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Evolution of the New Zealand Emissions Trading Scheme: Sectoral Coverage and Point of Obligation

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Naturally all errors, omissions, and opinions expressed are the responsibility of the authors.

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Abstract

When it was launched in 2008, the New Zealand Emissions Trading Scheme (NZ ETS) pioneered the design concept of implementing an emissions trading scheme (ETS) across all sectors of the economy (e.g. stationary energy, transport, industrial processes, forestry, waste and biological emissions from agriculture) and all six major greenhouse gases (GHGs). This reflected New Zealand's relatively unique emission profile among industrialised countries (with heavy renewable generation, nearly half of emissions from agriculture, and a large land area suitable for forestry) and its interest in finding effective, efficient, and equitable solutions to the challenge of meeting its international emission reduction targets. Further innovations at the time – influenced in part by the government's previous efforts to implement a carbon tax in the energy and industry sectors – were the selection of predominantly upstream points of obligation in the energy sector, with the potential for some major downstream energy users to opt in voluntarily, and the selection of a default processor-level obligation in the agriculture sector, with the option to shift to a farmer-level obligation. As of 2017, the entry of biological emissions from agriculture has been deferred indefinitely. Otherwise, the proof of concept on both broad sectoral coverage and upstream points of obligation has been demonstrated through practical experience. To help inform future ETS policy making in New Zealand and internationally, this paper provides a conceptual foundation for design decisions on ETS coverage and points of obligation, and explores the history of and rationale for the specific design choices that have been made in this regard in New Zealand.

JEL codes

Q58; Q48; Q50

Keywords

Emissions trading, sectoral coverage, point of obligation, NZ ETS

Summary haiku

Emission pricing
can have more effect when it
reaches far and wide

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1 Introduction

Emissions trading systems (ETSs) are an effective mechanism to help jurisdictions reduce their greenhouse gas (GHG) emissions and combat climate change. By the end of 2017, 19 emissions trading systems will have been implemented across 35 countries, 15 provinces/states and 9 cities. They will regulate 7 billion tonnes of emissions in economies encompassing 15 per cent of global emissions and close to half of global GDP (International Carbon Action Partnership 2017). These systems all differ in their level of emission reduction and price ambition, the sectors and gases they cover, the activities that are covered within each sector, how emissions units are allocated, and how they link with other sources of emission units (Partnership for Market Readiness and International Carbon Action Partnership 2016).

Reflecting New Zealand's national context, the New Zealand Emissions Trading Scheme (NZ ETS) was launched in 2008 with a number of innovative design features that differ markedly from many other ETSs under operation or consideration. This is one of a series of research papers by Motu analysing the key design features of the NZ ETS. These papers are intended to help both New Zealand and international researchers and stakeholders understand the broader conceptual framework for ETS design, how the NZ ETS operates today and how this has changed over time, the rationale for the design choices that have been made, and what can be learned from practical experience with implementation. It is hoped that the findings can be applied to inform and improve the future development of the NZ ETS and ETSs in other jurisdictions.

This paper focuses on the history of the policy decisions surrounding sectoral coverage and the choice of point of obligation in the NZ ETS. This was an area where New Zealand was a pioneer and can offer valuable experience to other jurisdictions considering an ETS. The NZ ETS was the first system in the world designed to cover the six major greenhouse gases[1] across all sectors of the economy (e.g. stationary energy, transport, industrial processes, forestry, waste, and biological emissions from agriculture). It chose to place the point of obligation upstream (at the level of fuel production and import) in the stationary energy and transport sectors, and selected a default processor-level point of obligation in the agriculture sector with the option to shift to farmer-level obligation (although since 2012 unit obligations for biological emissions from agricultural have been deferred indefinitely). In Section 2, we begin with an overview of the various conceptual factors that influence ETS design decisions around sectoral coverage and point of obligation by sector. In Sections 3 and 4, we apply this to New Zealand's specific case

[1] The six gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

and discuss the current design features of the NZ ETS relating to sectoral coverage and point of obligation, how these decisions came about, and how they have evolved over time. In Section 5, we compare these features of the NZ ETS with those of other ETSs currently in operation.

2 Conceptual design considerations

We first briefly lay out the key design considerations that are applicable across sectors. We focus particularly on considerations that are relevant to New Zealand's unique local context and emissions profile. We later discuss how these aspects influence decisions about inclusion of sectors in the NZ ETS and the choice of points of obligation within those sectors.

2.1 Sectoral coverage

The choice of sectoral coverage of an ETS can be broken down into three interrelated components: the sectors to be covered by the system, the entities and activities within each sector that are covered, and the gases emitted as a result of these activities. These choices involve making trade-offs among several factors: the environmental effectiveness and cost effectiveness of the system, equity considerations, the prospects for bilateral and multilateral linking, and the administrative and political feasibility of the system. The factors that are considered most important will depend on the objectives of a particular system and the political context in which it will operate.

2.1.1 Environmental effectiveness

Environmental effectiveness relates to the ability of the system to deliver emissions reductions. When deciding which sectors to include in a system, designers should consider the total level of current and projected emissions in the sector, the likely responsiveness of each sector to the new price signal, the potential for both cross-border and cross-sectoral leakage, and the permanence of emissions reductions.

Sectors with high emissions or rapid emissions growth have, by definition, the greatest potential to reduce emissions in the long term. It is difficult to predict where emission reductions will most easily occur in the short term and longer-term emission reductions are likely to be easier to achieve if they can occur gradually: this allows time for innovation and learning. Emissions from livestock agriculture could be an example of this. Thus these sectors are key targets for regulation; they may, however, not be the first sectors to enter.

The ability of a sector to respond to the price signal relates to the technical and economic potential for emissions reductions that could be achieved by including that sector in the system,

and the extent to which cost rather than non-price barriers are the main barriers to mitigation. Companies with low marginal abatement costs will invest heavily in mitigation when they face a predictable emissions price because they can reduce their production costs (inclusive of emissions liabilities); they will therefore reduce their emissions. In contrast, companies with high abatement costs may not mitigate; they will try to pass on their higher costs to their consumers, and may also face a fall in the value of their assets to reflect the high cost of their emission liabilities. This suggests that sectors with emitting companies with low-cost mitigation options should be the priority for inclusion in an ETS.

However, a response from the emitters within a sector is not the only way emissions reductions could be achieved within that sector; the price sensitivity of downstream consumers will also affect the level of emissions reductions that can be achieved in a given sector. Emissions from production and import of transport fuels may not be easily mitigated by the companies involved, but consumers of these fuels might respond. If consumers are sensitive to the price of the sector's output, and the emissions price is at least partially passed on to consumers, standard market analysis would predict a relatively large fall in the quantity of the sector's output due to reduced consumer demand, and therefore reduced emissions. The more price-sensitive the consumers, the larger the fall in emissions will be.

Consumers may however be able to substitute their consumption of the output of a covered sector to a close substitute produced by a non-covered sector (cross-sectoral leakage) or to an internationally produced output (international leakage). If they do so, total emissions (either local or global) may not actually fall. In general, a high risk of cross-sectoral leakage would argue for a more comprehensive sectoral coverage, while a high risk of international leakage could be used to justify the exclusion of a particular sector, or the application of other measures to ease the transition such as free allocation or border tax measures.

Cross-sectoral leakage occurs when a reduction in emissions from one sector (as a result of inclusion into the system) results in an (partially) offsetting increase in emissions in a related, but excluded sector. Cross-sectoral leakage is more likely when sectoral coverage is defined at a relatively fine level. Consider, for example, fuel switching. This could occur if petrol is covered by the system, but diesel is not. This could cause users of petrol to switch their fuel to diesel as the price of the petrol rises. Emissions from petrol would fall, but this would be offset by increased emissions from diesel fuels. Cross-sectoral leakage could also be an issue in the construction sector: if production of steel is included in a system but production of cement is not, the price of steel would rise relative to the price of concrete. This could cause those in the construction industry to use more cement and less steel. The increase in emissions from cement would at least partly offset the reduction in emissions from the steel sector.

International leakage occurs when customers switch from buying the output of a sector covered in a local system to purchasing an output produced in another country that does not have an ETS, does not include that sector in their system, or faces a lower price or stringency of regulation. The fall in production locally will reduce emissions from that sector locally, but will not decrease national emissions as long as our national emissions target is fixed; another sector can increase its emissions up to that target level. Global emissions are likely to rise for two reasons. First, if the New Zealand production is replaced in a country with no target, the extra emissions in that country are a direct global increase. Global emissions from the leakage-prone sector may also increase if the foreign supplier is less GHG efficient in production than the New Zealand one, or if international transport emissions are significant. The extent of cross-sectoral or international leakage does depend on the ability of customers to substitute between the outputs of included or excluded sectors, either locally or internationally.

2.1.2 Cost effectiveness

Two elements of cost-effectiveness should influence the choice of sectoral coverage in an emissions trading system. These are realising the least-cost mitigation opportunities and minimising transaction and administrative costs.

Everyone uses energy directly and emissions are also embodied in all goods and services that consumers purchase. This means that mitigation opportunities are spread throughout all sectors of the economy. A broad sectoral coverage, and broad coverage of activities within each sector, means that a larger fraction of the country's emissions are subject to a price. This provides incentives for mitigation across the whole economy, and increases the number of low-cost mitigation activities that will be undertaken.

Administrative costs are incurred by the system's participants and the regulatory agency charged with operating the system. Participants have obligations under the system to measure and report their emissions and to surrender sufficient emissions units to cover their emissions. The regulatory agency must be able to verify a participant's emissions. Measurement and verification of emissions is easier in some sectors, such as energy.: energy emissions depend on the quantity of each fuel type burnt; this data is readily available and is easy to verify. Including sectors where measurement and verification is relatively straightforward will not impose significant administrative costs. In other sectors, such as agriculture or forestry, credible measurement and verification of emissions are more difficult – administrative costs from these sectors will be higher.

Transaction costs are associated with trading emission units (in New Zealand these are called New Zealand Units, NZUs). These include the costs of locating a buyer or seller (search costs) and the costs involved in completing a transaction (e.g. time spent negotiating a deal and

any brokerage fees). Search costs could be an important issue in a small ETS with few actors and poorly developed brokers. It could be difficult to find a buyer or seller of permits and, in addition, individual trades could affect the market price; the system could have low liquidity. One way to increase liquidity is to broaden the sectoral coverage of the system and hence increase the number of participants and potential traders.

2.1.3 Equity

The choice of sectoral coverage is influenced by two main equity considerations – equity of treatment and equity of outcomes. Equity of treatment says that all emitting sectors in the economy should be treated the same under the policy. Excluding an emitting sector from a system could be seen as inequitable by the covered sectors and could complicate the politics of introducing the system. If the system is introduced as part of a suite of policies aimed at complying with international obligations, the excluded sector would in effect be subsidised by the rest of the economy. The country is still liable for the emissions from the sector, but the liability for that sector's emissions ultimately lies with the taxpayer.

Equity of outcomes is concerned with the final distribution of costs and benefits as a result of the policy. Implementing an ETS will impose costs on the sectors included. The size of these extra costs will differ by sector and will depend on the level of emissions, mitigation potential, and the degree of local and international competition. Where costs fall within the sector depends on firms' abilities to pass on costs to consumers and to workers. In some cases, for example petrol, all emissions costs are likely to be passed on to consumers through higher prices at the pump. In others, e.g. coal, costs may be heavily borne by the owners of coal mines and by miners. If coal can be replaced by other lower-emitting fuels, then coal producers may not be able to pass the cost on.[2] Extra costs imposed on a sector that faces strong international competition could reduce their competitiveness and lead to contraction in output and hence loss of jobs and asset value. Outcomes could be considered inequitable if the proportion of the total costs of the system imposed on that sector exceeds the fraction of total emissions that the sector generates or if the consumers or workers affected are especially vulnerable. These concerns could be alleviated with other measures, such as free allocation of units or a 'progressive obligation' that reduces the effective emissions price faced by the sector.

