instruments.

21. See Parliamentary Commissioner for the Environment (2011), *Review of MAF Afforestration Schemes*.

22. Wilding pines are classed as a pest species and their removal can be exempted from liabilities under the NZ ETS, mitigating these risks.

Make greater use of market-based instruments in natural resource management

- Enforce the RMA's requirement (under Section 32) to consider the costs and benefits of alternative policies, including market-based approaches as opposed to the default option of command and control. Make sure this includes quantification wherever possible.
- Continue to develop better measurement of water abstraction and quality via evolving national guidelines. On this basis, implement water charging for domestic, industrial and agricultural uses.
- Allow water use consents to be tradable with as few restrictions as possible. Make the scope and definition of consents more amenable to trading by: unbundling entitlement and use, and ensuring consistent rules around when they can be adjusted. Apply pollution-rights trading to address water (and air) pollution, as in the Lake Taupo case; but avoid giving newcomers free rights.

Strengthen price signals in climate change policy, conditional on the international context

- Continue to review the effectiveness of the Emissions Trading Scheme (ETS), with the aim of achieving Kyoto goals most efficiently. Improve assessments of past policy performance and of future contingencies in Kyoto accounting. Devote sufficient resources to financial risk management in departments responsible for meeting Kyoto or other international mitigation obligations.
- If there is a Kyoto-style international agreement, set a cap on ETS permit allocations while removing the limit on the domestic carbon price (retaining some form of backstop against excessive price fluctuations), consistent with meeting Kyoto commitments. Discontinue the current temporary 50% discount for non-forestry sectors as scheduled. Consider auctioning permits and use auction revenues to cut distortive taxes or to compensate poorer households. Use the 2011 review to put these changes into place.
- As in the EU ETS, set aside a buffer within the overall cap (itself being set equal to 1990 national gross emissions, i.e. the Kyoto baseline) for free allocations to exposed firms. Distribute them in a targeted and efficient manner that is independent of actual emissions. Retain temporarily free allocations to sectors that meet the current EITE criteria until such time as major trading partners (Australia, United States, Japan) implement their own carbon pricing schemes (or until the buffer is depleted). Make it clear at the time of the 2011 review that these will in no case imply the right to further compensation for reduced property values.
- Do not provide new entrants into the protected sectors free allocations, as this would be antithetical to the objectives of the ETS and to Such new firms (*e.g*. lignite-to-diesel producers) should have to purchase permits to cover their entire emissions.
- If there is continued international uncertainty maintain uncapped allocations to EITE firms while shifting their method of distribution toward delinkage from intensity-based output in order to assist restructuring toward a low-carbon economy. Tax credits for example could be given for costs of emissions-reducing investments or inputs. With presumably no international obligations to be renegotiated in this case, the result would be a *de facto* carbon tax with targeted tax relief for vulnerable industries, having the objective of keeping New Zealand on a environmentally sustainable growth path and in continued anticipation of a future agreement.
- Extend the ETS to agriculture in 2015 as planned but so long as it remains sheltered elsewhere, maintain a flexible regime.
- Provide incentives under the ETS to create permanent carbon sinks, notably by protecting indigenous forest plantings and wetlands reclamation. Continue to work toward post-Kyoto accounting rules that facilitate such incentives. Maintain afforestation grant schemes that help control soil erosion and encourage indigenous forest plantings beyond that afforded by ETS incentives alone,
- Investigate and promote innovations (*e.g*. smart metering, pastoral emissions mitigation technology, wood- or algae-based biodiesel) where they have proven potential to enhance the responsiveness of consumers and producers to ETS price signals.

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