

Synthetic Greenhouse Gases and the Emissions Trading Scheme

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Executive Summary

The government has developed legislation enabling the introduction of an emissions trading scheme (ETS) for New Zealand. The legislation currently provides for the entry of emissions of hydrofluorocarbon (HFC) and perfluorocarbon (PFC)^a gases as part of the industrial processes sector on 1 January 2010. Details on that entry, including estimation methodologies, will be part of regulations yet to be drafted.

HFCs are used in a wide range of equipment and products in the refrigeration/air conditioning, aerosols, fire protection and foam-blowing sectors (in decreasing level of significance). The most common HFCs have 100-year GWPs^b between 650 and 3800. HFC emissions accounted for 742,000 tonnes CO₂-equivalent in 2005 (1.0% of New Zealand's gross greenhouse gas emissions).

Assessment of options for points of obligation

The proposed emissions trading legislation currently obliges those undertaking the bulk importation of HFCs to surrender an equivalent number of emission units from 2010 at the end of each reporting period. Bulk importation is a simple proxy for potential emissions (assuming that all HFCs crossing the border will one day be emitted). It fails to account for some important elements:

- the importation of equipment pre-charged with HFCs (estimated at 281 tonnes or 46% of potential HFC emissions in 2006)
- the competitiveness impacts on domestic refrigeration and air conditioning manufacturers that compete with pre-charged equipment
- the proportion of potential emissions that are re-exported in manufactured equipment.

For the New Zealand greenhouse gas inventory, a combination of methods has been developed over the years to estimate emissions from different HFC applications, some based on IPCC default leakage rates and equipment lifetimes and others based on New Zealand-specific data.

For imported or manufactured aerosol cans (or inhalers), this approach means that all HFC propellants are assumed to be emitted within two years from the year of import. At the other extreme, foam insulation and fire protection products are assumed to have very long lives with relatively low annual leakage rates. In between these extremes are the various refrigeration and air conditioning (AC) applications with a range of assumed equipment lifetimes, e.g. 50% of household refrigerators/freezers have been assumed to be retired after 20 years (compared with 100% for commercial self-contained refrigerators/freezers). The original, full HFC charge is assumed to be emitted on retirement of a household refrigerator while for retired commercial equipment, a portion of the original HFC is assumed to be collected for recycling or destruction.

^a Nearly all New Zealand PFC emissions are sourced from smelting aluminium. PFC-218 is a component of two rarely used refrigerants that has been assessed to be a minor source of emissions. In general, where HFCs are referred to, the discussion will equally apply to PFC-218 and any other PFC uses that may be developed in future.

^b Global warming potentials (kilograms of CO₂ equivalent warming to 1 kg of refrigerant over 100 years).

Table B at the end of this summary outlines the ETS design issues around points of obligation that maximise coverage while minimising compliance costs and equity concerns.

The following options for points of obligation are assessed in detail:

1. Upstream border point of obligation: bulk chemical importers are the only points of obligation for simplicity with relatively simple exemptions for four significant exporters of HFC-containing equipment. The lack of ETS coverage of imported equipment containing HFCs would have a major impact on the competitiveness of four New Zealand manufacturers. There would also be no price signals to encourage refrigerant changes in imported equipment. As well as 100% of refilling HFC (replacing leakage), about 19% of HFC in new equipment (mainly commercial refrigeration/AC) would be covered by the ETS in 2010.
2. Upstream border point of obligation + limited equipment exemptions: the same chemical importers as (1) with exemptions for new self-contained equipment filled in New Zealand (not just exports) that faces competition from imports. Competitiveness impacts would be overcome with relatively low compliance costs but there would be no price signals for imported equipment. About 15% of HFC in new equipment would be covered by the ETS in 2010.
3. Widespread border obligation: the same chemical importers as (1) plus up to about 100 equipment importers for an annual 1000 tonnes CO₂ equivalent threshold (or up to perhaps 600 for 100 tonnes). Competitiveness impacts would be overcome and there would be price signals for imported equipment but with high compliance costs. As well as 100% of refilling HFC, more than 99% of HFC in new equipment (at the lower threshold, including mobile AC) would be covered by the ETS in 2010.

The following options for points of obligation have been rejected because of their limited benefits and/or relatively high compliance costs:

4. Upstream sales point of obligation: the same chemical importers as (1) except applying the point of obligation on sales rather than imports may provide less incentive for avoidance behaviour (extra stocks of HFCs before 2010) for somewhat higher compliance costs. Otherwise the same impacts as (1).
2. Upstream border point of obligation + exemptions for all equipment: the same chemical importers as (1) with exemptions for all equipment (self-contained and remote systems) filled in New Zealand. Competitiveness impacts would be overcome with very high compliance costs (due to complexity and lack of verifiability) and there would be no price signals for imported equipment.
3. Upstream border point of obligation + equipment exemptions based on projected collection for destruction: the same chemical importers as (1) with exemptions for all equipment (self-contained and remote systems) filled in New Zealand based on a range of negotiated emission factors related to projected collection for destruction. This could provide good recovery incentives and competitiveness impacts would be overcome but with very high compliance costs (due to complexity and lack of verifiability) and there would be no price signals for imported equipment.

ETS impacts on HFC prices

A price-based policy measure such as the ETS will have major impacts on HFC prices, as illustrated in Table A. The projected price increases do not include mark-ups by chemical importers or the costs of market participation.

Table A: HFC basic price increases from projected emissions prices

	GWP*	Present cost (\$/kg)	At \$15/tCO ₂ (\$/kg)	At \$30/tCO ₂ (\$/kg)	At \$50/tCO ₂ (\$/kg)
HFC-134a	1300	\$12	\$20	\$39	\$65
HFC-227ea	2900		\$44	\$87	\$145
R404A mixture	3260	\$15	\$49	\$98	\$163
R410A mixture	1720	\$17	\$26	\$52	\$86
HFC-245fa / HFC-365mfc [#]	920		\$14	\$28	\$46

* IPCC 1996 Revised Guidelines 100-year global warming potentials (kilograms of CO₂ equivalent to 1 kg of refrigerant).

IPCC Third Assessment Report 2001 GWPs are assumed for a 50:50 mixture.

For comparison one chemical importer provided a range of current wholesale prices (excluding GST) for relatively small refrigerant purchases (10–20 kg): \$12/kg for HFC-134a, \$15/kg for R404A and \$17/kg for R410A. So for a \$30 per tonne CO₂ market price, the prices for the three common refrigerants would increase by factors of at least three to seven times the current wholesale prices.

Many users of HFCs will simply absorb the price increases because refrigerant (or propellant) costs are a relatively small proportion of total equipment operating costs. Other users will have significant cost increases that may impact on their competitiveness and/or encourage a shift to alternative refrigerants or technologies where these are available. To minimise these cost increases, it will be important to design the ETS in a way that addresses competitiveness and equity concerns with low compliance costs.

The impacts of the three main options are discussed below for each sector.

Stationary refrigeration and air conditioning equipment

Emissions from this sector totalled 133 tonnes of HFCs in 2006 and there will be major growth in future emissions with the accelerating retirement rate of equipment containing HFCs. For the national greenhouse gas inventory, the HFC imports, exports and bank^c for this sector were broken down into seven sub-sectors. The bank estimates for 2006 are presented to indicate their relative significance for future emissions:

- household refrigerators and freezers and dehumidifiers: 196 tonnes (low uncertainty)

^c The HFC bank is the term used for the accumulated chemical held in imported and New Zealand manufactured equipment minus exports, leakage and equipment retirement (treating any recycling or destruction separately).

- self-contained refrigerated equipment used in the retail food and beverage industry: 58 tonnes (medium to high uncertainty)
- remote cabinet systems as used in supermarkets and some other food retailers: 148 tonnes (low to medium uncertainty)
- household and commercial air conditioners 176 tonnes (low to medium uncertainty)
- transport refrigeration systems: 45 tonnes (medium uncertainty)
- dairy farm refrigeration systems: 113 tonnes (medium to high uncertainty)
- other refrigeration (mainly industrial and commercial coolstores): 171 tonnes (very high uncertainty).

Bulk importers, local equipment manufacturers and others would have major concerns about equity and competitiveness if HFCs in imported equipment were not covered by the ETS. It would be relatively easy to overcome the competitiveness concerns for the four major manufacturers affected, but to overcome equity concerns the compliance costs of widespread equipment importer points of obligation would be high.

A number of the larger equipment importers have current mandatory appliance efficiency reporting requirements so extra compliance costs to include refrigerants would be minimal (to achieve an auditable standard). However, there is a large range of other equipment importers (numbering up to 100) that would face significant reporting costs as well as market participation costs that all would experience. Some form of HFC import licensing may be required.

The main impact of ETS price increases (assuming competitiveness concerns are addressed) is likely to be increased investment in improving commercial refrigeration and AC leakage reduction (including refrigerated transport and coolstores). There will perhaps be a shift to CO₂ systems for new supermarket installations and to ammonia systems in new large coolstores.

There exists the potential for the perverse outcome that until HCFCs (hydrochlorofluorocarbons that have ozone depleting and global warming properties) are phased out by 2015, some of them would be cheaper alternatives to HFCs covered by the ETS. This would appear to be a strong possibility in the coolstore sector, meaning that the lives of ageing, inefficient equipment are likely to be extended to avoid the costly HFC alternative.

Mobile air conditioning

It is estimated that 148 tonnes of HFC were emitted from the New Zealand MAC sector in 2006, about one quarter from vehicle retirements. As the HFC MAC fleet ages, emissions are expected to accelerate as more of this fleet retires and releases a higher proportion of the approximately 1600 tonnes HFC contained in vehicles.

Importers of motor vehicles (most having HFC MAC systems) could be made points of obligation at the Customs border to be consistent with a decision to cover imported equipment HFC in the ETS. The advantage of inclusion is that the ETS would then apply consistently across all HFC equipment imports.

The overwhelming disadvantage would be the compulsory market participation for at least 50 and up to about 500^d new and used vehicle importers for no clear benefit. ETS inclusion would not drive a MAC technology change and refrigerant recycling would already be incentivised by the ETS coverage of bulk HFC used for servicing.