2.1.4 Linking

Which sectors to include technically should not matter for linking, as long as measurement, reporting and enforcement for all included sectors are credible. If one country does not trust the

[2] This has not been the experience in the NZ ETS. In New Zealand, circumstances that enable coal producers to pass on emission costs include the lack of alternative fuel options on the South Island (which does not have reticulated natural gas), restrictions imposed by asset types, and restrictions on the gas pipeline capacity north of Auckland.

measurement and reporting system of a particular sector in another country (e.g. New Zealand's unusual inclusion of forestry), the first country may not want to link with the system in the other. Sectors may also feel unfairly regulated (or excluded) if they are covered in one system but not the other, and this could have political implications. Linking alters emissions prices. This could lead to unwanted implications in some sectors that could affect inclusion: either the price could be 'too high' and lead to competitiveness concerns or concerns about consumer prices in some sectors; or 'too low', leading to lower incentives for mitigation innovation and investment than the country desires for other sectors. If one linking partner opposes ETS coverage of a particular sector (e.g. plantation forestry or agriculture) for ideological reasons, its participants may end up trading in those units anyway under a linking agreement.

2.2 Points of obligation

The point of obligation in an ETS is the entity that is required to report a defined set of information and surrender emissions units. All industries have a vertical chain of production and consumption, often with several layers from initial production to final consumption. Emissions occur at one or more of these steps. The point of obligation must surrender sufficient emissions units to match these emissions. Any layer can be chosen to be the point of regulation, and different layers will give the system different characteristics.

We talk about the point of obligation relative to the point in the supply chain where emissions actually occur. An obvious choice of point of obligation for some sectors would be the point source of emissions. An 'upstream' point of obligation places the point of obligation at a point in the supply chain before the emissions are generated (e.g. fossil fuel producers/ importers). A 'downstream' point of obligation places the point of obligation at a point in the supply chain after the emissions are generated (e.g. at the processor level for livestock emissions).

Three key interrelated aspects should be considered when choosing the point of obligation for each included sector: administration costs; the coverage of sectoral emissions[3] (including consideration of the pass-through of emission price incentives along the supply chain); and external credibility. An ideal system would have minimal administration costs, a broad coverage of emissions from each included sector with effective transmission of emission price incentives, and effective monitoring, reporting, and compliance systems.

The points of obligation must hold or be able to collect sufficient auditable data to infer emissions from the chain of production, they must be legal entities on which the government

[3] Greater coverage of emissions in an ETS broadens the incentive of sector actors to mitigate as well as the government's scope of control over emissions.

can enforce compliance and they must have either a direct (by mitigating) or indirect (by passing emission liabilities on through prices) ability to respond to the emission liabilities they face.

The point in the supply chain chosen to be the point of obligation does not have to be the point at which emissions occur, or the point at which emissions abatement is possible. As long as the point of obligation can pass the emission price through the supply chain, the actual emitter still faces the price signal and the incentive to reduce emissions is still present. In fossil fuel supply chains, a small group of firms (e.g. importers or pipelines) will often be a 'pinch point' through which all production passes. These can be efficient points of obligation because there are so few actors.

Points of obligation will experience an increase in costs when they face emission liabilities. Some firms will be able to pass these on to other producers in the supply chain or to consumers. In a well-functioning economy, the ultimate distribution of costs will not depend on the point of obligation. If for equity, political, or competition and leakage reasons the government wishes to protect some firms or consumers, free allocation can be used strategically to alter the distribution of costs. The point of obligation also does not need to be the point of free allocation.

Where it is not possible to cover all of a sector's emissions through a small number of easily monitored actors, one option for reducing transaction costs for a given point of obligation is to apply a threshold for excluding *de minimis* sources of emissions. In setting thresholds, there is a trade-off between emissions coverage and administration/compliance costs. Setting the threshold for an activity too high will reduce administrative and compliance costs, but could also significantly reduce emissions coverage. Conversely, a threshold that is too low and includes many small firms will increase the coverage of emissions, but the administrative and compliance costs may outweigh the environmental benefits of including these firms. The definition of thresholds must be easy to determine and not easily manipulated over time. Firms should not be incentivised to break into small parts to avoid regulation.

2.2.1 Stationary energy and transport

Where the point of obligation should be placed in the stationary energy and transport sectors in order to achieve low administration and compliance costs, broad coverage, and system credibility depends on the specific structure of the energy market in the country.

An upstream system can offer potential benefits in all of these areas, particularly if there is a relatively small number of large miners/extractors or importers that service the domestic energy markets, if credible data are collected and reported on energy imports and exports, and if energy prices are not rigidly regulated. Targeting the top of the energy supply chain ensures

broad coverage of downstream energy consumers and reduces the potential for production and emissions leakage from covered to uncovered sources.

In the case where there is a large number of relatively small upstream producers, the appropriate point of obligation may be further downstream, such as large processing plants (e.g. oil refineries) or distributors (e.g. gas pipeline operators).

Placing the obligation for energy at the point of emission typically would involve a significantly larger number of participants for the same level of coverage, would achieve lower coverage because thresholds will need to be applied, and would generally increase administration and compliance costs. It does not improve the accuracy of estimates of emissions from fossil fuels. The emissions are (almost) invariant to the way in which fuel is combusted.

Applying a point of obligation to transport fuel users across the sector would likely be impractical. However, most operational ETSs have applied the point of obligation to power generators, which typically carry other requirements for environmental regulation and reporting and are experienced in energy trading activity. Many operational ETSs also apply the point of obligation to large point sources of emissions such as industrial boilers. A key argument for applying regulation to large emitters directly rather than to their energy suppliers is that companies may respond differently to a direct obligation rather than a price signal; this argument is contentious.

Systems with the point of obligation for fossil fuel emissions at the point source tend to have high thresholds for inclusion and relatively low coverage compared to upstream systems. In a sector or jurisdiction where energy suppliers are large in number or difficult to monitor and regulate, however, making large point sources that can be regulated points of obligations could complement upstream regulation that will tend to be incomplete. In this situation, including large point sources instead of or as well as upstream points of regulation could increase coverage.

In the municipality-scale ETSs in Tokyo and Saitama in Japan, the point of obligation was applied at the point of energy consumption in the commercial and industrial sectors because energy supply and electricity generation were not entirely controlled within the jurisdiction.

A critical consideration in the energy sector, particularly for electricity, is whether emission prices will be passed along the supply chain by the market or whether the government intervenes to regulate energy prices. In the case of the Korean ETS and the Chinese ETS pilots, policy makers have chosen to impose distinct unit surrender obligations covering both direct emissions at the point of electricity generation and indirect emissions at the point of electricity consumption by ETS participants. This is because electricity prices are regulated, and therefore unit obligations targeted at only one point in the supply chain would not generate a price signal across the supply chain to incentivise behaviour change.

2.2.2 Industrial processes and synthetic greenhouse gases

Industrial process emissions are the non-energy emissions that arise from a production process (e.g. CO_2 from cement production; PFCs from aluminium production). The most obvious choice for the point of obligation for these emissions is the point at which the emissions occur, rather than at the downstream point of product consumption, because this is the only point at which the emissions can be accurately determined and the easiest point to administer. Industrial producers tend to be more diverse in terms of the size and number of their operations than importers or producers of fossil fuels, so setting thresholds for inclusion can be a key strategic issue in this sector. As with the thresholds for small producers/importers in the energy sector, these should be set in a transparent way that cannot be easily manipulated over time.

Industrial producers can also generate emissions removals, either through technologies such as carbon capture and storage or producing a product with a substance embedded that would result in emissions were it not embedded. Firms that perform emissions removals could be rewarded with emissions units for undertaking these activities.

Setting the point of obligation for emissions generated through the use or disposal of manufactured products containing synthetic gases (e.g. refrigeration and air conditioning systems containing HFCs or PFCs) can be more complex. The likelihood and rate of emissions can vary according to how the products are used and disposed of. If the market for these products is dominated by a restricted number of product manufacturers, importers or distributors, then they could serve as the appropriate point of obligation to achieve broad coverage and ease of administration. Another alternative is to move upstream of the point of emission and target the domestic manufacturer or importer of the gases.

2.2.3 Forestry

The forestry sector can be both a source of CO_2 emissions – through forest harvesting, deforestation, and forest degradation – and a carbon sink – through afforestation, reforestation, replanting and general forest management (e.g. pest control). With the exception of the NZ ETS, the major ETSs developed to date have either included forestry activities only via forestry offsets generated through external projects, or excluded them entirely. Experience gained with crediting forestry offsets under domestic and Clean Development Mechanism projects has highlighted the challenges around ensuring additionality, providing accurate measurement and monitoring, accounting for leakage of emissions outside of the project area and ensuring the permanence of credited removals. Including the entire forestry sector in an ETS with continuity across phases can remedy many of these challenges, while also adding new ones.

When including forestry as an obligated sector in an ETS, it is necessary to consider the treatment of both emissions and removals in order to provide efficient price-based incentives to

enhance carbon stocks; ensure equitable treatment across different types of land areas, land uses and participants; and avoid perverse outcomes such as the loss of indigenous biodiversity associated with slower-growing species. It is also necessary to consider how forestry activities are accounted for under the jurisdiction's broader GHG reduction targets, and decide the extent to which forestry definitions, activities and accounting methodologies applied under the target (e.g. under international convention) should flow through to participants in the ETS. Divergence in rule sets could have fiscal and target implications for the government. More complex accounting issues can include whether to credit actual or average carbon stock changes during cycles of forest establishment, harvesting and replanting; and whether to account for the timing of emissions from harvested wood products.

The point of obligation selected for forestry activities in an ETS should be the holder of the legal right to create, manage or remove forest carbon stocks, and regulators must be able to assign and manage liabilities associated with the future reversal of credited removals, even if the ownership changes. If the landowner is selected as the primary point of obligation, it may be desirable to enable the option for the obligation to be transferred under legal contract to the holder of the forestry rights for that land if those are different parties.

A key challenge is the number of potential points of obligation, and the number of small landowners. This requires strong administrative and enforcement capability and, probably, the cooperation of the majority of sources. One solution to this is to make ETS participation for afforestation or reforestation a voluntary activity; this reduces compliance issues because provision of data is a requirement for participation, but they can still arise, particularly if credits need to be surrendered on harvest. Deforestation liabilities cannot be voluntary, so strategic use of thresholds may be needed, and in some cases the forestry sector will not be able to be fully included.

2.2.4 Agriculture

The agriculture sector contributes biological emissions of CH_4 and N_2O from livestock production, manure management, use of fertilisers and cropping.[4] Energy emissions associated with agriculture activities are accounted for under the stationary energy and transport sectors. Agricultural soil carbon emissions or removals can be managed in this sector or as a land-use activity.

As with forestry, a small number of ETSs have provided for inclusion of the agriculture sector through offsets from project-based activities, and the NZ ETS is the only ETS to plan for the inclusion of biological emissions from agriculture as a point of obligation.

[4] Wool producers were not included in the 2008 legislation for administrative and practical reasons (Ministry for Primary Industries 2012).

The agriculture sector poses some unique challenges for emissions trading: collecting data accurate enough to infer emissions and reward mitigation; and the large numbers of farms. These are related. Mitigation responses can include land-use change (from ruminant agriculture to other food production; or from agriculture to forestry) and changes in practices within land uses (e.g. improved farm efficiency). The accounting methods for biological emissions from agriculture which are applied at the national inventory level could be used at a processor level (milk processors; slaughter houses; nitrogen fertiliser manufacturers) to provide incentives for land-use change and efficiency in use of nitrogen fertiliser. Large processors could be a feasible point of obligation.

Having the point of obligation only at the processor does not however allow distinctions between high- and low-emitting producers of the same products.[5] These differences can be considerable (Anastasiadis and Kerr 2013). Placing the point of obligation at the farmer level poses a significant administrative and technical challenge to both regulators and ETS participants, given the potentially large number of farms and the need for capacity building and resources for farm-level monitoring, reporting and verification.

2.2.5 Waste

Emissions from waste are generated by the biodegradation of organic material. The most obvious point of obligation in this sector is the landfill operator. Emissions in this sector vary by landfill characteristics, and the ideal system would provide incentives for improving landfill design (e.g. use of landfill gas recovery and flaring), directing waste to the lowest emitting landfills, and reducing the quantity of landfilled waste. The landfill operator can easily pass on the price signal to waste producers (e.g. households and businesses) in the form of tipping fees. For efficient administration, a threshold could be applied to exclude small landfills. However, care should be taken to avoid creating perverse incentives to divert waste to non-regulated landfills.

2.2.6 Hybrid approaches

It is possible to take a hybrid approach to choosing the point of obligation within sectors. This would entail setting a default point of obligation in the sectoral supply chain, while allowing for other firms (either upstream or downstream) to opt in (or be required to participate) as a point of obligation accompanied by a carving-out of their emissions from the liabilities assigned to the default point of obligation. For example, the point of obligation in the energy sector could be placed upstream at the point of fuel production/import, but large energy users could opt in (or

[5] Through contractual arrangements independent of government, processors could distribute the emissions liability to farm-level producers on the basis of the producers' relative emissions efficiency; however, this would require a sound system for farm-level reporting and verification of emissions.

be required to participate) as a point of obligation for their energy emissions. A hybrid system will likely increase the administrative complexity of the system, but may improve political acceptability and, in some cases, coverage. Effective thresholds would need to be set to define when large energy users could or must be participants – these should be set high enough so as to not significantly complicate the administration of the system, or place an undue burden on the firms that are the default points of obligation. Such a hybrid approach could also be achieved through non-legislated commercial arrangements on an opt-in basis.

3 Sectoral coverage in the NZ ETS

The NZ ETS was designed to cover all sectors of the economy and all six gases specified by the Kyoto Protocol, although as of 2017 this had not yet been achieved in practice. These sectors are broadly described in legislation as stationary energy, liquid fossil fuels,[6] industrial processes, forestry, waste, and agriculture (referring to biological emissions of CH_4 and N_2O).

From an early stage of ETS policy consideration, officials recognised that a larger trading system provides greater opportunities to seek out least-cost mitigation options, while larger systems are more administratively burdensome (for example, see Ministry for the Environment 2006). The broad sector coverage in the NZ ETS represented a marked departure from the model established by the European Union Emissions Trading System (EU ETS), which initially limited sector coverage to stationary energy (e.g. power stations and combustion installations) and selected industrial producers. From late 2006 through to early 2007, public feedback was sought on the issue of which sectors should be included in a domestic ETS if the government pursued that option post-2012. The government's summary of submissions reported wide support for an ETS to eventually include all sectors (Ministry for the Environment 2007a). Once the government decided to proceed with an ETS in the period pre-2012, it supported a broad design covering all sectors of the economy, citing equity, environmental integrity, operational efficiency, and economic efficiency as the drivers of the decision (Cullen and Parker 2007; Ministry for the Environment and The Treasury 2007).

The founding legislation for the NZ ETS, the Climate Change (Emissions Trading) Amendment Act 2008, provided for sectors to enter in stages over the period 2008 through 2013, with periods of voluntary and mandatory reporting prior to the start of unit surrender obligations for later entrants. Staged entry of sectors and voluntary reporting in advance of mandatory obligations are common features of ETS (Partnership for Market Readiness and International Carbon Action Partnership 2016). For example, the EU ETS had already initiated

[6] Essentially this covers transport fuels but also includes diesel and fuel oil used for electricity or industrial heat.

emissions reporting by points of obligation in advance of imposing mandatory ETS reporting with unit obligations, In New Zealand's case, it was recognised that some sectors would require more time than others to build the administrative and technical capacity to participate in the system (Ministry for the Environment and The Treasury 2007). In amendments in 2009 and 2012, entry dates for some sectors were changed to defer the economic impact of the system.

Table 1 presents the final entry dates for covered sectors. The evolution of sector entry is detailed below.

Table 1: Sector entry into the NZ ETS

Sector	**Voluntary reporting**	**Mandatory reporting**	**Unit obligations**
Forestry		1 January 2008	1 January 2008
Liquid fossil fuels	1 January 2009	1 January 2010	1 July 2010
Stationary energy		1 January 2010	1 July 2010
Industrial processes		1 January 2010	1 July 2010
Synthetic gases	1 January 2011	1 January 2012	1 January 2013
Waste	1 January 2011	1 January 2012	1 January 2013
Agriculture	1 January 2011	1 January 2012	Deferred indefinitely

3.1 Climate Change (Emissions Trading) Amendment Act 2008

3.1.1 Forestry

Forestry was the first sector to enter the scheme, with pre-1990 forest owners facing deforestation liabilities and post-1989 forest owners having the option to earn units from 1 January 2008. Old-growth indigenous forest remaining in forest was excluded from the NZ ETS, and exemptions were applied to deforestation of tree weeds. The inclusion of both forestry emissions and removals in the NZ ETS broke new ground in international ETS design, and as of 2017 remains a globally unique ETS feature.

Forestry had always featured prominently in the government's strategy for meeting New Zealand's international climate change obligations under the first commitment period of the Kyoto Protocol (Hodgson 2002a; Hodgson 2002b). At the time of Kyoto ratification in 2002, New Zealand was projected to be a net seller of units because of its forestry removals during the first commitment period, and the government indicated its preference for retaining both forestry credits and liabilities rather than devolving these to the sector for that period. Reasons cited for this preference include equity considerations between pre-1990 and post-1989 forest owners, transaction costs, and the desire to maximise the value of the credits (Hodgson 2002b).

After consultation on its 2002 climate change policy package, the government chose to assume forest sink credits and liabilities for post-1989 forest for the first commitment period, and to assume deforestation liabilities for pre-1990 forest up to a deforestation cap of 21 million tonnes of CO_2 (Hodgson 2002b; Hodgson 2002a). This policy was developed in the context that the government would retain international credits and liabilities associated with other sectors of the economy as well.

When designing the NZ ETS, the government considered it key to include the forestry sector to both discourage deforestation and incentivise cost-effective mitigation through afforestation (Cullen and Parker 2007). Foresters have the ability to bring forward deforestation, and deforestation had already accelerated considerably in New Zealand in the lead-up to the first Kyoto commitment period. To deter further acceleration of deforestation in anticipation of the NZ ETS, the founding legislation passed in September 2008 applied unit obligations to forestry retrospectively as of 1 January 2008. Delaying forestry obligations by one year could have increased emissions by 12–24 million tonnes of CO_2 (Finance and Expenditure Committee 2008b). As a result, there was no voluntary or mandatory reporting period prior to the commencement of surrender obligations in the forestry sector. To allow time for institutional development and capacity building, the sector was assigned a longer initial compliance period and did not have to surrender units until 30 April 2011 (changed in the 2009 amendments to 31 May 2011).

3.1.2 Liquid fossil fuels

Under the 2008 Act, liquid fossil fuels were to face voluntary reporting obligations from 1 January 2009 and mandatory reporting obligations from 1 January 2010. Surrender obligations were to commence from 1 January 2011. The measurement and monitoring requirements for this sector are relatively straightforward and the sector is expert in market transactions. In its 2007 consultation document, the government had proposed mandatory reporting and unit surrender as of 1 January 2009, creating potential for cross-sectoral trading during the first compliance period for forestry (Ministry for the Environment and The Treasury 2007). The government changed its preferred entry dates during legislative deliberation on the grounds of reducing pressure on the economy and on household finances given rising international fuel prices (Finance and Expenditure Committee 2008a). The entry dates changed again in 2009 amendments (detailed below).

3.1.3 Stationary energy, industrial processes and synthetic greenhouse gases

Stationary energy and industrial processes were scheduled to enter with mandatory reporting and unit obligations on 1 January 2010, with the exception of emissions of high-GWP (global

warming potential) synthetic GHGs (SF_6, HFCs, and PFCs other than from aluminium). Harmonising the entry of stationary energy and industrial processes was considered important because many of those activities were interdependent and the government wanted to manage transitional assistance to those sectors in a comprehensive package (Finance and Expenditure Committee 2008b).

Synthetic gases were to begin voluntary reporting on 1 January 2011, mandatory reporting on 1 January 2012, and unit obligations on 1 January 2013. This delay reflected the potential administrative complexities, particularly for HFCs and PFCs in imported goods, and the desire to allow more time for development of collection and destruction programmes and substitute products. A memorandum of understanding was already in place between the Crown and major users of SF_6 on best-practice emissions management through 2012 (Finance and Expenditure Committee 2008b).

3.1.4 Waste

The waste sector was scheduled to face voluntary reporting obligations from 1 January 2011, mandatory reporting obligations from 1 January 2012, and unit obligations from 1 January 2013. The rationale for deferring entry of the waste sector was that the government was introducing a waste levy in 2008 that would also incentivise emission reductions, and it wanted the sector to adjust to the levy before facing an ETS price (Ministry for the Environment and The Treasury 2007). The government engaged with the sector on how the waste levy and ETS obligations would interact.

3.1.5 Agriculture

Under the 2008 Act, the agriculture sector[7] was scheduled to face voluntary reporting obligations for biological emissions[8] from 1 January 2011, mandatory reporting obligations from 1 January 2012, and unit obligations from 1 January 2013. In the government's initial framework for the NZ ETS, the agricultural sector was scheduled to be a later entrant primarily due to the technical and administrative difficulties associated with measuring and verifying emissions, but political considerations were also influential. There was also uncertainty as to what near-term mitigation opportunities existed in the sector that did not involve significant reductions in production (Ministry for the Environment and The Treasury 2007).

There was a history of conflict between the agriculture sector and the government on emission pricing. Under the 2002 climate change policy package, the government had agreed to exempt the agriculture sector from emission pricing during the first commitment period if the

[7] This was defined as pastoral and arable farming and horticulture.
[8] These encompass CH_4 and $N_2O$from livestock production and fertiliser use. Energy emissions associated with agriculture-related activities are covered under the stationary energy and liquid fossil fuel sectors.

sector committed to investing in mitigation research in partnership with the Crown. If there was insufficient research investment by the sector, the government indicated it would impose a research levy (Hodgson 2002a; Hodgson 2002b). This proposed levy was branded as a "fart tax" and generated domestic protests and international media attention. In 2004, the government entered into a memorandum of understanding on a mitigation research strategy with parties to the Pastoral Greenhouse Gas Research Consortium, avoiding the need for a research levy during the first commitment period (New Zealand Government 2004). Therefore, there was a shared expectation across government and the sector that the sector would not be subject to an emission price at least through 2012.

Both the inclusion and the timing of entry of biological agricultural emissions were highly contentious issues during consultation on the NZ ETS framework and legislation. In submissions, sector participants raised concerns in particular about the lack of options for mitigation beyond reducing output; the existing agreement for the sector to conduct mitigation research in return for exemption from emission pricing through 2012; the complexity and cost of emissions monitoring, reporting and verification by participants; and the international competitiveness implications of pricing agricultural emissions in New Zealand which were not priced in other countries (Emissions Trading Group and Ministry of Economic Development 2008). The government ultimately proceeded to include biological emissions from agriculture on the following grounds laid out in officials' departmental report on the final bill:

> The NZ ETS is designed to apply fairly across all sectors and all greenhouse gases over time and this core principle has been well regarded. The agriculture sector represents over half of New Zealand's greenhouse gas emissions, the cost of which, if not borne by the agriculture sector, will be borne by other parts of the New Zealand economy. This is inequitable, inefficient from an economic perspective, and does not create strong incentives to employ existing technology or invest in new technologies to reduce emissions. Excluding the agriculture sector could forgo a significant quantity of low-cost emissions reductions. Only one submitter indicated that the agriculture sector should be excluded from the ETS altogether (Emissions Trading Group and Ministry of Economic Development 2008).