Aerosols and metered dose inhalers

About 37 tonnes of HFC were emitted from about 4 million metered dose inhalers in 2006 with a further 17 tonnes HFC emitted from using other specialised aerosols in New Zealand.

If a decision was made to implement the ETS with widespread points of obligation covering imported equipment containing HFC, it would be important in terms of equity and emissions coverage to include the aerosols sector. While compulsory market participation would be required for very few importers to cover the major source (metered dose inhalers) there may be a larger number of importers of other aerosols (possibly 10 in total for a 100 tonnes CO₂ equivalent threshold).

The impact of ETS pricing on a New Zealand manufacturer of aerosol cans would be major if its exports were not exempted. The price increase on the average can would be of the order of 50% so the company's competitiveness against imports would need to be preserved. The basic price impact on inhalers would be smaller – of the order of 10%.

Fire protection

This sector is a very small source of HFC emissions because there are such low discharge and leakage rates. It would be relatively easy to include in the ETS (if imported equipment is covered) with just one or two import points of obligation.

However, apart from ETS consistency with other sectors and within the sector, there are no clear benefits when there is such a low leakage rate. The HFC price is already high enough to ensure that recycling is maximised.

If ETS pricing includes imported equipment, there may be no new HFC installations. If the ETS point of obligation is only on bulk supply, there may be little change in the costs of current systems because of the low leakage rate.

Foam

Rigid foams blown with HFC or HCFC have superior insulating and foam formulation properties to alternative blowing agents but are more expensive to produce. A HFC mixture is being used by at least three companies but the high price (three to five times higher than the HCFC) makes it uneconomic for most purposes.

^d A very approximate estimate is that 500 vehicle importers would import 100 cars or 60 trucks for a threshold of 100 tonnes of CO₂ equivalent (or 50 for a 1000 tonnes threshold).

Three tonnes of HFC were used in 2006 and total emissions were 0.4 tonne but there could be major emissions growth as the main HCFC is due to be phased out in New Zealand by 2015.

Importers of products containing HFC foam (like refrigerators) could be made points of obligation to be consistent with equipment refrigerant points of obligation. It is difficult to see sufficient benefits to justify the administrative complexity of calculating the liability for a large range of products.

HCFC is well suited to foam-blowing and it is likely to be used for as long as possible until the 2015 phase-out. Consequently the ETS impact on the foam industry could be major in the medium term since there are few practical alternatives to HFCs once HCFCs are phased out.

Recycling and destruction

A relatively low proportion of used refrigerants is collected for recycling or destruction in New Zealand compared with Australia. An increasing proportion of the collected refrigerants is HFC for which no recovery levy has been paid. The Recovery Trust and chemical importers are keen to engage with the Ministry for the Environment on the issue of HFC levies on both imported bulk chemicals and equipment.

An incentive scheme could be designed as an effective means of encouraging recycling or collection for destruction. ETS participation by the Recovery Trust would be an inefficient means because market participation costs might be too high to justify the relatively low level of credits granted for exporting for destruction.

Conclusions

In conclusion, assuming that re-exported chemical in equipment is not counted and an import threshold is applied of say 1000 tonnes of CO₂ equivalent, the competitiveness impacts identified in this report from a border obligation on HFC chemical importers would be on four major companies. (There might be a few extra companies for a 100 tonnes threshold.) A widespread border obligation on all equipment imports would remove any competitiveness concerns for relatively high compliance costs while limited exemptions on locally manufactured equipment would achieve the same result for relatively low compliance costs. Instead of limited exemptions, these manufacturers could be given free ETS allocations to protect their competitiveness but there would be extra compliance costs from market participation.

In the transition to 2010, there will be an important role for the Ministry for the Environment, and for industry associations, in capacity building to facilitate participation in the ETS. It is recommended that improved knowledge of potential participants would be required before ETS coverage could be considered for the self-contained commercial refrigeration, refrigerated transport and mobile air conditioning sectors (in particular).

Table B: Options for points of obligation

	Upstream border obligation	Upstream border obligation + limited equipment exemptions	Widespread border obligation
Participant numbers (2006)	11 (>1000 tonnes CO ₂ equivalent) or 12–14 (>100 t CO ₂ -e)	Same	Same for chemical importers plus: an estimated ^o 50?? Mobile Air Conditioning and 50? others (>1000 t CO ₂ -e), or 500?? + 100? (>100 t CO ₂ -e).
Coverage of 2010 emissions	100% of refilling (replacing leakage) + about 19% of new equipment.	100% of refilling + about 15% of new equipment.	100% of refilling + >90% of new equipment (>1000 t CO ₂ -e) or >99% of new equipment (>100 t CO ₂ -e).
Compliance costs	Reporting costs likely to be minimal for chemical importers. Minimal extra costs in providing accurate records for exempting exports of four major manufacturers. Market participation would add significant costs.	Same with minimal extra costs in providing accurate records for exempting exports and New Zealand sales by four major manufacturers.	Same for chemical importers. Market participation would add significant costs for all. Extra reporting costs for large importers of equipment likely to be minimal if already reporting appliance efficiency. Significant extra costs in reporting accurate records for smaller commercial refrigeration/air-conditioning (AC), refrigerated transport, mobile AC and aerosols importers.
Economic impacts	Main impacts likely to be investment in commercial leakage reduction and perhaps a shift to new supermarket CO ₂ systems and ammonia in new large coolstores. Some foam industry impacts could be major as few alternatives once HCFCs phased out. Reduced competitiveness for locally manufactured refrigeration and air-conditioning equipment sold in New Zealand.	Same but no reduced competitiveness for locally manufactured equipment sold in New Zealand.	Same except costs of market participation will be passed to purchasers of bulk HFC and of HFC equipment and no reduced competitiveness for locally manufactured equipment sold in New Zealand. Additional main impacts likely to be reduced sales of relatively low priced aerosol cans and air-conditioning units.
Equity issues	Major concerns about equity and competitiveness if imported equipment not covered. Perhaps some avoidance behaviour by equipment importers. Small chemical importers may find ETS participation too costly and leave HFC importing to larger suppliers leading to a reduction in competition.	Same but no equity issue about imported equipment being exempted if also limited exemptions for New Zealand manufactured equipment.	Same but equity and competitiveness and avoidance concerns removed by covering imported equipment. Some would argue a portion of equipment HFC should be exempted based on projected collection for destruction on retirement.
Advantages	Simplicity and minimising compliance and verification costs. Relatively easy to exempt exports of four major manufacturers. Some future retirement emissions covered.	Relatively easy to exempt exports and New Zealand sales of four major manufacturers. No competitiveness issues over imported equipment.	Equity and competitiveness and avoidance concerns removed by covering imported equipment. Future retirement emissions covered for all equipment purchased from 2010.

^o Figures denoted with ‘?’ should be considered speculative and ‘??’ highly speculative

	Upstream border obligation	Upstream border obligation + limited equipment exemptions	Widespread border obligation
Disadvantages	<p>Inconsistent for ETS to cover some future potential rather than all actual emissions.</p> <p>Bulk importers and manufacturers would have major concerns about equity and competitiveness for locally manufactured refrigeration and air-conditioning equipment if imported equipment not covered. Also potential avoidance behaviour by equipment importers.</p> <p>Small importers may find ETS participation too costly and leave HFC importing to larger suppliers leading to a reduction in competition.</p>	<p>Bulk importers would still have major concerns about equity and avoidance if imported equipment not covered.</p> <p>Limited coverage of future retirement emissions.</p>	<p>Significant extra costs in reporting accurate records and market participation for smaller commercial refrigeration/air-conditioning, refrigerated transport, mobile AC and aerosols importers in particular.</p>

1 Introduction

The government has developed legislation enabling the introduction of an emissions trading scheme (ETS) for New Zealand. The scheme is expected to cover all greenhouse gases and all sectors over time. The legislation currently provides for the entry of emissions of hydrofluorocarbon (HFC) and perfluorocarbon (PFC) gases as part of the industrial processes sector on 1 January 2010. Details on that entry, including estimation methodologies, will be part of regulations yet to be drafted.

Emissions of the synthetic greenhouse gases (SGGs) – HFCs, PFCs and sulphur hexafluoride (SF₆) – have fundamental differences from other emissions associated with industry and industrial processes. The sources are very disparate and typically small with long lag times between gas utilisation and eventual emission – particularly for HFC refrigerants and for SF₆.

Although SF₆ emissions have been assessed as relatively low at about 550 kg in New Zealand in 2006¹ (CRL Energy 2007), its 100-year global warming potential (GWP) is extremely high (1 kg is equivalent to 23,900 kg CO₂ emissions for inventory purposes). Most SF₆ emissions are being managed and reported under existing Memorandums of Understanding (MOUs) with the major emitters. Many minor emitters and a few major emitters are not subject to any MOU. Officials acknowledge the need to encourage those major emitters to sign the MOU and to undertake reviews of the existing MOUs. This work should have some priority in the short term even though SF₆ emissions are proposed to be outside the ETS until 2013.

Nearly all of New Zealand's PFC emissions are sourced from anode effects while smelting aluminium. This makes ETS coverage relatively easy, as New Zealand Aluminium Smelters has good estimates of its emissions. PFC emissions decreased significantly during the 1990s as a result of process changes (12 tonnes assessed in 2006). PFC-218 is a component of two rarely used refrigerants that has been assessed to be a minor source of emissions (1.2 tonnes imported in 2006, none in 2005). In general, where HFCs are referred to, the discussion will equally apply to PFC-218 and any other PFC uses that may be developed in future.

Therefore HFC emissions are considered to be the most immediate areas of uncertainty where policy advice is needed with regard to implementing an ETS. HFCs are used in a wide range of equipment and products in the refrigeration/air conditioning, aerosols, fire protection and foam-blowing sectors (in decreasing level of significance). The most common HFCs have 100-year GWPs between 650 and 3800. HFC emissions accounted for 742,000 tonnes CO₂ equivalent in 2005 (1.0% of New Zealand's gross greenhouse gas emissions).

¹ Compared with approximately 42 tonnes held in electrical equipment. Other emission sources are assessed to be negligible at around 10 kg per year.

1.1 National inventory of HFC emissions

To consider the options for including HFCs (and other SGGs) in the ETS, it is instructive to consider how HFC emissions are calculated for the National Inventory of Greenhouse Gas Emissions. When there is very limited information on how HFCs are used in a country, the only available inventory method is to estimate potential emissions from the sum of HFCs imported into the country as bulk chemicals or contained in equipment minus any exports or destruction (CRL Energy 2007). In effect this simple approach assumes that all HFCs are emitted in their year of import and it ignores the different periods the HFCs are held in stock or contained in various equipment types before emission.

IPCC (2001) states that this approach is not recommended and instead it is good practice to gather information that allows actual emissions to be estimated. For the New Zealand inventory, a combination of methods has been developed over the years to estimate emissions from different HFC applications, some based on IPCC default leakage rates and equipment lifetimes and others based on New Zealand specific data.

For imported or manufactured aerosol cans (or inhalers), this approach means that all HFC propellants are assumed to be emitted within two years from the year of import. At the other extreme, foam insulation and fire protection products are assumed to have very long lives with relatively low annual leakage rates (4.5% and 1.5% respectively).

In between these extremes are the various refrigeration and air conditioning applications with a range of assumed equipment lifetimes, e.g. on the basis of a New Zealand survey, household refrigerators and freezers have been assumed to have longer average lifetimes than in other developed countries so that only 25% are assumed to be retired after 15 years and 50% after 20 years (compared with 50% and 100% for commercial self-contained refrigerators and freezers respectively). The original, full HFC charge is assumed to be emitted on retirement of a household refrigerator (even though a small quantity is collected for destruction). For retired commercial equipment, a portion of the original HFC is assumed to be collected for recycling or destruction (CRL Energy 2007).

Calculations for the refrigeration and air conditioning applications are based on a simple approximation that HFC emissions arise only from retirements and from systems that are maintained with top-up refrigerant. This top-down approach avoids the difficulty of estimating the wide range of leakage rates for different equipment (IPCC 2001). The consequence of this approach is that the HFC refrigerant bank² for each application is generally an over-estimate because it assumes leakage only occurs for equipment that has refrigerant topped up during maintenance.

² The HFC bank is the term used for the accumulated chemical held in imported and New Zealand manufactured equipment minus exports, leakage and equipment retirement (treating any recycling or destruction separately).

1.2 ETS proposal for coverage of HFC emissions

The proposed emissions trading legislation currently obliges those undertaking the bulk importation of SGGs to surrender an equivalent number of emission units from 2010 at the end of each reporting period. Bulk importation is a simple proxy for potential emissions. It fails to account for some important elements:

- the importation of equipment pre-charged with HFCs (estimated at 281 tonnes or 46% of potential HFC emissions in 2006)
- the competitiveness impacts on domestic refrigeration and air conditioning manufacturers that compete with pre-charged equipment
- the proportion of potential emissions that are re-exported in manufactured equipment.

It is important to consider the options to deal with each of these issues.

1.3 Purpose and structure of this report

The purpose of this report is to:

1. summarise the current bulk HFC/PFC imports and the chemical importers (including recent changes) and the likely impact of the ETS on their businesses noting intra-sectoral equity issues where they arise, and the completeness of coverage of domestic emissions from this approach
2. summarise 2006 bulk and pre-charged imports and emissions broken down into the following sectors: aerosols (including metered dose inhalers), foam blowing, solvents, fire protection, refrigeration (household, commercial self-contained cabinets, supermarkets, transport, dairy farming, industrial coolstores) and air conditioning (household, commercial and vehicle)
3. give detailed consideration to the practicality (costs and benefits) of applying points of obligation at various points in the supply chain and likely ETS impacts on different stakeholders within each of these sectors and sub-sectors with respect to their significance, the phase-out of HCFC alternatives, and the required accuracy (and consequent compliance costs) of sales and import records for audit purposes
4. develop very approximate imports and emissions projections for 2015 for the business as usual case, an upstream obligation case (chemical importers only) and a widespread obligation case for a projected CO₂ price
5. detail the chain of ownership of chemicals that are imported then re-exported such that emissions do not occur in New Zealand and discuss whether it is possible (in terms of accuracy) to exclude such chemicals from an upstream (importer) obligation
6. summarise in a table format the various options for points of obligation in each sector, including listing benefits, economic impacts, records accuracy for auditing, compliance costs for participants, equity issues, incentives for destruction, adoption of new technologies and alternatives.

The format of the report is first a section discussing implications for bulk chemical importers and then sections discussing each of the user sectors (in decreasing order of significance) under the following sub-sections:

- Stakeholders and potential points of obligation
- Export implications
- Compliance costs
- Potential for alternatives
- Price impacts
- Uncertainties

The final summary section identifies the range of risks, costs and benefits of ETS coverage of HFC and PFC emissions.

As a very approximate indicator of potential ETS impacts, an HFC imports and emissions model has been developed for each user sub-sector. The model has been used to estimate the impacts of the upstream obligation and widespread obligation cases compared with the business as usual (BAU) case in 2015 for a \$30 per tonne CO₂ price (in 2008 dollars). Many of these projections are highly speculative.

An important aspect of the BAU case is that it is assumed that awareness and actions on greenhouse gas emissions mitigation continue to grow, even though there is no ETS coverage in this case. One refrigeration/air conditioning installer with extensive industry experience (Bowen 2008) believes that refrigerant prices or efficiency improvements will not be the major driver in shifting supermarket chains away from HFCs to say CO₂ refrigerant. Rather it will be the corporate decisions to reduce 'carbon footprints' as public awareness and calls for action grow.

2 Bulk Chemical Importers

Summary

A bulk chemical importer point of obligation at the Customs border has the great advantage of simplicity because it would minimise the number of compulsory market participants (while ensuring the price signal is passed on to users) and compliance returns could readily be verified.

It would be reasonable and relatively easy to exclude any HFC that is exported as bulk chemical or in products. There would be a major impact on competitiveness of four manufacturers, in particular if their exports of equipment containing HFCs were included in the ETS coverage.

ETS coverage of imported HFCs will have a major price impact because of their high Global Warming Potentials. For a \$30 per tonne CO₂ market price, the prices for the three common refrigerants would increase by factors of three to seven times the current wholesale prices (plus any mark-ups and the significant costs of market participation).

Bulk importers, local equipment manufacturers and others would have major concerns about equity and competitiveness if HFCs in imported equipment were not covered by the ETS. It would be relatively easy to overcome the competitiveness concerns for the four major manufacturers affected, but to overcome equity concerns the compliance costs of widespread equipment importer points of obligation would be relatively high.

In the transition to 2010, there will be an important role for the Ministry for the Environment and industry associations in capacity building to facilitate participation in the ETS.

This section considers the options for the bulk chemical importers who would be the key points of obligation in an ETS. Stakeholders, export implications, compliance costs, price impacts and uncertainties are discussed but potential for alternatives is not relevant because it is associated with user sectors and is discussed in the appropriate sections.

2.1 Stakeholders and potential points of obligation

The seven most significant importers and distributors of HFCs/PFCs in 2006³ were:

- Polychem Marketing Ltd
- Patton Refrigeration
- Heatcraft NZ Ltd
- Refrigeration Engineering

³ Danfoss NZ Ltd's refrigerant business went to Heatcraft January 2006. Rhodia NZ Ltd's refrigerant business went to Dupont September 2005.

- Orica Chemnet
- Ilys Ltd (trading as Cooling Supplies)
- BOC Gases.

Dupont operates from Australia and imports relatively small quantities of specialised refrigerants into New Zealand on a cost insurance freight basis, meaning that the suppliers receiving these refrigerants should be reporting them for inventory purposes.

Some mobile air conditioning (MAC) suppliers have sometimes imported containers (~10 tonnes net) of HFC-134a jugs that are mainly sold to MAC servicers. In 2005/06, Carrier Ltd (through its Totaline parts division) and Repco Ltd each imported a container.

Temperzone Ltd imports its own refrigerants for manufacturing its range of air-conditioning units. The amounts of R407C and R410A have been relatively small over the period 2002–2006 for which records have been provided. However, during 2007 the company stated that it has rapidly shifted away from R22 (HCFC) and expects to use up to 50 tonnes of HFC in 2008.

Pacific Urethanes Ltd stated it was importing annually 1 to 3 tonnes of the high-cost HFC-245fa/365mfc mixture for co-foam-blowing with HCFC-141b. In 2006, as well as its own use, it supplied the HFC to at least two other companies. Three other foam-blowing chemical suppliers (Huntsman, NZ Urethanes, Polymer Developments) had imported small amounts of HFC-245fa/365mfc for customer trials but found little demand because of the high price.

There are two potential points of obligation for the bulk chemical suppliers: at the Customs border or at the point of sale to customers. The advantage of the border point is simplicity and the ability to check compliance returns against Customs records while the disadvantage is that suppliers may import large quantities before January 2010 to avoid the obligation.

A sales point of obligation on the bulk chemical importer (and not on wholesalers) would remove any incentive for a supplier to import large quantities before January 2010 although users would still have this incentive. A possible advantage is that HFC users may be less likely than suppliers to carry the costs of holding large quantities. The disadvantage of a sales point of obligation would be the increased complexity resulting from sales between importers and other chemical importers. Currently, there are major difficulties in eliminating double counting for inventory purposes from such sales. Chemical importers would ensure they held records to prove an obligation had already been met by the importer they purchased from. For this reason and because of stock change differences between import and sales records, these records would be more difficult to verify than for a border point of obligation.

With either a simple border or sales point of obligation on bulk chemical importers, if the ETS had applied in 2006, it would have covered 100% of 336 tonnes calculated HFC emissions together with about 31% of the 265 tonnes chemical contained in new equipment.