In its report on the Bill, the Finance and Expenditure Committee expressed the hope that early reporting obligations for the agriculture sector would create an opportunity to thoroughly test the reporting system, encourage the sector to prepare in advance for unit obligations, promote market transparency, and incentivise earlier action to reduce emissions (Finance and Expenditure Committee 2008b).

3.2 Climate Change Response (Moderated Emissions Trading) Amendment Act 2009

In November 2008, the general election brought to power a new National government which initiated a review of the NZ ETS under its confidence-and-supply agreement with the ACT Party

(Cameron and Rive 2011). Following the 2009 review, the government introduced the Climate Change Response (Moderated Emissions Trading) Amendment Act 2009, which harmonised the unit obligation dates for liquid fossil fuels, stationary energy, and industrial processes to 1 July 2010, with mandatory reporting from 1 January 2010 (Smith 2009a). Deferring unit obligations for the stationary energy and industrial process sectors by six months allowed more time for the development of emission factors and the industrial allocation plan, but imposed a net fiscal cost to the government estimated at NZ$100 million from foregone units. This loss was countered by advancing unit obligations for liquid fossil fuels by six months, which produced a fiscal benefit estimated at NZ$175 million (Smith 2009c).

The government's initial position regarding the entry date for agriculture during the 2009 review was to keep the agriculture sector's start date for unit obligations of January 2013, but introduce intensity-based free allocation and a one-for-two progressive unit obligation from January 2013 until July 2015. The rationale for this position was the lack of effective mitigation technologies in the sector and "weaknesses in the current international regime's treatment of agricultural emissions" (Smith 2009a).

By the time the Climate Change (Moderated Emissions Trading) Amendment Bill was introduced to Parliament, the government's position had changed to delaying unit obligations for agriculture until 1 January 2015 (Smith 2009b). This was a highly contentious issue during legislative deliberation, contributing to the failure of the committee to reach agreement on the draft legislation (Finance and Expenditure Committee 2009). The Labour[9] and Green Parties opposed the government's proposal to defer unit obligations for agriculture. In its minority statement, the Labour Party cited fiscal reasons for this recommendation: under the government's preferred approach, agriculture would be responsible for 4 percent of the total costs of meeting international obligations, while being responsible for nearly 50 percent of emissions. Delaying the entry of the agriculture sector would mean that taxpayers then become liable for these emissions. It also noted expert opinion that the potential for leakage was low, and that cost-effective mitigation options did exist but were not being encouraged. Under the final amendments, reporting obligations from the initial legislation were retained (voluntary reporting in 2011 and mandatory reporting from 2012) but unit obligations from agriculture were deferred until 1 January 2015.

[9] The Labour Party had signalled some willingness to compromise on that issue by proposing a one-year delay in unit obligations if agreement was reached on other issues, but their proposal was rejected by Cabinet.

3.3 Climate Change Response (Emissions Trading and Other Matters) Amendment Act 2012

In 2011, the government undertook a statutory review which, among other things, re-assessed unit obligation dates for synthetic GHGs and biological emissions from agriculture. The independent Emissions Trading Scheme Review Panel appointed by the government as required in legislation recommended retaining unit obligations for SF_6 and for bulk imports of HFCs and PFCs, but replacing those obligations with a comparable levy for HFCs and PFCs in imported goods in order to reduce transaction costs. Regarding unit obligations for agriculture, the Review Panel recommended retaining the July 2015 unit obligation date as legislated. The Review Panel considered that including agriculture in the system would have both short-term and long-term benefits. In the short-term, the price signal provided by inclusion would encourage the use of existing technologies, thereby improving productivity. In the longer term, it would support the development and use of new abatement technologies. Economic efficiency and equity were again cited as reasons why agriculture should be included as legislated. The panel also discussed the need to provide certainty to the sector, noting that many submitters were concerned about the lack of certainty about whether agriculture would be included. Further deferral would only add to this lack of certainty (Emissions Trading Scheme Review Panel 2011).

In early 2012, the government consulted on proposed changes to the NZ ETS. The government's initial position was to introduce the power to defer the start date of unit obligations for agriculture by up to three years, pending review in 2014. Agriculture would then enter if technologies existed to reduce emissions and if other countries had taken sufficient steps to reduce their emissions in general (New Zealand Cabinet 2012b; Ministry for the Environment 2012b). The government reported that submitters from the agriculture sector supported its position, whereas the majority of submitters (mainly foresters, industry and environmental groups) were opposed on equity, economic and environmental grounds (Groser 2012b). When the government introduced the Climate Change (Emissions Trading and Other Matters) Amendment Bill to Parliament, it chose instead to defer unit obligations for agriculture indefinitely, with the intention that agriculture would enter when the above conditions were met (New Zealand Cabinet 2012a). The government considered that these conditions would form the basis of a fair test to ensure the agricultural sector remained competitive (Ministry for the Environment 2012a).

The 2012 amendments also included a series of adjustments to the scope of deforestation liabilities for the forestry sector. Among the forestry issues considered by the 2011 Review Panel was the option to introduce "forest offsetting": enabling landowners of pre-1990 forest to

avoid deforestation liabilities by planting a carbon-equivalent new forest elsewhere. Introducing this option would give landowners more flexibility to make economically efficient land-use decisions. However, at the time, this option was under negotiation as part of the post-2012 Kyoto forestry accounting rules and including this option under the ETS would come at a fiscal cost to the government if it was not agreed upon internationally. The Review Panel recommended the introduction of forest offsetting, unilaterally if required, subject to further consideration of fiscal costs once international rules for the period post-2012 had been decided. The Review Panel also recommended that the government "claw back" the post-2012 tranche of free allocation to pre-1990 forest landowners if forest offsetting was introduced (Emissions Trading Scheme Review Panel 2011). After the "flexible land use" rules enabling forest offsetting were agreed at the international level in Durban in 2011 and further domestic consultation, the government proceeded to introduce forest offsetting for pre-1990 forest under the NZ ETS with a suspension of post-2012 free allocation for those who took up the new option (Groser 2012b).

When amending the legislation, the government also introduced further technical changes affecting the scope of deforestation activity carrying ETS liabilities. The government's objectives included to extend the tree-weed exemption for pre-1990 forest beyond 2012, exclude tree weeds on post-1989 forest land, and "clarify where deforestation liabilities do not apply – by allowing existing forest management practices to be undertaken along forest land boundaries, so long as the cleared land is not put to any other use; ensuring where forest land cannot be replanted due to natural disturbance, that participants do not face a deforestation liability; and better allowing for natural regeneration and re-establishment of poplar and willow forests for erosion control" (Groser 2012c).

4 Point of obligation in the NZ ETS

When designing the NZ ETS, the government's aims in choosing the points of obligation included keeping compliance and administrative costs low, covering as many of each sector's emissions as practicable, ensuring the feasibility of monitoring and verification, and providing appropriate incentives to reduce emissions. The government's preference was for an upstream point of obligation where appropriate, but this decision was taken separately for each sector, as detailed below (Ministry for the Environment and The Treasury 2007; Cullen and Parker 2007). Across sectors, obligated producers are defined by the activities they conduct and thresholds are used to exclude small producers. Table 2 and Table 3 (see the Appendix) summarise mandatory and voluntary activities (respectively) under the NZ ETS, the assigned points of obligation, and the number of participants as of 2015.

4.1 Stationary energy and liquid fossil fuels

4.1.1 Where is the NZ ETS today?

The NZ ETS imposes a mandatory obligation on upstream producers or importers of fossil fuels used for transport and stationary energy (Table 2), with the option for major purchasers to opt in as points of obligation (Table 3). Exports of liquid fossil fuels, natural gas and coal are excluded from ETS obligations as the end-use emissions are outside New Zealand; however, mining and processing emissions associated with these exports are included in NZ ETS obligations.

As of June 2016, five entities carry mandatory obligations for liquid fossil fuels.[10] The regulated activity is owning obligation fuel at the time the fuel is removed for home consumption in accordance with the Customs and Excise Act 1996, or otherwise removed from a refinery, other than for export. The Climate Change (Liquid Fossil Fuels) Regulations 2008 define obligation fuels as: motor spirit with a research octane number of less than 95, motor spirit with a research octane of 95 or greater, automotive diesel, marine diesel, aviation spirit, jet fuel, light residual fuel oil, heavy residual fuel oil, or any other liquid fossil fuel that is directly combusted when used.[11] Liquefied petroleum gas[12], lighting kerosene, solvents, chemicals, and lubricants are explicitly excluded from the list of obligation fuels. A minimum threshold of 50,000 litres of obligation fuel is specified in the Act.

As of June 2016, 93 entities carry mandatory obligations in the stationary energy sector. Regulated activities include: mining or importing coal; mining or importing natural gas; using geothermal fluid; combusting used or waste oil, used tyres, or other waste to generate electricity or industrial heat; refining petroleum where this involves the use of intermediate crude oil products for energy or feedstock purposes; and using crude oil or other liquid hydrocarbons (other than obligation fuel or as specified). Thresholds are listed in Table 2. Whereas most of the participants in the stationary energy sector operate upstream at the point of fuel production or import, producers using geothermal fluid and combusting waste products assume liabilities at the point of emission, and producers using crude oil or other liquid hydrocarbons assume liabilities at the point of use.

The eligibility thresholds for the different activities which are not defined in Schedule 3 of the Climate Change Response Act 2002 are specified in the Climate Change (General Exemptions) Order 2009. This Order also differentiates between mining coal and mining coal in

[10] The data in section 4 on the number of points of obligation under Schedules 3 and 4 are from Environmental Protection Authority (2016).
[11] Each obligation fuel has its own emissions factor that is specified in the Climate Change (Liquid Fossil Fuel) Regulations 2008.
[12] Liquefied petroleum gas (LPG) is covered instead under stationary energy.

the form of peat. A threshold of 2,000 tonnes per year applies to the activity of mining coal compared to 10,000 tonnes per year for peat.

The Climate Change (Stationary Energy and Industrial Processes) Regulations 2009 make coal miners responsible for emissions of fugitive coal seam methane (Ministry for the Environment 2008).

Schedule 4 of the Act allows for large fuel purchasers to opt in as a point of obligation if they meet a specified threshold for purchases from mandatory participants (see Table 3). Thresholds of 10 million litres apply to obligation jet fuel and 35 million litres to other obligation fuels. As of June 2016, five participants have exercised the opt-in option for liquid fossil fuels. Four of these are airlines and the other is an independent transport fuel retailer. Thresholds of 250,000 tonnes per year apply for coal purchasers and 2 petajoules per year for natural gas purchasers. As of June 2016, six participants have exercised the opt-in option for stationary energy fuels: three are energy retailers, two are large manufacturers, and one is a gas retailer supplying natural gas to households which cannot connect to gas mains.

When a large energy user opts in as a point of obligation, the mandatory participant ceases to be responsible for the emissions embodied in the fuel it sells to opt-in participants. This requires mandatory participants to carve out the emissions they sell to opt-in participants.

Under section 60 of the Climate Change Response Act 2002, exemptions from Schedule 3 of the NZ ETS were enabled for two firms: Refining NZ (formerly New Zealand Refining Company Ltd), and OceanaGold Ltd, which had entered into Negotiated Greenhouse Agreements (NGAs) with the Crown prior to 31 December 2005. These firms had committed to mitigation pathways based on "world's best practice" in emissions intensity in return for an exemption from the proposed carbon tax, and the terms of these agreements were honoured under the NZ ETS provisions of the Climate Change Response Act 2002.

4.1.2 How and why did the NZ ETS get there?

Pricing energy emissions was intended to shift investment in upstream energy supply from fossil fuels to renewable sources and incentivise downstream energy efficiency. An upstream point of obligation in the energy sector was a key design feature of the carbon tax proposed by the Fifth Labour Government in 2002. Inland Revenue Department (2005) details the government's plan to tax fossil fuels as early in the supply chain as possible, either at the point of import or extraction or the point of removal from a refinery. This policy design was based on advice from the Treasury (1997). This feature of the proposed carbon tax was carried over to the design of the NZ ETS at an early stage. Cullen and Parker (2007) reaffirmed the government's desire to minimise the number of participants in the NZ ETS, while maintaining broad coverage and appropriate incentives. Given New Zealand's relatively small number of

large players in most energy markets, the government opted for an upstream point of obligation in the energy sectors and this was put into the original Climate Change (Emissions Trading) Amendment Bill 2008. This decision has remained unchanged through the 2009 and 2011 reviews.