With either a border or sales point of obligation, there is an argument that the chemical installed in new equipment should be exempted until it is released at the end of its life (or alternatively a portion exempted based on projected recovery for recycling or destruction). The advantages would be that the ETS is more directly linked to actual rather than potential emissions and incentives would be created for recycling or collection for destruction of the HFC in the retired equipment. The overwhelming disadvantages would be the administrative complexity of calculating the exemptions for a large range of products and verifying equipment sales. Because it would be impractical to monitor all equipment retirement and to require points of obligation on retirement emissions, ETS coverage would be reduced.

Ivan Tottle of Polychem is chair of the Importers and Wholesalers Group (IWG), a committee of the Refrigeration and Air Conditioning Companies Association (RACCA). He said that a key issue for the IWG is the need to have the government use Customs import declarations as a means of regulating HFC and HCFC chemicals, so that imported equipment chemicals and bulk chemicals are treated in a similar way (Tottle 2008). As well as ETS coverage, this is relevant for levies to fund collection and destruction (covered in Section 9).

In terms of the ETS, he has a personal view that it is inappropriate to charge all imported bulk HFCs at the border because then the ETS would not reflect actual emissions (allowing for the delays before equipment retirement) and this could be a disincentive to maximising recovery for destruction. He would prefer to make HFC release illegal and reinforce previous government and industry efforts (No Loss Campaign) with better systems to achieve greater recovery rates.⁴

However, given the practical options being considered for the ETS, he stated it would be easier to have a border than a sales point of obligation because there would be fewer participants and fewer transactions to be reported. When asked about the transition to the ETS, he said it was inevitable that chemical importers or users respectively would accumulate stock – a sales option would simply shift the accumulation point. He added that he would be surprised if anyone would carry more than 3–6 months stock because of the extra costs of holding it. He could see the possibility of a chemical importer profiteering by holding stock before 2010 and then selling it in 2010 at market rates with the equivalent of the emissions obligation included in the price. Based on his experience of the NZ market, he said he did not think the ETS participation would knock any of the main chemical importers out of the business but it might discourage small importers who have imported HFCs on a sporadic basis (Tottle 2008).

Ivan Tottle said the IWG would consider the inclusion of HFCs in all imported equipment as a critical part of the ETS. Even though there are wrong Customs declarations (both accidental and deliberate), he believes at least 80% of the classifications would be correct and they could be used as a basis for making equipment importers ETS points of obligation. As well as all types of refrigeration and air-conditioning equipment, vehicles with MAC should all be included. While individuals importing vehicles could be excluded, companies importing 10–20 vehicles must be included or it would penalise the importer of 50 vehicles. Similarly, if supermarket chains or small companies imported cheap air-conditioning units, they must be included or the large stakeholders would be penalised – for fairness the small ones should not be exempted (“often the price increase would be less than the profit margin”). He could not estimate the likely number of consequent ETS participants but considered the application of any threshold would result in “the large importers getting penalised and the small ones getting away with it” (Tottle 2008).

He believed it would be worth exploring options for exempting a portion of say the refrigerant based on an estimate of the likely recovery at the end of the equipment life. He dismissed the option of exempting all HFC held in equipment as unrealistic.

In summary, CRL Energy concludes a bulk chemical importer point of obligation at the Customs border has the great advantage of simplicity because it would minimise the number of compulsory market participants (while ensuring the price signal is passed on to users) and compliance returns could readily be verified.

⁴ He believes with good education and better systems in place, the industry could achieve an overall emissions rate of only around 3% of total imports (compared with 58% currently).

2.2 Export implications

For equity reasons, it would be reasonable to exclude from the point of obligation any HFC that is exported as bulk chemical or in products. This would be consistent with the inventory methodology and would avoid the potential for the chemical becoming an additional point of obligation (or taxation) in the country the HFC is exported to.

Two of the chemical importers have reported export sales of bulk HFCs mainly to South Pacific nations in some years (around 3 tonnes annually from 2004 to 2006). The importers could be required to hold the documentation to demonstrate that such sales need not be included in their annual return.

Similarly, if a customer was to export significant HFC amounts in its products, the importer could be required to hold the documentation to demonstrate that such sales need not be included in their annual return. Therefore the importer would not charge the customer for the permits for that exported chemical it would otherwise have to reconcile around March the following year.

There is a commercial sensitivity issue that arises from such a system for the four HFC users that export significant amounts in their products. One of these companies would not be concerned at all about providing its supplier with such documentation because that supplier could already calculate its exports quite easily. However, another company representative expressed concern that its export sales were highly commercially sensitive and the supplier could have links to a competing manufacturer. He said such a concern might lead to the company importing its own HFC (as Temperzone does). This could also be a potential barrier to competition if an exempted manufacturer wants to change supplier but is concerned about confidential sales data held by the previous supplier. A chemical importer representative (Tottle 2008) considered his company had a system that would sufficiently ensure the confidentiality of customer information.

Another potential concern is that the exporter would be limited to dealing with chemical importers and not wholesalers but this is currently irrelevant because all four companies are supplied by chemical importers (or import their own HFC).

An alternative that has the advantage of avoiding the confidentiality issue would be for such chemical importers and customers to pay the emissions price on exported chemical and the manufacturer could be rebated the equivalent amount by the government as part of the free allocation scheme. However, this option has the major disadvantages of increased compliance costs for officials and for the company having to enter the market to sell its permits. It could be provided as an ETS opt-in alternative that would leave the cost-benefit assessment in the hands of the manufacturers.

2.3 Compliance costs

A representative of Polychem (one of the largest importers) stated that additional compliance costs to participate in the ETS were likely to be negligible because the information for its annual return (including any exports) would readily be obtained from the company's imports or sales records (Tottle 2008). He may be underestimating the attention that will be required to match permit purchases with imports, even though from the EU experience, there are likely to be several permit brokers offering their services.

In summary, it is concluded that importers will inevitably be required to become ETS participants. Auditable record keeping for the annual return is likely to add minimal costs to current imports or sales records. In the transition to 2010, there will be an important role for the Ministry for the Environment and industry associations in capacity building to facilitate participation in the ETS. Market participation would add significant costs if considerable management time is spent on optimising permit purchase prices – each company will evaluate the costs and benefits of such an approach compared with utilising brokers.

It is conceivable that small companies (even though they are familiar with handling HCFC licences) may find ETS participation too costly and leave the HFC importing to larger suppliers leading to a reduction in competition.

2.4 Price impacts

A price-based policy measure such as the ETS will have major impacts on HFC prices, as illustrated in Table 1 for projected emissions prices ranging from NZ\$15 to \$50 per tonne of CO₂ equivalent. The calculations are based on 100-year global warming potentials used for national greenhouse gas inventories developed by IPCC for the 1996 Revised Guidelines (rather than subsequent revisions). The projected price increases do not include ‘pass-through’ factors such as mark-ups by chemical importers or the costs of market participation.

Table 1: HFC basic price increases from projected emissions prices

	GWP*	\$15/tCO ₂ \$/kg	\$30/tCO ₂ \$/kg	\$50/tCO ₂ \$/kg
HFC-134a	1300	\$20	\$39	\$65
HFC-227ea	2900	\$44	\$87	\$145
R403B	2730	\$41	\$82	\$137
R404A	3260	\$49	\$98	\$163
R407C	1530	\$23	\$46	\$76
R408A	1940	\$29	\$58	\$97
R410A	1720	\$26	\$52	\$86
R413A	1770	\$27	\$53	\$89
R417A	1940	\$29	\$58	\$97
R507A	3300	\$50	\$99	\$165
HFC-245fa / HFC-365mfc [#]	920	\$14	\$28	\$46

* IPCC 1996 Revised Guidelines.

IPCC Third Assessment Report 2001 GWPs are assumed for a 50:50 mixture.

A Polychem representative provided for comparison a range of current wholesale prices (ex GST) for relatively small refrigerant purchases (10–20kg): \$12/kg for R134A, \$15/kg for R404A or R507A and \$17/kg for R410A. Large purchasers would expect to pay 20–30% less (Tottle 2008). So for a \$30 per tonne CO₂ market price, the prices for the three common refrigerants would increase by factors of three to seven times the current wholesale prices (plus the significant costs of market participation).

When asked what medium-term impact he expected the ETS pricing would have, he responded that the focus would shift onto reduced leakage and improved installers/servicers performance. Supermarkets and other refrigerant users would still have to purchase the HFCs. He would have to talk to industry experts before he could identify any realistic alternatives to HFCs.

Chemical importers are keen to engage with the Ministry for the Environment on the related issue of HFC levies (on both imported bulk chemicals and equipment) for recovering used refrigerants for destruction (see Section 9 below).

CRL Energy concludes that the economic impacts on bulk importers would not be major: mainly reduced business as HFC usage decreases in the medium term (perhaps replaced by alternatives). The costs of market participation would be passed on to customers. If HFC imports contained in equipment were not covered by the ETS, bulk importers would have major concerns about equity. There might be some avoidance behaviour by equipment importers: many 'pre-charged' units are currently imported with a refrigerant container for installation so there might be a shift to importing 'spare' containers or ones that are much larger than necessary for installation.

2.5 Uncertainties

Chemical importers' records of HFC imports and sales are likely to be extremely accurate and readily verified by comparison with Customs records. It is presumed that officials responsible for ETS compliance would be given access to Customs records for auditing purposes. It would also be desirable for the Ministry for the Environment to have access to these Customs records in compiling the national greenhouse gas inventory (as has happened in some years). This would greatly improve the level of accuracy for these key quantities and reduce the time taken by the chemical importers and officials to compile the information for inventory surveys. There are systems in place to ensure commercial sensitivity is respected.

Currently there are four manufacturers exporting significant amounts of HFC in their products. Three already maintain accurate records for reporting exports to Australia so it is likely there will be minimal extra compliance costs in providing accurate records for exemptions from the point of obligation in New Zealand.

3 Stationary Refrigeration and Air Conditioning Equipment

Summary

If a high priority is placed on equitable ETS treatment of bulk chemical HFCs and the large amount of HFCs contained in imported equipment, widespread points of obligation would require compulsory market participation for about 100 importers in this sector (in addition to chemical importers and assuming a low annual threshold for total HFC imports).

A number of the larger equipment importers have current mandatory appliance efficiency reporting requirements, so extra compliance costs to include refrigerants would be minimal (to achieve an auditable standard). However, there is a large range of other equipment importers that would face significant reporting costs as well as the market participation costs that all would experience. Some form of HFC import licensing may be required.

Recommendations are made on the self-contained commercial refrigeration and refrigerated transport sub-sectors (in particular) where much improved knowledge of potential participants would be required before ETS coverage could be considered.

The main impact of ETS price increases (assuming competitiveness concerns are addressed) is likely to be increased investment in improving commercial refrigeration and air-conditioning leakage reduction (including refrigerated transport and coolstores). There will perhaps be a shift to CO₂ systems for new supermarket installations and to ammonia systems in new large coolstores.

There exists the potential for the perverse outcome that until the 2015 phase-out, some HCFCs (that have ozone depleting and global warming properties) would be cheaper alternatives to HFCs covered by the ETS. This would appear to be a strong possibility in the coolstore sector, meaning that the lives of ageing, inefficient equipment are likely to be extended to avoid the costly HFC alternative.

For the national greenhouse gas inventory, the HFC imports, exports and bank⁵ for this sector were broken down into seven sub-sectors. The bank estimates for 2006 are presented to indicate their relative significance for future emissions:

- Household refrigerators and freezers and dehumidifiers: 196 tonnes (low uncertainty)
- Self-contained refrigerated equipment used in the retail food and beverage industry: 58 tonnes (medium to high uncertainty)
- Remote cabinet systems as used in supermarkets and some other food retailers: 148 tonnes (low to medium uncertainty)
- Household and commercial air conditioners: 176 tonnes (low to medium uncertainty)
- Transport refrigeration systems: 45 tonnes (medium uncertainty)

⁵ There is insufficient information to accurately estimate the accumulated HFC bank for each sub-sector but these approximate figures serve to indicate relative significance.

- Dairy farm refrigeration systems: 113 tonnes (medium to high uncertainty)
- Other refrigeration (mainly industrial and commercial coolstores): 171 tonnes (very high uncertainty).

Mobile air conditioning (MAC) is discussed separately in a later section of this report.

3.1 Stakeholders and potential points of obligation

Widespread points of obligation covering imported equipment containing HFC would require compulsory market participation for a large number of importers in this sector (assuming a low annual threshold for total HFC imports). Up to 20 household and possibly 50 commercial refrigerator/ freezer importers and about 30 household and commercial air-conditioning equipment importers (and an uncertain number of refrigerated transport importers) could be involved, although many of these may be relatively insignificant. Estimates have been made below of the number of potential participants in each sector if a significance threshold was applied of 1000 tonnes CO₂ equivalent (0.3 to 0.8 tonne HFC depending on the HFC mix) or alternatively 100 tonnes. .

The estimates in this section are based on EECA's MEPS lists of appliance importers and manufacturers (as compiled in January 2006). Some of the 2006 list no longer import these products and responses to CRL Energy's equipment surveys were far from complete (CRL Energy 2007). EECA would have a more accurate view of current importers and their relative significance in terms of sales volumes, although this information is highly commercially sensitive. Recommendations are made on particular sub-sectors where much improved knowledge of potential participants would be required before ETS coverage could be considered.

Household refrigerators / freezers / dehumidifiers

The number of appliance importers in this sector is up to 20 and refrigerant charges (average less than 0.2 kg) are much lower than for air-conditioning units. Consequently, only about seven importers might be included if say a 1000 tonnes CO₂ equivalent total annual import HFC threshold was applied (perhaps 10–15 for a 100 tonne threshold).

Self-contained refrigerated equipment

Self-contained retail refrigerators and freezers are charged at the time of manufacture and have very low leak rates. Based on a sample of loosely defined Customs categories, this is a sector covering a vast range of equipment including all frozen food display cases, reach-in refrigerators and freezers, beverage merchandisers and vending machines and large retail display cases that include a self-contained refrigeration unit. There are also various classifications of water coolers, ice cream, 'soft serve' and 'slush' machines, bar fridges, blood bank and laboratory fridges/freezers, ice makers, blast chillers, milk coolers, ice cream freezers and small cool boxes. Statistics New Zealand's import figures for imported commercial cabinets are unfortunately not as detailed as for the household sector, with just a simple breakdown to refrigerator and freezer units (often no distinction between small water coolers and large chiller units).

On the positive side, Skope is the largest New Zealand manufacturer of commercial cooler and freezer cabinets (75% exported to Australia) and the company provided very detailed data on unit sizes, sales and refrigerant amounts for the inventory (CRL Energy 2007). EECA made available sales information for the range of unit types and sizes gathered from its MEPS survey (with brand names removed). An industry expert in this sector (Miller 2008) was also very helpful in providing an assessment of the whole New Zealand market, including large numbers of commercial refrigeration units not included in EECA's MEPS survey.

Overall there were considerable difficulties in deciding how to deal with contradictory data for this sub-sector and an estimate of 50 potential points of obligation is highly speculative. Miller estimated that about 20 companies imported the vast majority of commercial units. Inventory calculations for these companies suggest that nearly all would fall within a 100 tonnes CO₂-equivalent annual import HFC threshold but none would reach a 1000 tonnes threshold.

Remote cabinet systems

Since these systems are all charged in New Zealand with imported bulk chemical, the HFCs would be covered by the ETS.

Household and commercial air conditioners

Industry sources (including Bowen 2008 and Murphy 2007) stated that as well as all household air-conditioning units, almost all commercial equipment is imported pre-charged with refrigerant. The combination of increasing single-phase unit sales and the rapid shift from R22 to R410A are the reasons for the estimate of a near doubling (from 2005) of imported air-conditioning equipment HFC to 94 tonnes in 2006. The air-conditioning importers generally indicated the switch to HFC had only happened significantly during 2004 and 2005.

Refrigerant charge amounts are much greater for air-conditioning than for refrigeration units: 0.75 kg for up to 4 kW cooling capacity, 1.5 kg for 4-8 kW, 2.0 kg for 8-12 kW and 2 to 12 kg for commercial three-phase units ranging up to 65 kW.

These factors, together with the shorter average lifetime for air-conditioning equipment, mean that within a few years HFC emissions from this sub-sector may become the dominant emissions source within the refrigeration and air-conditioning sector.

EECA's list of air-conditioning importers (minus smaller ones no longer importing) totals about 30 companies, including three companies labelled 'manufacturers'. An accurate estimate of the total HFC imports for each company could only be made if there was access to detailed EECA data. There is a group of about seven major importers that probably account for more than 75% of total imported units. Given that a total of 94 tonnes HFC in air-conditioning imports has been estimated in 2006, a high proportion of the 30 companies may be included for a 100 tonnes CO₂-equivalent annual HFC threshold (and perhaps more than 10 for a 1000 tonnes threshold).

Ivan Tottle pointed out that air-conditioning installers would also be concerned if HFC held in imported equipment were not be covered by the ETS. Currently New Zealand-manufactured equipment is considered of higher efficiency than many imported brands. If only the New Zealand-manufactured equipment is subjected to the ETS pricing, it could lead to reduced

efficiency air-conditioning units being used – as well as the reduced competitiveness for local manufacturers (Tottle 2008).

Transport refrigeration systems

Thermo King and Transcold are the two companies that import pre-charged refrigeration units that are fitted to trailer units and self-powered (or ‘cab-over’) trucks. The consensus estimates were that there are now about 900 and 1000 respectively of these pre-charged units in New Zealand, with about 100 new units of each imported annually. In addition, there are approximately 2500 ‘off-engine’ (or ‘direct-drive’) vans and trucks that are very difficult to estimate because no statistics are kept on the range of imported used Japanese vehicles (CRL Energy 2007). Two hundred of these units were assumed to be imported annually, probably by a wide range of vehicle importers.

Refrigerant charge sizes of 10 kg, 6 kg and 2.5 kg respectively were estimated for these three different-sized units. A range of HFC phase-in rates were assumed for the different units. The conclusion was that 2 tonnes of HFC was imported in these units in 2006, adding up to an estimated bank of 18 tonnes. This suggests that currently fewer than 10 refrigerated truck importers may be included for a 100-tonnes CO₂-equivalent annual HFC threshold (and perhaps none for a 1000-tonne threshold).

Hall’s Refrigerated Transport advised that it had taken over 20–30 older refrigerated rail units and four larger units from Toll Rail. In the absence of better information, it was concluded that the quantity of HFC would be negligible compared with the refrigerated truck fleet.

Royal Wolf Trading was able to provide an overview of 5000–6000 three-phase refrigerated containers and 2000–3000 single-phase units owned and leased in New Zealand (rather than owned by overseas shipping companies). These are all pre-charged and contain respectively 5–6 kg and 3 kg refrigerant (some HFC and some HCFC). Five hundred and 50 three-phase and 250 single-phase units were assumed imported per year and it was concluded that 3.5 tonnes of HFC was imported in these units in 2006 adding up to an estimated bank of 27 tonnes (CRL Energy 2007). This suggests that currently fewer than 10 refrigerated container importers may be included for a 100 tonnes CO₂ equivalent annual HFC threshold (and perhaps only one for a 1000 tonne threshold).

The relative significance of the refrigerated shipping industry is not known – apparently this issue was considered to be too difficult to include in the Montreal Protocol (Roke 2008).

Dairy farm refrigeration systems

Since these systems are all charged in New Zealand with imported bulk chemical, the HFC would be covered by the ETS.

Other refrigeration (mainly industrial and commercial coolstores)

Since these systems are all charged in New Zealand with imported bulk chemical, the HFC would be covered by the ETS.

3.2 Export implications

There are major equity and competitiveness issues to be addressed for three large New Zealand manufacturers (and perhaps some smaller ones) that export high proportions of their products. Fisher & Paykel (household refrigerators/freezers), Skope (commercial self-contained refrigerators/freezers) and Temperzone (commercial air-conditioning units) would all face unacceptable losses of competitiveness if their exported HFC was not exempted from the ETS. Exemption would be consistent with the inventory methodology and would avoid the potential for the HFC becoming an additional point of obligation in the country the equipment is exported to.