In the Climate Change Response (Emissions Trading and Other Matters) Amendment Act 2012, the government added an activity to the stationary energy section (part 3) of Schedule 3: using crude oil or other liquid hydrocarbons where any prescribed threshold is met. According to Groser (2012b), this addition was made to cover 'own use' of these products and remove a potential loophole in coverage.[13] This took effect as of 1 January 2014.

Cullen and Parker (2007) signalled the government's consideration for allowing the opt-in of large users of coal and natural gas. These firms are primarily electricity generators and major industrial producers who generate their own energy. Further, Ministry for the Environment and The Treasury (2007) shows the government's openness to allowing large energy users to opt-in as a point of obligation. At that stage of ETS development, the opt-in consideration was limited to large users of coal and natural gas. Following stakeholder engagement, the decision was made to allow for large users of coal, natural gas, and jet fuel to opt in as a point of obligation if they purchased fuel above a fuel-specific threshold (Ministry for the Environment 2007b). The process of opting in was designed to ensure that large fuel purchasers did not opt into and out of the system on a regular basis so that fuel suppliers had sufficient notice to alter contractual arrangements.

Major fuel purchasers were generally supportive of the opt-in option. Some of these firms expected to be points of obligation for non-energy industrial process emissions or carried liabilities under the EU ETS and wanted to coordinate the management of their carbon liabilities. Other firms, particularly fuel suppliers, were concerned that the opt-in mechanism would increase the administrative complexity of the system, and could create contracting and price uncertainty for fuel suppliers. Officials and sector participants discussed whether the fuel suppliers and purchasers could use contractual arrangements outside of the system to manage price pass-through issues. Some energy users were concerned that upstream fuel suppliers could be unwilling to enter into such contracts voluntarily, and a legislative mandate would be required to ensure this option would be available.

Emissions Trading Group and Ministry of Economic Development (2008) shows that support for the opt-in was not universal, particularly in the liquid fossil fuels sector. The proposal found support from large fuel users. Some fuel users wanted to see the provision

[13] At the time, upstream miners of natural gas and oil were using condensates and other liquid products as energy sources to run generators and compressors on drill and processing sites. This change also was intended to future-proof the system in the event of introducing large-scale LPG or liquefied natural gas (LNG) export facilities.

extended to cover all liquid fossil fuels, not just jet fuel. Fuel providers were opposed to the extension of the provision to all liquid fossil fuels, citing increased administrative and compliance costs. Officials were unclear about the extent to which extending the provision would increase the administrative costs. The provision would mainly be utilised by companies with large vehicle fleets purchasing diesel, and supporters suggested that a high-enough threshold would mitigate the risk of high compliance costs. Nonetheless, extending the opt-in would require companies to keep track of a large number of lower-volume transactions. Officials suggested that the government consult further with the fuel supply industry to see what measures could be taken to minimise additional administrative costs if the provision was extended.

Emissions Trading Group and Ministry of Economic Development (2008) also shows that the opt-in provision for coal or natural gas was more widely supported. A key issue raised in submissions was the level of the thresholds, with some submitters claiming they were set too high, such that some large users would not meet the threshold. Officials rejected this suggestion, stating that there is a clear distinction between the very largest energy users who meet the thresholds and the next tier down; ultimately officials did not recommend any changes be made to these thresholds.

The Climate Change (Emissions Trading) Amendment Act 2008 ultimately allowed large users of jet fuel, coal, or natural gas to opt in as a point of obligation for their energy emissions. In the Climate Change (Emissions Trading and Other Matters) Amendment Act 2012, the opt-in for liquid fossil fuels was extended to include all obligation fuels covered by the Act. Groser (2012c) mentions that the opt-in provision was initially only available to airlines, as they were the only firms purchasing large volumes of liquid fossil fuels. Since the system was introduced, fuel retailers which are not mandatory participants have begun to purchase substantial volumes of fuel from mandatory participants. These retailers sell fuel for use in international transport and also export fuel. As these firms are not participants, they cannot account for these transactions in an emissions return. Their only option is to supply the information to the company that sold them the fuel, and this company may modify its emissions return accordingly. Furthermore, the larger liquid fuel users and retailers wanted to manage their own surrender obligations and were capable of doing so. On the grounds of sector interest and equity, the government decided to extend the opt-in provision to large users of all liquid fossil fuels.

The use of a predominantly upstream point of obligation in the energy sector with the option for downstream opt-in has proven to be a functional arrangement and neither the government nor sector participants have proposed fundamental changes to this architecture since its inception. To gain understanding of practical experience with the system, the authors

interviewed a small number of market participants in 2014: government administrators, a carbon market expert in a major business organisation, a carbon trader from a large company that opted in as a point of obligation, and a market broker. Interviews revealed that some downstream participants felt they could lower their emission costs by assuming direct unit obligations rather than relying on the purchasing strategies of upstream suppliers. One concern was that upstream suppliers may lack expertise or a sufficient incentive to find the best deals; however, this concern could similarly apply to downstream users. Another concern was the possibility that in a small and imperfectly competitive market, upstream suppliers could pass on higher emission prices than they were bearing (see Stock 2012; Smellie 2013).[14] One respondent reported that it considered it had saved millions of dollars from doing its own purchasing. Respondents reported that having the opt-in in legislation had proven useful for those who met the threshold; while it would be possible for unit obligations to be shifted to any downstream participants under private contractual arrangements outside the NZ ETS, some upstream energy suppliers had indeed proven resistant to this for firms below the threshold that had requested this option. One respondent commented that this resistance was more of an issue for liquid fossil fuels than for coal or gas,[15] and that electricity generators that had opted in as points of obligation on coal or gas were reluctant to allow contractual opt-in for their customers due to the complexity of electricity pricing. However, another respondent noted that its firm had voluntarily contracted to provide emission units (which had been freely allocated in this case) to its transport fuel supplier instead of bearing passed-through emission costs; this enabled the firm to avoid exposure to emission price risk from both its supplier and its need to sell its excess free allocation. s (Kerr and Duscha 2014).

4.2 Industrial processes and synthetic greenhouse gases

4.2.1 Where is the NZ ETS today?

Table 2: lists the industrial activities carrying mandatory non-energy emission obligations in the NZ ETS. These are divided into two groups in Schedule 3 of the Act. Subpart 1 covers industrial production of iron and steel, aluminium, clinker or burnt lime, glass (using soda ash), and gold. Subpart 2 covers synthetic GHGs. As of June 2016, there are nine participants with obligations

[14] If the market were competitive, upstream fuel suppliers would be incentivised to obtain the lowest-price units and minimise emission costs passed downstream. If the market were not perfectly competitive, upstream fuel suppliers would already be passing on elevated fuel prices up to the level that users could bear, thereby limiting suppliers' further potential to pass on full or inflated emission prices. Therefore, even in an uncompetitive market, upstream fuel suppliers would still have an incentive to minimise emission costs and maximise profits by purchasing the lowest-priced units.

[15] Unlike coal and gas contracts, which are often set out with a fixed price for a period with subsequent escalation clauses for contract term extensions, contracts for liquid fossil fuels tend to reflect more international price volatility and involve greater potential for switching of suppliers and more variable types of customers. This creates incentives for liquid fossil fuel suppliers to manage their own unit liabilities instead of relying on unit surrenders by customers.

under Subpart 1 and 22 under Subpart 2. PFCs generated from aluminium production are covered under Subpart 1, and PFCs for other applications under Subpart 2. Synthetic GHGs in imported goods[16] are excluded from the NZ ETS and covered instead under a synthetic GHG levy. In most cases, the point of obligation applies at the point of emission. An exception is bulk-imported HFCs and PFCs (e.g. which are not contained in goods), where the obligation applies at the point of import. The Act allows for firms to opt in to the system to earn units for emission removal activities relating to industrial activities. These are addressed separately in section 4.7.

4.2.2 How and why did the NZ ETS get there?

Pricing industrial process emissions was intended to incentivise more emissions-efficient manufacturing processes, product substitution toward lower-emission alternatives, and more efficient use of industrial products by consumers. Industrial process emissions were included in the government's initial proposal for a carbon tax (Hodgson 2002a). Under the carbon tax, the government's preferred option was to place the point of obligation for the tax at the point in the supply chain where emissions could be easily measured and where a charge could be cost-effectively applied. Emitters in the industrial processes sector were involved in the preparation for the carbon tax and these firms generally had good emissions data (Ministry for the Environment and The Treasury 2007). This work was not wasted, and the point of obligation for the industrial processes sector was set at the point of emissions in the initial design of the ETS. The activity-based definitions in the Act for mandatory participants in the ETS for the industrial processes sector reflect this decision. Initial estimates were that these definitions would cover 35 firms.

The major changes that have occurred with regard to point of obligation in this sector have been in the treatment of synthetic GHG emissions. In the initial legislation, importers of HFCs and PFCs, including the importation of these gases contained in goods, were to face surrender obligations under the system after 1 January 2013.[17] Instead, imported goods containing these gases were shifted outside the NZ ETS and covered by a synthetic GHG levy which took effect from 1 July 2013. Synthetic GHGs in household goods and the effects of passengers[18] are exempted from the levy, as are those in medical devices. These changes were recommended by the ETS Review Panel under the 2011 statutory review (Emissions Trading Scheme Review Panel 2011). The panel found that the transaction and compliance costs

[16] These include motor vehicles with air conditioning units as well as refrigerators, freezers, heat pumps, air-conditioners and refrigerated trailers (New Zealand Customs Service 2013).
[17] The goods include motor vehicles, air conditioning units, and refrigeration units.
[18] According to the Climate Change (Synthetic Greenhouse Gas Levies) Regulations 2013, "A passenger on a ship or an aircraft who imports leviable goods that are the passenger's household goods or other effects is exempt from paying the levy in relation to those leviable goods if the goods are not intended for gift, sale, or exchange." This applies both when the leviable goods accompany the passenger and otherwise.

imposed on importers of goods containing synthetic gases would be high, given the relatively large number of small importers of such goods. The government agreed with the panel's recommendations (Groser 2012a). This change was included in the Climate Change (Emissions Trading and Other Matters) Amendment Act 2012 and operationalised through the Climate Change (Synthetic Greenhouse Gas Levies) Regulations 2013.

The point of obligation for SF_6 was set at the importer level in the 2008 legislation; under the 2012 amendments, it was shifted to the level of the electrical switchgear operator. Electrical switchgear accounts for over 85% of the use of SF_6 in New Zealand and large users account for 77% of SF_6 emissions (Groser 2012a); the emissions occur when the gas leaks from the electrical equipment. Submitters to the 2011 ETS Review Panel felt that the treatment of SF_6 under the initial legislation was inequitable as the government's liability is only for actual emissions and not potential emissions (Emissions Trading Scheme Review Panel 2011). The panel recommended that the government shift the point of obligation to major users of SF_6 rather than importers. Groser (2012a) shows the liabilities under the two options for point of obligation; under the assumption that 2% of the SF_6 in a single piece of switchgear leaks per year, the annual user-based liability would only be 15% of an importer-based liability, which assumes 100% leakage up front.[19] This paper also details the government's decision to move the point of obligation for SF_6 from the importer to the user.