McAlpine Hussman Ltd also indicated it exported small amounts of HFC in commercial refrigeration equipment in 2005. On checking with a manager at their Tauranga manufacturing plant (Prestidge 2008), it was established that the number of units being exported to Australia and the South Pacific is a relatively small proportion of the company's sales and around 95% are empty remote cabinets. The annual total of exported HFC is likely to be well below a 100 tonnes CO₂-equivalent annual HFC threshold.

There has been no comprehensive study to discover if there are any other relatively small exporters of equipment containing HFC.

The issues regarding a relatively simple exemption mechanism, compliance costs and commercial sensitivity were addressed in the Bulk Chemical Importers section 2.2 above.

3.3 Compliance costs

This section considers the likely compliance costs for the large range of equipment importers in this sector that would result from widespread points of obligation covering imported equipment containing HFC. (The minimal compliance costs for exports exemption were covered in Section 2.2.)

Some equipment importers were contacted by telephone and asked how much work would be required to comply with the auditable annual reporting that would be associated with widespread points of obligation (stressing that this is a possibility for discussion that is not currently proposed in the legislation).

Electrolux (one of the largest household refrigerator importers) considered that MEPS reporting for EECA was not onerous although the spreadsheet format could be improved (Webster 2008). The company supported the MEPS scheme as a means of improving efficiency, although there are concerns that EECA does not undertake sufficient monitoring to ensure that cheap inefficient brands are removed from the marketplace. The representative believed that adding

refrigerant amounts to the current MEPS reporting system would result in minimal additional compliance costs.

The Skope representative believed the reporting would be much easier now than a few years ago because all their systems are in place for reporting exports to Australia to comply with their refrigerant legislation (King 2008). He notes that in 2006/07, there were 695 Australian licences for importing refrigeration and air-conditioning equipment containing an HCFC or HFC refrigerant charge and he considers it would not be a huge administrative task to include similar companies in the ETS for the smaller New Zealand economy.

Fujitsu (one of the main air-conditioning equipment importers) considers any additional reporting to be onerous but HFC reporting would not add major compliance costs to the current MEPS requirements (Freeman 2008). The representative said she had to merge a couple of different reports to generate information for the inventory HFC survey. If there were more regular reporting, they would amend their financial reporting system to include the HFCs.

Panasonic (another of the main air-conditioning equipment importers) also did not see any difficulty in extending MEPS reporting to include refrigerants (Day 2008). The company has had issues with insufficient EECA checks of cheap, low-efficiency imports that are being sold through TradeMe, home shows and even car yards.

Advance (a smaller air-conditioning equipment importer) considered that MEPS reporting is “not a huge chore” (Pilbrow 2008). Extending this to include calculations for refrigerant types and amounts would not be difficult for the range of models for most importers. The added cost would not be an important issue as long as there was “a level playing field”.

Temperzone considered that for equity reasons, all imported equipment should be subject to the same charges as equipment manufactured in New Zealand (Curran 2008). It was important that competitors that manufacture in Asian countries face the same costs that Temperzone will face. The company would have no extra costs from the compliance reporting.

Fisher & Paykel expressed similar views stating that “our biggest concern is that both imports and exports of high-GWP refrigerants in finished products as well as in bulk must be counted” (Roke 2008).

Arrow Refrigeration (a major commercial refrigeration importer and installer) stated some contrary views because the company finds the MEPS reporting process “painful” (Miller 2008). The annual MEPS returns require “heaps of calculations” that take a great deal of management time (too complex for administrative staff). The company has written to EECA suggesting that instead of re-entering data collated the year before, it would be much easier if most of the information could be carried over from the initial registration and simply adding the new sales numbers. Refrigerant quantities could be included relatively easily compared with the range of information EECA requires. The process would only involve MEPS equipment but there are numerous categories of MEPS-exempt commercial refrigeration units. He very helpfully provided estimates of the unit numbers, refrigerant types and amounts for the inventory (CRL Energy 2007). However, the exercise demonstrated that it would not be simple for the range of MEPS-exempt equipment importers.

In conclusion, almost all respondents to this brief survey indicated that it would be relatively easy to extend current MEPS reporting (for year ending March) to include refrigerant amounts. None could give a specific estimate of the amount of additional time it would require and none indicated any understanding of what market participation would mean. However, the sample is biased towards larger importers who have well established reporting systems. Particular note

should be taken of Arrow's response pointing out the difficulties in the self-contained commercial refrigeration sub-sector, especially for units not subject to MEPS reporting. There are several importers in this diverse sub-sector and in the unregulated refrigerated transport sub-sector.

It is recommended that a more detailed study of the self-contained commercial refrigeration and refrigerated transport sub-sectors is undertaken to obtain a better understanding of the number of participants and potential compliance costs resulting from widespread points of obligation.

3.4 Potential for alternatives

A report from the International Institute of Refrigeration (2007) describes 'cutting edge' R&D in a number of refrigeration and air-conditioning applications. Stirling cycle refrigeration and non-vapour-compression technologies (magnetic refrigeration,⁶ solar refrigeration, desiccant technology, thermoacoustic refrigeration, thermoelectric cooling, large-scale absorption based air-conditioning) could be of interest in the long term but R&D regarding natural refrigerants (ammonia, CO₂, hydrocarbons) is being actively pursued. Ammonia could gain ground in medium-capacity refrigeration applications but doubts were expressed whether ammonia can secure a significant share of the air-conditioning market given the safety risks. Potential applications of CO₂ were described as numerous, but noted the important obstacle of the construction costs of equipment suitable for the high pressures involved when CO₂ is used.

The Australian Greenhouse Office commissioned a survey (ICF Consulting 2003) of over 30 refrigeration and air-conditioning manufacturers, distributors and experts on "most promising options for reducing greenhouse gas emissions in 2020". CO₂ systems were expected to achieve 20–50% market penetration by 2020 in the cold storage sector and 10–20% in the retail food sector. Hydrocarbons were expected to achieve >50% market penetration by 2020 in the household refrigeration and MAC sectors, 20–50% in the retail food and refrigerated transport sectors. Secondary loop systems⁷ use HFCs and/or natural refrigerants and were expected to achieve 20–50% market penetration by 2020 in the retail food and cold storage sectors but less than 10% in the commercial air-conditioning sector.

According to local experts in the refrigeration and air-conditioning industry (Bowen 2008, Cleland 2008), use of alternative HFCs or technologies in almost all sectors will be driven by international developments rather than New Zealand prices (usually a low proportion of installed costs). Apart from an increased focus on maintenance to minimise leakage (very high in refrigerated transport and some supermarkets and coolstores), the ETS pricing will drive a shift in some sub-sectors where alternatives are currently economically viable. Long equipment lives mean that shifts will mainly be in new installations, e.g. supermarkets and coolstores.

⁶ Magnetocaloric materials heat up when they are positioned in a magnetic field and cool down to a lower temperature than their initial temperature when this field is removed. For many years, these materials operated only at extremely low temperatures but some new materials capable of operating at room temperatures, with more powerful permanent magnets, have emerged over the past few years.

⁷ Secondary loop technologies can use a wide variety of fluids in the primary loops and secondary loops (e.g. ice slurry, water, organic and non-organic salts, alcohols, and others). The survey focused on SLS using HFCs and ammonia as primary refrigerants and ice slurry as a secondary refrigerant. Information is provided on a promising new SLS technology, which uses a mixture of propylene and distilled water as the secondary refrigerant.

There might be some conversion to lower-GWP alternative HFCs or HCFCs but there are not many 'drop-in' alternatives that do not require major system changes. There exists the potential for the perverse outcome that until the 2015 phase-out, some HCFCs (that have ozone depleting and global warming properties) would be cheaper alternatives to HFCs covered by the ETS. This would appear to be a strong possibility in the coolstore sector (still dominated by R22), meaning that the lives of ageing, inefficient equipment are likely to be extended to avoid the costly HFC alternative (Cleland 2008).

Hydrocarbons are used in a few (mainly European) imported household refrigerators. They could also be used as alternative refrigerants for many new dairy farm systems given their relative isolation in relation to the flammability issue (Cleland 2008).

Recycling is an alternative that is covered in Section 9 below.

3.5 Price impacts

The impact of a \$30 per tonne CO₂ price on average refrigerant prices will be substantial and should lead to some major changes in this sector in the long term. It would be equivalent to a basic price increase (before mark-ups) of \$39/kg for R134A, \$52/kg for R410A and \$98/kg for R404A (compared with respective wholesale prices from Section 2.4 of \$12/kg, \$17/kg and \$15/kg).

In the opinions of some installers, even \$100/kg extra on R404A will have only a slow shifting effect on the majority of supermarket systems. Once technical problems are better sorted out, most new ones and replacements after 15-year lifetimes may be CO₂ but this will only represent about 20% of the total by 2015. Price and efficiency will not be the main driver compared with corporate policies to reduce 'carbon footprints' as public awareness grows (Bowen 2008, Oliver 2008).

In the self-contained cabinets and household refrigerators sectors (if importers are obliged to purchase permits), the cost increase will be almost negligible. This would probably mean a negligible shift in import refrigerant types for these sectors by 2015, unless the likes of Coca Cola etc make international corporate decisions to shift away from HFCs (to perhaps CO₂) (Bowen 2008, Cleland 2008, King 2008).

Household air-conditioning importers believe the higher prices will have a significant impact on their sector (because the refrigerant amount is so much higher at around 1 kg) but they can not see what the alternative technology will be. A commercial air-conditioning installer (Bowen 2008) sees the refrigerant price as a much lower proportion of total installation costs and so much less likely to be a major driver. Alternatives appear to be much less likely by 2015 and very dependent on international developments (more so than supermarket refrigeration).