In contrast to the points of obligation for stationary energy and transport, the points of obligation for industrial processes may also be recipients of free allocation if they meet the eligibility criteria. Free allocation is provided on an output basis to emissions-intensive, trade-exposed (EITE) industrial producers, encompassing their direct industrial process emissions and their direct and indirect emissions from stationary energy. It is interesting to note that there are some differences in the scope definition for industrial process activities between the determination of ETS liabilities and the determination of free allocation. Free allocation is calculated as the product of:

a) an allocative baseline defined for each activity (based on average industry emissions over a previous period);
b) annual output for that activity, and
c) the level of assistance (set at 0.6 for moderately emissions-intensive activities and 0.9 for highly emissions-intensive activities).[20]

[19] The principle of charging for actual rather than potential emissions was suitable for SF_6 because emissions can occur over a long time period, or can be avoided if the equipment is well maintained. It is interesting to note that ETS obligations apply to the waste sector and HFC emissions on the basis of potential emissions. In the case of waste, this allows emission costs to be passed on at the point where waste disposal is priced. In the case of HFCs, this facilitates determination of removal units for gas exports.

[20] The activities eligible to receive free allocation, their emissions intensities and their allocative baselines are defined in the Climate Change (Eligible Industrial Activities) Regulations 2010.

Whereas ETS liabilities are assessed separately for industrial process and energy emissions, the calculation of free allocation is designed to capture the emissions associated with end-product output, including both industrial process and energy emissions. For example, the ETS liability for industrial process emissions applies to the activity of producing clinker, an intermediate product, but the determination of free allocation is made on the basis of cement production. Similarly, the ETS liability applies to the activity of producing steel billet, but the determination of free allocation takes account of additional energy consumed to produce rolled steel. The determination of free allocation in this way is intended to incentivise whole-of-process improvements in emissions intensity, including changes in the end composition of products with emissions-intensive intermediate inputs.

4.3 Forestry

4.3.1 Where is the NZ ETS today?

Table 2 lists the activity that defines a mandatory forestry participant in the NZ ETS. Firms face a surrender obligation if they deforest land that was in forest prior to 1 January 1990, and if the total amount of land deforested in a five-year period is greater than two hectares.[21] Exemptions apply to landowners with total holdings of less than 50 hectares of pre-1990 forest land on 1 September 2007, for deforestation of tree weeds, and for areas less than one hectare or less than 30 metres wide at their widest point, where clearing is required for best-practice forest management (see section 179A of the Climate Change Response Act 2002). From 1 January 2013, pre-1990 forest owners have been able to offset their deforestation liability by planting a forest on eligible post-1989 forest land; the new forest must cover at least the same land area and achieve the same carbon stock as the original forest.

For deforestation of pre-1990 forest, the default point of obligation is the landowner (Ministry for the Environment and The Treasury 2007). However, the Act allows for the obligation to be moved from the landowner to the person in charge of the land-use decision, if the landowner can prove to the Environmental Protection Agency (EPA) that the right to decide to deforest pre-1990 forest land was undertaken by a third party and the landowner had no control over the decision.[22] The third party would then be liable for the surrender of emissions units to cover the deforestation.

[21] Deforestation is defined as the clearing of forest in order to convert the land to another land use. Harvesting pre-1990 forest and replanting to allow regeneration does not result in a liability in the NZ ETS.
[22] Under the Forestry Rights Registration Act 1983, a landowner can grant a forestry right to another person, which enables that person to establish, maintain and harvest – or maintain and harvest – a crop of trees on the land. This enables separation of the ownership and value of the trees from the ownership and value of the land.

As of June 2016, 45 entities were registered for deforesting pre-1990 forest land. However, this statistic reflects deforestation activity during the year from July 2015 through June 2016, and not the level of registration for deforestation since inception of the system. For example, over that year, 11 participants were added and 54 participants were removed relative to registration in the previous year.

Table 3 lists the activities for which entities may become voluntary ETS participants in the forestry sector. Leaseholders, forestry rights holders, or owners of forested land that was forested after 31 December 1989 can opt into the system to receive emissions units for the carbon sequestered in their forests.[23] Individuals who are party to a Crown conservation contract may also opt in to the system to receive emissions units.[24] These voluntary participants are required to surrender emissions units associated with emissions from harvest or deforestation.

Voluntary forestry participants account for the vast majority of participants in the NZ ETS; as of June 2016 there were 2,115 voluntary forestry participants registered in the system. Of these, 2,012 had registered as owners of post-1989 forest land,[25] 90 as holders of a registered forestry right,[26] and 13 as holders of a registered forestry lease.[27] No parties to a Crown conservation contract have opted into the system. Placing the point of obligation at the level of the entity making the land-use decisions relating to the harvesting or deforesting of forest land constitutes a point-source point of obligation in the forestry sector.

4.3.2 How and why did the NZ ETS get there?

In designing the ETS, the government was seeking appropriately directed incentives for reduced deforestation, greater afforestation and reforestation, and greater average carbon stocks (e.g. by extending rotation lengths). Under the ETS, international emissions liabilities from deforestation of pre-1990 forest were devolved from the government to the sector. The government decided to place ETS deforestation obligations on the landowner (Ministry for the Environment and The Treasury 2007). The landowner is usually the one to make the decision to deforest the land and convert it to a different land use. If the landowner is not the one making the decision to deforest, the individual making this decision becomes the mandatory participant for the activity of deforesting pre-1990 forest land.

[23] To register as a participant, a landowner of post-1989 forest must have written agreement of any holder of a registered forestry right or lease, and vice versa. A registered forestry right is granted by the landowner to a third party and grants the third party the right to establish or maintain and harvest a forest on the land covered by the right.
[24] Under the Climate Change Response Act 2002, a Crown conservation contract is a written agreement with the Crown for the removal and storage of GHGs on post-1989 forest land that is Crown land managed or administered under the Conservation Act 1987 or Acts listed in Schedule 1 of that Act.
[25] During the prior year, 40 participants were added and 90 removed.
[26] During the prior year, six participants were added and five removed.
[27] During the prior year, five participants were added and 29 removed.

At the framework stage, Cullen and Parker (2007) also signalled the government's intention to allow owners of forest planted after 1989 to opt in to the system. These participants could then earn units for the carbon sequestered in their forests, while also taking on a liability for future harvest or deforestation. The inclusion of post-1989 forest was intended to create an incentive to extend rotation lengths and replant forests as well as to generate sufficient liquidity in the market to foster cross-sectoral trading once other sectors entered the system (Ministry for the Environment and The Treasury 2007). The activity definitions for post-1989 forest land explicitly state that the person in charge of the harvesting decision is the one who may become a participant in the system. The principle is that the owner of the forest, not the owner of the land that the forest is on, should be the one to receive emissions units and face the deforestation or harvest liability (Ministry for the Environment and The Treasury 2007). For post-1989 forest land where the landowner and forest owner are different, one of these participants can enter only if they have the written agreement of the other party.

4.4 Agriculture

4.4.1 Where is the NZ ETS today?

As of 2017, agricultural participants in the ETS face only reporting obligations for biological emissions. Table 2 lists the activity that defines when a participant must report emissions under the Act. The default point of obligation in the Act is at the manufacturer/importer level for nitrogen-based fertilisers and at the processor level for livestock emissions. This constitutes a mid-stream point of obligation for livestock emissions and an upstream point of obligation for fertiliser emissions. The Act allows for the point of obligation for both livestock and fertiliser emissions to move to the farmer level if determined by an Order in Council. Under this outcome, the farmer level would constitute a point-source obligation. As of June 2016, 80 entities faced reporting obligations in the agricultural sector, of which 11 import or manufacture synthetic fertilisers containing nitrogen and the remainder conduct animal slaughter (43), export live cattle, sheep or pigs (12), or process dairy milk or colostrum (14).

4.4.2 How and why did the NZ ETS get there?

The desired outcomes from including agriculture in the ETS included improving the emissions efficiency of production activities and incentivising lower-emitting land uses while maintaining administrative feasibility and broad compliance. The debate about whether this could best be achieved through a processor- versus farmer-level point of obligation has been going since the decision to include agriculture in the ETS was made in 2007. Cullen and Parker (2007) show that the government's initial preference was to place the point of obligation at the processor

level for biological emissions and the manufacturer/importer level for fertiliser. It also signals that the government was considering that it may be more appropriate to move the point of obligation to the farmer level in the longer term. The government's initial preference for a processor-level point of obligation was chosen to minimise the number of participants in the system (Ministry for the Environment and The Treasury 2007). It was expected that this would involve 35 firms.[28] Placing the point of obligation at the farmer level would dramatically increase the number of participants in the system, increasing the administrative costs and complexity for the government and farmers. Concerns were also raised about the difficulty of assessing and verifying emissions at the farmer level and ensuring adequate levels of compliance with ETS obligations across the sector. At the time, there was a relatively low level of trust between farmers and the government, which had already impacted on the accuracy of sector reporting because some farmers were concerned that information reported for other purposes could be used by the government to determine farmers' NZ ETS liabilities.[29]

Stakeholders in the agricultural sector had a strong preference for a farmer-level point of obligation (Ministry for the Environment 2007b). A farmer-level point of obligation could provide greater incentive and rewards for farmers who reduce their emissions, relative to a processor-level point of obligation which resulted in an average price being passed to farmers regardless of their individual behaviour. A processor-level obligation provides only an incentive to shift production away from red meat and milk products. Suggestions in sector submissions for improving the emission price incentive for farmers included requiring the price pass-through to be reported on invoices from downstream or upstream suppliers[30]; having processors serve as "aggregators" for managing emission obligations while legal ETS obligations remained with farmers; and offering two-tier reporting, enabling farmers to choose between using default assumptions or preparing a detailed emissions return reflecting farm-specific behaviour (Emissions Trading Group and Ministry of Economic Development 2008).

The government maintained its preference for a processor-level point of obligation, citing the administrative complexity of the alternative. A further consideration was that given the methodological challenges, farm-level accounting may not have delivered markedly better precision or more equitable outcomes relative to processor-level accounting in terms of estimating emissions and incentivising emission reductions.[31] Officials acknowledged that a processor-level obligation would function more like a per-kilogram levy and farmers' mitigation

[28] This number was revised to 43 participants during consideration of the Bill. In contrast, officials reported that there were about 55,000 farms and orchards in New Zealand. Imposing a participation threshold of 127 tonnes of CO_2eq (about 382 sheep or 52 dairy cows) would cover 98 percent of sector emissions but still involve 34,000 participants (Emissions Trading Group and Ministry of Economic Development 2008).
[29] Personal communication from Jacob Haronga, 1 August 2016.
[30] We note that this would not have 'improved the price incentive' but would have made it more visible.
[31] For example, emissions from urine patches vary with soil drainage, and these differences may not be captured under standardised methodologies for estimating on-farm emissions.

opportunities would likely relate to changes in output mix. Enabling processors to pass through recognition under the NZ ETS for improvements in farmer-level practices would involve many of the same challenges as direct farmer-level NZ ETS reporting. Officials identified a hybrid option enabling farmers to opt in as direct points of obligation with a processor-level carve-out, in a manner similar to that in the stationary energy and transport sectors, but did not proceed further with this approach (Emissions Trading Group and Ministry of Economic Development 2008). The final ETS Bill placed the point of obligation at the processor level, but allowed for it to move to the farmer level through an Order in Council.

The government signalled that it intended to continue engaging with the sector to determine the most appropriate point of obligation. For this purpose it initially used the Agriculture Technical Advisory Group (AgTAG) established in 2007 by the Ministry of Agriculture and Forestry.[32] In February 2009, the AgTAG submitted its final report to the government. It recommended a farmer-level obligation for non-fertiliser emissions on the grounds of "the superior price signal," and suggested that the landowner rather than the stockowner should carry the legal obligation to support broad coverage and compliance. It recommended against consideration of a hybrid option. This would be complex and might create emissions leakage and other perverse effects. It acknowledged the need for farmer education prior to implementing a farmer-level obligation. Regarding fertiliser emissions, it recommended an obligation at the point of manufacture or import because this would provide broad coverage with low administrative costs and an effective price signal for farmers (Agriculture Technical Advisory Group 2009). Despite this recommendation and considerable support for a farmer-level obligation from submissions, the government's choice of a default processor-level point of obligation with flexibility to move to the farmer level was maintained during the 2009 amendments, which deferred entry of the sector until 2015. At that time, the government removed the previous legislative requirement to make a decision by 30 June 2010 on changing to a farmer-level obligation (Smith 2009a; Smith 2009b; Ministry for the Environment 2009).