Some installers (Bowen 2008, Oliver 2008) and a chemical importer (Tottle 2008) consider the main impact of ETS price increases is likely to be increased investment in improving commercial refrigeration and air-conditioning leakage reduction (including high leakage rates for refrigerated transport and some industrial coolstores). There will perhaps be a shift to CO₂ systems for new supermarket installations and ones that are refurbished after average 15-year lifetimes. Ammonia systems will become more attractive in new large industrial coolstores but there are no obvious alternatives for small to medium coolstores or for dairy refrigeration.

Bulk importers, manufacturers and others (Cleland 2008) would have major concerns about equity and competitiveness and reduced energy efficiency if imported equipment is not covered by the ETS. Temperzone considered that for equity reasons, all imported equipment should be subject to the same charges as equipment manufactured in New Zealand (Curran 2008). It was considered very important for its competitiveness that competitors that manufacture in Asian countries should face the same costs. An additional point made by a chemical importer (Tottle 2008) is that commercial air-conditioning installers would be concerned that the higher cost for New Zealand-manufactured air-conditioning units may mean that lower efficiency imported units will be chosen by customers on cost grounds alone.

Fisher & Paykel and Skope have made similar arguments that loss of competitiveness compared with imported equipment would have major impacts on their businesses that could result in transferring production overseas (Roke 2008, King 2008).

A widespread border obligation on all equipment imports would remove any competitiveness concerns for relatively high compliance costs while limited exemptions on locally manufactured equipment would achieve the same result for relatively low compliance costs. Instead of limited exemptions, these manufacturers could be given free ETS allocations to protect their competitiveness with the extra compliance costs from market participation.

In summary, the main impact of ETS price increases (assuming competitiveness concerns are addressed) is likely to be increased investment in improving commercial refrigeration and air-conditioning leakage reduction (including refrigerated transport and coolstores). There will perhaps be a shift to CO₂ systems for new supermarket installations and to ammonia systems in new large coolstores.

In terms of projected HFC usage and emissions, CRL Energy assesses that there may be surprisingly little impact from the ETS pricing by 2015 (assuming the equivalent for \$30 per tonne CO₂ in 2008 dollars). These projections are highly speculative. Based on the assumption that the business as usual (BAU) case will include major international technology developments and corporate decisions to reduce 'carbon footprints', these shifts will happen regardless of the ETS price level. Consequently, it is assessed that the ETS pricing will have negligible impact compared with BAU on HFC imports or emissions in the household or self-contained refrigeration or refrigerated transport sub-sectors.

The major price influence (assuming competitiveness concerns are addressed) is likely to be increased investment in preventing leakage and helping to drive supermarket chains away from HFCs to CO₂ refrigerant in up to 20% of installations by 2015. Because the lifetimes of these systems are about 15 years before total overhaul, the pricing impact on total emissions from this sector is likely to be less than 10% below BAU. Similarly, the shift for new coolstores (and dairy refrigeration systems) to ammonia and other alternatives will largely be driven by the HCFC phase-out and corporate environmental policies rather than ETS pricing, so the overall emissions impact from ETS pricing may be much less than 10% below BAU.

The ETS pricing may however influence the sales of the lower-priced brands of household air-conditioning units (because of the relatively large charge of refrigerant and shorter lifetimes). This might result in 10% fewer imports by 2015 than BAU (and consequent lower retirement emissions about 10 years after the ETS introduction).

3.6 Uncertainties

Uncertainties for compliance reporting for chemical importers (and for limited exemptions) would be relatively low compared with uncertainties about how to cover all significant equipment importers for widespread points of obligation.

Many equipment manufacturers and importers are currently required to report their sales for the EECA MEPS scheme. Their reporting is much more detailed than what would be required for ETS compliance with a widespread point of obligation, but it could be a good reporting basis (with refrigerant additions) for the majority of equipment that would be covered by such an ETS.

It was strongly emphasised in the inventory recommendations that staff of the Ministry of Economic Development or Ministry for the Environment should be given access to Customs information (as has happened in the past) in order to get the much more accurate import data for individual bulk chemical shipments (CRL Energy 2007).

For equipment containing HFCs, import records would be much less useful because of inadequate classifications in Customs records. Consideration would have to be given to some form of licensing to import HFCs. This licensing would carry with it an obligation to report import levels accurately together with average refrigerant charge calculations for comparison with the threshold. This would require guidelines to be developed with default refrigerant charges – so that equipment importers would know early on how likely they were to cross the threshold and be required to purchase ETS units.

The big uncertainties for future projections will be the big unknowns in the inventory – the hugely significant coolstores (where it will become more cost-effective to shift larger ones to ammonia), dairy farms and refrigerated transport.

4 Mobile Air-Conditioning

Summary

It is estimated that 148 tonnes of HFC were emitted from the New Zealand Mobile air-conditioning (MAC) sector in 2006, including about one quarter from vehicle retirements. As the HFC MAC fleet ages, emissions are expected to accelerate as more of this fleet retires and releases a higher proportion of the approximately 1600 tonnes HFC contained in vehicles.

Importers of motor vehicles (most having HFC MAC systems) could be made points of obligation at the Customs border to be consistent with a decision to cover imported equipment HFC in the ETS. The advantage of inclusion is that the ETS would then apply consistently across all HFC equipment imports.

The overwhelming disadvantage would be the compulsory market participation for at least 50 and up to about 500 new and used vehicle importers for no clear benefit. ETS inclusion would not drive a MAC technology change and refrigerant recycling will already be incentivised by the ETS coverage of bulk HFC used for servicing.

The automotive industry has used HFC-134a as the refrigerant for mobile air conditioning (MAC) in new vehicles since 1994. HFC-134a is imported into New Zealand for use in the MAC industry through bulk chemical importers and within the air-conditioning systems of imported vehicles. The last car assembly plant operating in New Zealand closed in 1998 and the last truck assembly plant closed shortly after.

The conclusion of the top-down inventory study (CRL Energy 2007) was that 148 tonnes of HFC were emitted from the New Zealand MAC sector in 2006, 27% from vehicle retirements. This retirement proportion is growing rapidly as the HFC MAC fleet ages and the refrigerant HFC bank had grown to an estimated 1600 tonnes by the end of 2006. The top-down methodology accounts for only the servicing refills and does not attempt to estimate the leakage rates so actual annual emissions are likely to be under-estimated. Over a 20-year period, there would be little difference between accumulated actual emissions and assessed emissions – because leakage will instead be assessed in the assumption that retirements are equivalent to emitting the full initial charge.

This section does not consider refrigerated transport, which is included in the Stationary Refrigeration sub-sector.

4.1 Stakeholders and potential points of obligation

Importers of motor vehicles (most having HFC MAC systems) could be made points of obligation at the Customs border to be consistent with a decision to cover imported equipment HFC in the ETS. The advantage of inclusion is that the ETS would then apply consistently across all HFC equipment imports. The overwhelming disadvantage would be the compulsory inclusion of a large number of new and used vehicle importers as ETS participants for no clear

benefit. ETS inclusion would not drive a MAC technology change and refrigerant recycling will already be incentivised by the ETS coverage of bulk HFC used for servicing.

4.2 Export Implications

The number of exported vehicles containing HFC in MAC systems is likely to be insignificant. However, if ETS coverage of vehicle MAC is to be seriously considered, there should be a study of the impacts on any small niche manufacturers, e.g. coachbuilders.

4.3 Compliance costs

Default refrigerant charge amounts could easily be developed in relation to vehicle size with sufficient accuracy to minimise ETS reporting requirements. Importers could provide documentation for actual charge amounts for popular models.

Air-conditioning systems were retrofitted (with ‘aftermarket’ units) to new trucks and buses and to used cars. MAC installers confirmed in 2007 that the aftermarket installations peaked at about 1500 per year from 2000–2002 and had fallen away significantly by 2004 so coverage of these units would add minimal compliance costs.

4.4 Potential for alternatives

The Australian Greenhouse Office survey (ICF Consulting 2003) of several MAC manufacturers, distributors and experts on “most promising options for reducing greenhouse gas emissions in 2020” assessed that hydrocarbons were expected to achieve >50% market penetration by 2020 in the MAC sector.

The Motor Trade Association (MTA) has a committee of its MAC members whose key focus is on the end-of-life disposal of MAC systems. An MTA representative (Frampton 2007) stated the EU may phase out HFC-134a in new MAC systems by 2012. CO₂-based MAC systems are starting to be introduced in some models. Hydrocarbon-based MAC systems could be developed but US litigation is seen as a major barrier because of the slight fire risk. Japanese vehicle manufacturers have acknowledged the need to address the issue.

The representative said the MTA and many MAC installers were keen to get MfE cooperation to re-invigorate the No Loss Campaign as a means of promoting improved MAC disposal practices. One of the members of the MTA committee said many MAC installers were concerned about the ‘cowboys’ in the industry who did not follow recommended practices (Rogers 2008). His company promoted refrigerant recycling and sells the equipment (~\$2000) for servicers to do this.

It is concluded that any actions taken by New Zealand will clearly not influence international vehicle manufacture developments. Refrigerant recycling will already be incentivised by the ETS coverage of bulk HFC used for servicing.

4.5 Price impacts

The impact of a \$30 per tonne CO₂ price on the average refrigerant charge (0.75 kg HFC-134a) in an imported car MAC system would be a \$30 basic price increase, clearly negligible on the price of a new vehicle even with various mark-ups. It would have a much greater proportional impact on low-value used vehicle imports if these were included in the ETS as points of obligation.

Whether or not vehicle importers are covered by the ETS, the bulk chemical HFC used for servicing MAC systems would be covered and subject to a basic price increase of the order of \$40 per kilogram. However, there is a large mark-up since the typical retail price (excluding GST) is \$40–\$50/kg (Rogers 2008) even though the wholesale price is about \$12/kg. The \$40/kg price increase will have a significant impact (and will depend on the further mark-up) but not as high a proportional impact as the quadrupling of the wholesale price. It would be a factor for some drivers deciding whether to have their MAC system serviced but many would not notice the increase compared with the servicing labour costs.