In October 2010, the government established an Agricultural ETS Advisory Committee with eight members across the pastoral sector, research organisations and Māori/iwi. It was intended to serve for two years and was tasked with considering the transition to a farmer-level point of obligation, among other matters (Ministry of Agriculture and Forestry 2010a). The committee reported back to government in June 2011 with recommendations that the government exclude layer hens from the NZ ETS due to the low emissions and high administrative costs, provide for annual scientific review of and updates to agricultural

[32] Now the Ministry for Primary Industries.

emission factors, and recognise dicyandiamide (DCD), a nitrogen inhibitor, as an agriculture-sector removal activity under the NZ ETS. The committee also noted that most submissions on the government's agriculture sector regulations had supported a farm-level point of obligation under the NZ ETS (Agriculture ETS Advisory Committee 2011).

During the 2011 review of the NZ ETS, almost all submitters voiced a preference to move to a farmer-level point of obligation, as it would provide more direct and effective incentives to improve farm practices and reduce emissions (Emissions Trading Scheme Review Panel 2011). The amendments made following the 2012 review kept the processor-level point of obligation as the default, but Cabinet recommended that officials begin exploring options to move to a farmer-level point of obligation as soon as possible (Groser 2012b). KPMG (2012) compared three different versions of a farmer-level point of obligation: stock owner, landowner, and business owner. Its analysis showed that placing the point of obligation at the level of the farm business owner would best meet the government's objectives of high emissions coverage, lower compliance costs, and incentives for mitigation. As of 2017, the point of obligation for reporting remains at the processor level.

Starting in May 2010, the government consulted on regulations for exemptions and thresholds for points of obligation as well as emission methodologies in the agriculture sector. The government proposed the following criteria for species-level exemptions: inclusion in the Kyoto Protocol, potential for substitution and competition, and practicality of administration and materiality of emissions. The criteria proposed for sector-level exemptions included emissions materiality "relative to the commercial size of participant in terms of output" and equity with regard to potential for perverse incentives and distortions (Ministry of Agriculture and Forestry 2010b).

In the Climate Change (General Exemptions) Amendment Order 2010 and Climate Change (Agriculture Sector) Regulations 2010, which were passed by Order in Council in September 2010, the government provided exemptions for some sources of agriculture emissions. Amendments to both sets of regulations with implications for exemptions were passed in 2012. Table 2 reports the exemptions which apply as of 2017.

The following changes were made to agriculture exemptions in 2012 through amendments to the Climate Change (General Exemptions) Order 2009, Climate Change (Agriculture Sector) Regulations 2010, and the Climate Change Response Act 2002:

- An exemption was added for the slaughter of animals not for human consumption, removed for retail butchers, and extended beyond bobby calves to all calves and vealers.[33]
- ETS obligations were removed for producing eggs, but added for slaughtering layer hens.[34]
- An exemption threshold for dairy processing of milk or colostrum of 500 tonnes of milk solids per year was added, as well as an exemption for dairy processing of milk or colostrum from goats or sheep.
- Wool-related emissions were removed from the emission factor for sheep meat, as their inclusion had distorted the emissions liability for sheep meat relative to cattle meat.
- The venison emission factor was revised to exclude emissions from deer velvet production (Ministry for Primary Industries 2016; Ministry for Primary Industries 2012).

Further insight is available from government documentation on these decisions. In 2010, the government chose to exempt the following species from ETS obligations: llamas, alpacas, ostriches, emus, and ruminants other than sheep, cattle, goats and deer. The slaughter of horses was exempted due to equity considerations within the sector and to allow time for further consultation. The slaughter of layer hens and bobby calves was exempted in 2010 because those emissions were counted elsewhere. The higher threshold for egg production obligations for the years 2011 through 2013 was intended to exempt the smallest producers from pre-2014 reporting obligations.

The government noted the potential for systematic underreporting in the NZ ETS relative to the national inventory, given the combination of exemptions for indicated species and below-threshold producers, exclusions of on-farm animal deaths, exclusions of retail butchers and home kill, and conservatism on NZ ETS emission factors to avoid double counting, together with the inherent variability of biological systems. Ignoring exemptions, the NZ ETS was projected to

[33] Under the 2010 Amendment Order, the following exemption applied to the slaughter of animals: "A person who is the operator of a risk management programme registered under the Animal Products Act 1999 and is not a retail butcher (as defined in section 4[1] of the Animal Products Act 1999) and who carries out the activity of slaughtering ruminant animals, pigs, horses, or poultry listed in subpart 3 of Part 5 of Schedule 3 of the Act is exempt as a participant in respect of the activity except in relation to the slaughter of cattle (other than bobby calves), sheep, deer, goats, pigs, or poultry (other than layer hens)."

[34] Under the 2010 Amendment Order, the exemption thresholds for producing eggs were set at 2,290 layer hens per year in 2011, 2012, and 2013, and 860 layer hens per year after 2013, as calculated in accordance with regulation 13 of the Climate Change (Agriculture Sector) Regulations 2010.

undercharge the sector by about 3.7 percent per year on average, at a fiscal cost to the government (Smith 2010; Cabinet Economic Growth and Infrastructure Committee 2010). The Regulatory Impact Statement for the 2012 amendments to the agriculture regulations documents that changes to emission factors and exemptions were made to better align sector obligations with inventory reporting, simplify calculations and avoid perverse outcomes (e.g. potential double counting of emissions, animal welfare issues, and economic distortions) (Ministry for Primary Industries 2012).

4.5 Waste

4.5.1 Where is the NZ ETS today?

Table 3 shows the activity that defines a mandatory point of obligation in the waste sector. Entities face reporting and surrender obligations if they operate a waste disposal facility (i.e. landfills). Surrender obligations are restricted to municipal landfills where some proportion of the waste is from household sources (Ministry for the Environment 2011).[35] Landfill operators are required to surrender units for the CH_4 emitted from the biodegradation of organic material. Liable emissions are determined on the basis of waste disposed and either a default or landfill-specific emissions factor;[36] they do not account for improved management of existing waste. As of June 2016, there are 34 entities with surrender obligations for operating a landfill. Most of the landfills in New Zealand are operated by local government authorities; 23 of the participants in the waste sector are local councils. The activity of operating a landfill constitutes a point-source point of obligation.

The Climate Change (General Exemptions) Order 2009 provides an exemption for small landfills. Landfills located on the New Zealand mainland are exempt from reporting and surrender requirements if they take in less than 1,000 tonnes of waste in a year and are located 150 kilometres or more from a landfill listed in the Order, or if they take in less than 500 tonnes of waste in a year and are located 75 kilometres or more from a landfill listed in the Order, or are situated on one of New Zealand's offshore islands located 25 kilometres or more from mainland New Zealand.

[35] The NZ ETS excludes industrial fills, cleanfills, or any facilities that accept no household waste.
[36] While the NZ ETS defines a default emission factor for each regulated activity, in some cases it offers the option for participants to apply for a Unique Emissions Factor (UEF). The following activities are eligible to apply for a UEF: owning obligation fuel; purchasing obligation jet fuel; importing or mining coal; purchasing coal or natural gas; using geothermal fluid; combusting used oil, waste oil, used tyres, or waste; and operating a disposal facility. UEFs must be independently verified.

4.5.2 How and why did the NZ ETS get there?

By including the waste sector in the ETS, the government sought to reduce GHG emissions by incentivising improved landfill management practices and reducing anaerobic decomposition of organic waste. Under the ETS, surrender obligations only apply to municipal landfills, which are likely to contain an organic component. Emissions from wastewater treatment are excluded from the system: they are difficult to measure at an individual site, and there are hundreds of such facilities in New Zealand (Ministry for the Environment and The Treasury 2007). Therefore the administration and compliance costs associated with including these emissions were likely to outweigh the benefits. Waste incineration for energy production is covered under the stationary energy sector, and while waste incineration for other purposes technically is subject to ETS obligations, this activity does not appear to occur in New Zealand.

The decision to exempt small landfill operators was made following the 2011 statutory review. The rationale was that the combined administrative and compliance costs would outweigh the likely environmental benefits from including these entities (Emissions Trading Scheme Review Panel 2011). The 2011 Review Panel was concerned that a quantity threshold exemption could introduce perverse incentives for people to move their waste to exempt landfills, open new landfills falling below the threshold, or burn waste instead of taking it to landfill in areas where alternative waste disposal options are limited. The panel recommended that the exemption be based not only on the size of the landfill, but also on the geographic isolation of the landfill and the availability of alternative disposal options in the area. To avoid the perverse incentives for constructing small landfills, the panel recommended that the exemption apply only to existing landfills. This exemption was introduced into the Climate Change (General Exemptions) Order 2009 in January 2013 by the Climate Change (General Exemptions) Amendment Order 2012.

4.6 Other removal activities

4.6.1 Where is the NZ ETS today?

Participants can opt into the ETS and earn emissions units if they undertake specified non-forestry removal activities. Schedule 4 of the Act defines three categories of activity:

1. embedding emissions in products (either permanently or temporarily if the product is exported)[37];
2. exporting HFC or PFCs (including those contained in goods) above a threshold of one tonne per year or destroying HFCs or PFCs above a threshold of one tonne per year; and
3. carbon capture and storage (CCS).

For the first category, the start date for accruing units was 1 July 2010. The Climate Change (Other Removal Activities) Regulations 2009 specify two products that qualify as having an embedded substance: production of methanol and export of liquefied petroleum gas (LPG). As of June 2015, only one firm, a methanol producer, was a participant in this regard. For the second category, the start date for accruing units was 1 January 2013. As shown in Table 3, seven firms earned units for exporting HFCs and PFCs as of June 2015; none so far have opted in for destroying these gases.[38] The third category would require an Order in Council to apply and has never been activated.

4.6.2 How and why did the NZ ETS get there?

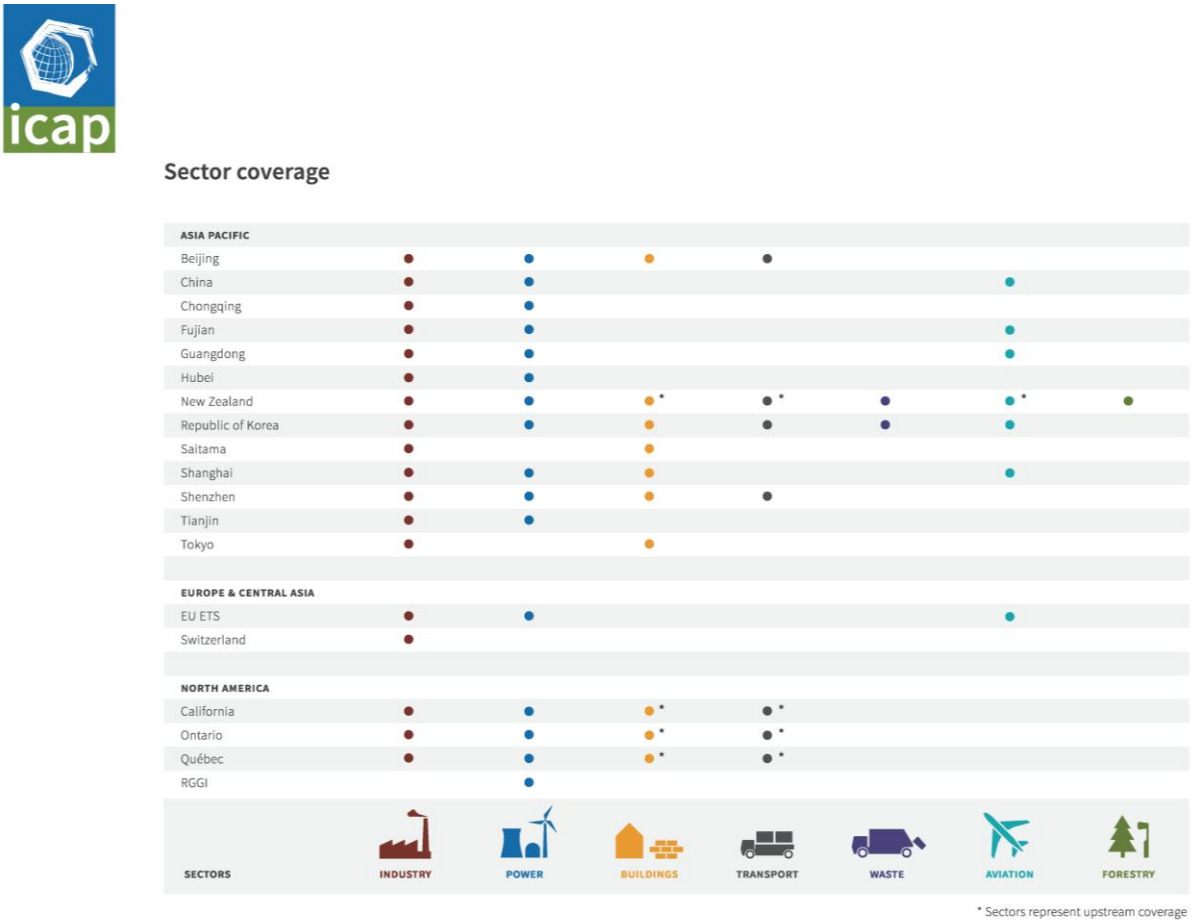
The potential to credit non-forestry removals was not addressed in the government's initial consultation document on NZ ETS design (Ministry for the Environment and The Treasury 2007), but was identified by stakeholders as an issue during consultation and was included in the first draft of legislation. Crediting industrial removal activities under the NZ ETS was consistent with New Zealand's inventory and target accounting and created a further benefit for eligible firms offsetting other emission costs imposed by the system. The option for crediting of CCS by Order in Council was included to help "future-proof" the ETS, but officials noted that a robust regulatory framework for CCS would need to be in place domestically first (Emissions Trading Group and Ministry of Economic Development 2008).

[37] To become a participant for these activities, the entity must be required to surrender emissions units for the emissions that would result if the substance was not embedded, and the result of the substance being embedded is a reduction from emissions reported in New Zealand's annual inventory.
[38] In New Zealand, PFCs and HFCs are collected by an industry body, Refrigeration Recovery NZ Limited, and exported to Australia.

5 How does the NZ ETS compare with other systems?

As of 2017, New Zealand's ETS remains the only system in the world designed to cover all economic sectors and all major GHG emissions over time, although it has not yet achieved this intention with the indefinite deferral of biological emissions from the agriculture sector. It was the first to include the transport sector, which has since been included in several systems. Its inclusion of forestry and potential future inclusion of agriculture as directly obligated sectors rather than sources of offset credits remains globally unique. The rationale for New Zealand's choices is detailed for each sector above. Other systems have made different choices, influenced by factors such as the emission profile of their economy, the scope and nature of their mitigation targets and mitigation opportunities, their existing policy and regulatory framework, their experience with market instruments, and economic and administrative considerations (Partnership for Market Readiness and International Carbon Action Partnership 2016). Figure 1 presents an overview of sector coverage in the ETS operating or anticipated as of 2017.

Figure 1: Sector coverage in the world's ETS



Source: International Carbon Action Partnership (2017)

The NZ ETS pioneered an upstream point of obligation across the energy sector, a feature which has been adopted selectively in other systems but not in others. Jurisdictions' choices in this regard have been influenced by many considerations, including existing regulatory and reporting structures, administrative effectiveness, the capability of firms to assume ETS obligations, and the effectiveness of emission price pass-through (Partnership for Market Readiness and International Carbon Action Partnership 2016).

The treatment of energy-sector emissions has varied considerably. Examples of choices made in different jurisdictions include:

- **Electricity sector**: Using a generator-level obligation (e.g. EU, California, Kazakhstan and Beijing) and/or a consumer-level obligation (e.g. Tokyo, Saitama and Beijing)
- **Stationary energy use**: Using an upstream obligation at the point of fuel supply (e.g. California and Quebec) or a downstream obligation at the point of fuel use (e.g. EU, Chinese pilots and Republic of Korea)
- **Transport**: Using an upstream obligation at the point of fuel supply (e.g. California and Quebec) or a downstream obligation at the point of fuel use for covered entities (e.g. Republic of Korea and the pilot ETSs in Shenzhen, Chongqing and Tianjin) (Partnership for Market Readiness and International Carbon Action Partnership 2016).

As global experience with emissions extends into new jurisdictions with different regulatory and market settings as well as political contexts, it will be interesting to see which ETS design choices are made and for what reasons.

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Appendix

Table 2: Activities for which entities are mandatory participants in the NZ ETS

Sector	**Activity**	**Point of obligation**	**Number of participants** (as of 30 June 2016)[39]
Forestry	Deforesting pre-1990 forest land	• Owner of forest land • Third party with deforestation rights, where the landowner has no control over the decision	• Deforesting pre-1990 forest land: 45
Liquid fossil fuels	Owning obligation fuel at the time it is removed from a refinery for home consumption or otherwise removed from a refinery other than for export, if the total amount of obligation fuel removed exceeds 50,000 litres a year	• Owner of obligation fuel at the time the fuel is removed for home consumption or otherwise removed from a refinery, other than for export	• Owning obligation fuel: 5

[39] Source: Environmental Protection Authority (2016).

Sector	**Activity**	**Point of obligation**	**Number of participants** (as of 30 June 2016)[39]
Stationary energy	Importing coal > 2,000 tonnes a year Mining coal > 2,000 tonnes a year, other than for export Importing natural gas > 10,000 litres a year Mining natural gas, other than for export Using geothermal fluid for the purpose of generating electricity or industrial heat where emissions exceed 4,000 t-CO_2eq a year Combusting used oil, waste oil, used tyres, or waste for the purpose of generating electricity or industrial heat > 1,500 tonnes a year Refining petroleum where the refining involves the use of intermediate crude oil products for energy or feedstock purposes Using crude oil or other liquid hydrocarbons where any prescribed threshold is met > 1,500 tonnes a year (applies on and after 1 January 2014).	• Point of fuel production or import for coal and natural gas • Point of use of geothermal fluid • Point of emission for combustion of waste products • Point of petroleum refining where the refining involves the use of intermediate crude oil products (for example, refinery fuels and gases) for energy or feedstock purposes • Point of use of crude oil or other liquid hydrocarbons (other than obligation fuel or as specified)	• Importing or mining coal: 24 • Importing or mining natural gas: 49 • Using geothermal fluid: 12 • Combustion of waste products: 4 • Using crude oil: 4
Industrial processes	Producing iron or steel (>100 t-CO_2eq per year) Producing aluminium, resulting in the consumption of anodes or the production of anode effects Producing clinker, or burnt lime, resulting in calcination of limestone, or calcium carbonates Producing glass using soda ash Producing gold (>5000 t-CO_2eq per year)	• Point of production	• Producing iron or steel: 2 • Producing aluminium: 1 • Producing clinker or burnt lime: 4 • Producing glass using soda ash: 2

Sector	**Activity**	**Point of obligation**	**Number of participants** (as of 30 June 2016)[39]
Synthetic greenhouse gases	Operating electrical switchgear that uses sulphur hexafluoride where the electrical switchgear contains at least 1 tonne of SF_6 Importing hydrofluorocarbons or perfluorocarbons, excluding those contained in goods Manufacturing hydrofluorocarbons or perfluorocarbons other than through producing aluminium, resulting in the consumption of anodes or the production of anode effects	• Point of import, manufacture, or equipment operation	• Operating electrical switchgear that uses SF_6: 7 • Importing HFCs or PFCs: 11
Waste	Operating a disposal facility	• Landfill operator	• 34

Sector	Activity	Point of obligation	Number of participants (as of 30 June 2016)[39]
Agriculture	*Processor level:* Importing or manufacturing synthetic fertilisers containing nitrogen (processor) (>1 tonne of synthetic fertiliser per year) Slaughtering ruminant animals, pigs, horses, or poultry[40] by a person who is the operator of a risk management programme registered under the Animal Products Act 1999 for the slaughter of animals (processor) Dairy processing of milk or colostrum (>500 tonnes of milk solids per year)[41] (processor) Exporting from New Zealand live cattle (>20 per year), sheep (>20 per year), or pigs (>20 per year) in accordance with an animal welfare export certificate (processor) *Farmer level:* Purchasing, other than for on-selling, synthetic fertiliser containing nitrogen for application to land (farmer) Farming, raising, growing, or keeping ruminant animals, pigs, horses, or poultry for reward; or the purpose of trade in those animals, or in animal material or animal products taken or derived from those animals (farmer)	• Default: Processor • Alternative by Order in Council: Farmer	• Importing or manufacturing synthetic fertilisers containing nitrogen: 11 • Slaughtering ruminant animals, pigs, horses or poultry: 43 • Dairy processing of milk/colostrum: 14 • Exporting from New Zealand live cattle, sheep or pigs: 12

[40] Under the Climate Change (General Exemptions) Order 2009 the slaughter of ruminant animals, pigs, horses, or poultry is exempt except for the slaughter for human consumption of the following animals: cattle (other than calves and vealers), sheep, deer, goats, pigs, or poultry.
[41] Under the Climate Change (General Exemptions) Order 2009, exemptions apply to dairy processing of milk or colostrum from goats or sheep, and dairy processing for which the person is not required to have a risk management programme registered under the Animal Products Act 1999.

Table 3: Activities for which entities may be a voluntary participant in the NZ ETS

Sector	**Activity**	**Point of obligation**	**Number of participants** (as of 30 June 2016)[42]
Forestry	Owning post-1989 forest land. Holding a registered forestry right or being the leaseholder under a registered lease of post-1989 forest land. Being party to a Crown conservation contract.	• Owner of forest land • Holder of a forestry right or lease with the agreement of the landowner	• Owning post-1989 forest land: 2,012 • Holder post-1989 forestry right: 90 • Holder post-1989 forestry lease: 13
Liquid fossil fuels	Purchasing obligation fuel from one or more mandatory participants, where the volume of fuel exceeds: 10 million litres for obligation jet fuel 35 million litres for other obligation fuels	• User of any obligation fuel	• Purchasing obligation jet fuel: 5
Stationary energy	Purchasing more than 250,000 tonnes of coal per year from one or more mandatory participants. Purchasing more than two petajoules of natural gas per year from one or more mandatory participants.	• User of coal or natural gas	• Purchasing natural gas: 3 • Purchasing coal: 3
Synthetic gases	Exporting HFCs or PFCs, including those contained in goods, where the exportation results in at least one tonne of removals from New Zealand's inventory in a year. Destroying HFCs and PFCs, where the destruction results in at least one tonne of removals from New Zealand's inventory in a year.	Point of export or destruction	• Exporting HFCs or PFCs: 9

[42] Source: (Environmental Protection Authority 2016).

Sector	Activity	Point of obligation	Number of participants (as of 30 June 2016)[43]
Other removal activities	Producing a product that contains a substance: a. That i. Is permanently embedded in the product; or ii. Is temporarily embedded in the product, and the product is exported with the substance embedded; and b. That would result in emissions if not embedded; and c. Where: i. A person is required to surrender units under the Act in respect of the emissions that would result if the substance was not embedded ii. If the result of the substance being embedded results in removals from New Zealand's annual inventory of at least 5000 tonnes for methanol or 300 tonnes for LPG Storing of carbon after capture, where: a. A person is required to surrender units under the Act in respect of the emissions that would result if the CO_2 was not capture and stored; and b. The result of the CO_2 being captured and stored is a reduction from emissions reported in New Zealand's annual inventory	• Producer	• Producer of product with embedded substances: 1

[43] Source: (Environmental Protection Authority 2016).

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