The price increase would create a much stronger incentive for MAC installers to recycle HFC where the servicing history of a vehicle is well known. One installer said the risk of recycling is that the quality of pooled refrigerant from 10 well-maintained vehicles could be ruined by adding low-quality refrigerant from a vehicle with a poor service record (Rogers 2008). Nevertheless, his company recycles approximately 0.5 tonne each year and he believes this practice will become more widespread with the ETS pricing.

He added that the price impact would have been significant on the retrofitting market when it was at its peak before 2003 because the cost was only about \$300. He confirmed there is no longer any retrofitting demand nor any supply of the parts required.

In summary, CRL Energy assesses that the widespread option for ETS pricing would have a negligible impact on MAC vehicle imports or HFC emissions by 2015 compared with BAU.

4.6 Uncertainties

The key sources of inventory uncertainty were the total quantity of HFC supplied to the MAC industry and the vehicle proportions fitted and retrofitted historically (building up the HFC bank). These would not be relevant to the accuracy of measurements required if MAC vehicle importers were made points of obligation.

Default refrigerant charge amounts could easily be developed in relation to vehicle size with sufficient accuracy to minimise ETS reporting requirements. Importers could provide documentation for actual charge amounts for popular models.

5 Aerosols and Metered Dose Inhalers

Summary

About 37 tonnes of HFC was emitted from about 4 million metered dose inhalers in 2006 with a further 17 tonnes HFC emitted from using other specialised aerosols in New Zealand.

If a decision was made to implement the ETS with widespread points of obligation covering imported equipment containing HFC, it would be important in terms of equity and emissions coverage to include the aerosols sector. While compulsory market participation would be required for very few importers to cover the major source (metered dose inhalers), there may be a larger number of importers of other aerosols.

The impact of ETS pricing on a New Zealand manufacturer of aerosol cans would be major if its exports were not exempted. The price increase on the average can would be of the order of 50% so the company's competitiveness against imports would need to be preserved. The basic price impact on inhalers would be smaller – of the order of 10%.

Around 25 million aerosol packages are sold in New Zealand each year. The majority of these are imported, with the balance being produced by at least four aerosol loading companies. HFC propellants are a high-priced alternative to hydrocarbons (approximately 200 times more expensive) and are therefore used in specialist applications. The applications which are most likely to require an HFC-based aerosol are those where low toxicity and flammability are required. Such applications include:

- metered dose inhalers
- aerosols used on aircraft (insecticides)
- aerosol products used in the underground mining industry
- dust-off agents used for computers, ATM machines, etc
- freeze spray products used to test electronic circuits
- solvent cleaning products used in the electronics industry.

Based on Pharmac's sales statistics, it was determined for the inventory survey that approximately 37 tonnes of HFC was emitted from about 4 million metered dose inhalers in 2006 (CRL Energy 2007).

It was concluded that a further 17 tonnes HFC (with a high uncertainty level) would have been emitted from using other specialised aerosols in New Zealand. It is not possible without access to Customs data to directly contact importers and obtain a more comprehensive estimate.

5.1 Stakeholders and potential points of obligation

If a decision was made to implement the ETS with widespread points of obligation covering imported equipment containing HFC, it would be important in terms of equity and emissions coverage to include the aerosols sector. While compulsory market participation would be required for very few importers to cover the major source (metered dose inhalers) there may be a large number of importers of other aerosols.

Glaxo Smith Kline indicated that it was responsible for about half of the metered dose inhalers so it would be reasonable to conclude that there would be only about three other suppliers to cover the vast majority of inhalers (Puckey 2008).

The number of importers of HFC aerosols is very poorly understood. One known importer would be included if an annual 1000 tonnes CO₂ equivalent annual HFC threshold was applied while another would not. There are likely to be very few that would meet such a threshold but Customs data may show there are significant amounts of specialised products that would need to be covered for consistency.

5.2 Export implications

Arandee is a New Zealand aerosol manufacturer that would suffer a major loss of competitiveness if its exported products were not exempted from the ETS price impacts (Greer 2008). The company has grown significantly in recent years by winning overseas contracts to fill insecticide aerosols for use in aircraft and electronic blower sprays. It claims that more than 90% of the cans are exported and the remainder should also be exempted because they are used on aircraft travelling internationally. It should be noted that these emissions are not exempted in the same way as CO₂ emissions from international bunker fuels. The national inventory accounts for emissions from aerosols approximately estimated to be used in New Zealand and subtracts the HFC in aerosols exported to other countries.

Arandee stated that it could easily provide its HFC supplier with auditable export information as a basis for ETS exemption and the company believes that the supplier would respect the commercial sensitivity. Some negotiation would be required on whether insecticide aerosols should be exempted if they are used in aircraft that started their journeys in New Zealand.

5.3 Compliance costs

Glaxo Smith Kline indicated that reporting the HFC content of its metered dose inhalers would not be difficult (Puckey 2008) and it is assumed this would be the same for other pharmaceutical suppliers. In contrast, aerosol importers are probably not used to compliance reporting and this may result in relatively high costs. Participation in the market to purchase permits would incur extra costs.

5.4 Potential for alternatives

Glaxo Smith Kline did not know of any alternative propellants for metered dose inhalers. Similarly, Arandee could not see any alternative propellant that would be suitable for aerosol use in aircraft.

5.5 Price impacts

The impact of a \$30 per tonne CO₂ price on the average inhaler propellant charge (15 g HFC-134a) would be a \$0.45 increase to an inhaler that Pharmac purchases for about \$4 (for Ventolin – other inhaler prices vary widely). For approximately four million inhalers, such increases would add up to a small but significant increase in Pharmac's bill for these essential products. However, a price increase of this level would be unlikely to result in reduced usage or a shift to a different propellant.

The impact of a \$30 per tonne CO₂ price on the average Arandee propellant charge (95 g HFC-134a) would be a \$3 price increase to a can that sells for \$6–\$7 (exclusive of GST). The company competes on the international market for its contracts (including for its local sales) so the impact could be quite severe.

In terms of projected HFC usage and emissions, CRL Energy assesses that there would be minimal impact on inhaler use from the ETS pricing by 2015 compared with BAU. However, imports of aerosol cans (with a much higher proportional price increase) could be reduced by up to 30% compared with BAU.

5.6 Uncertainties

Uncertainties associated with metered dose inhaler quantities would be minimal for any ETS reporting because of the dependence on Pharmac funding. Propellant amounts would need to be checked more rigorously from manufacturer information.

The Aerosol Association of Australia and New Zealand has stated that statistics on New Zealand aerosol manufacture and imports are very poor, leading to uncertain estimates of total usage and very uncertain estimates of the proportion containing HFC. It is recommended that if there is an intention to make aerosol importers points of obligation, a study of the range of importers should be made with access to Customs data.

6 Fire Protection

Summary

This sector is a very small source of HFC emissions because there are such low discharge and leakage rates. It would be relatively easy to include in the ETS (if imported equipment is covered) with just one or two import points of obligation.

However, apart from ETS consistency with other sectors and within the sector, there are no clear benefits when there is such a low leakage rate. The HFC price is already high enough to ensure that recycling is maximised.

The main supplier stated that ETS pricing would probably “kill the market” if it includes imported equipment, so there may be no new HFC installations. If the ETS point of obligation is only on bulk supply, there may be little change in the costs of current systems because of the low leakage rate.

HFCs are used as substitutes for halons in portable (streaming) and fixed (flooding) fire protection (fire suppression) equipment. Halons have traditionally been used in areas that contain high-value equipment and where risks to personal safety are high. These include computer rooms, data centres and on aircraft.

Within the New Zealand fire protection industry, the two main supply companies were identified as using relatively small amounts of HFC-227ea. The systems installed have very low leak rates with most emissions occurring during routine servicing and during accidental discharges.

For the inventory, a 1.5% leakage rate was assumed from an HFC bank of 28 tonnes resulting in emissions of just 0.4 tonnes in 2006 (CRL Energy 2007).

6.1 Stakeholders and potential points of obligation

Chubb is the main supplier and about 90% of its HFC imports are pre-charged in equipment (Boff 2008). The company also imports about 0.2 tonne of bulk HFC annually for servicing and accidental release. Tyco Wormald has been a minor supplier in earlier years but imported none in 2006. There are also some very minor suppliers of marine fire protection systems (some of which may purchase their HFC from bulk suppliers).

Clearly, this sector would be relatively easy to include in the ETS (if imported equipment is covered) with just one or two import points of obligation. However, apart from ETS consistency with other sectors and within the sector, there are no clear benefits when there is such a low leakage rate. The HFC price is already high enough to ensure that recycling is maximised.

6.2 Export implications

There appear to be no current export implications in this sector. Conceivably, ETS pricing could cause a shift away from current HFC systems and the reclaimed chemical could be exported.

6.3 Compliance costs

The two main suppliers already keep detailed records that would readily meet the audit requirements for an annual return.

6.4 Potential for alternatives

There are currently a couple of alternative fire protection systems that operate very differently from the HFC systems. Tyco Wormald markets Inergen and Chubb markets Argonite. Both are based on nitrogen/argon mixtures where the gas is relatively inexpensive while the hardware is very expensive, making the whole system more expensive than an HFC system currently with its high gas cost but low hardware cost. Chubb also referred to Novec, a very expensive fluorinated ketone that presumably has a low Global Warming Potential.

6.5 Price impacts

Chubb stated that if a \$30 per tonne CO₂ price translates to a price increase of \$87/kg HFC-227ea, “that will kill the market” (Boff 2008). The current gas price for bulk supply is \$43/kg and with good service records, any retired gas is readily reclaimed for stock.

Presumably, if the ETS point of obligation is only on bulk supply, there may be some shift in new installations away from HFC with little change in the costs of current systems because of the low leakage rate. If instead the ETS point of obligation includes imported equipment, there may be no new HFC installations. Either way, with a low leakage rate, the ETS pricing will have a negligible impact on emissions by 2015 compared with BAU.

If some minor marine system installers purchase HFC from bulk chemical importers, an equity issue may arise within the sector that might need further investigation.

6.6 Uncertainties

With the main suppliers keeping excellent records, there would be no uncertainty around coverage of these stakeholders. It is uncertain how many minor suppliers might be affected and how significant their sales are.

7 Foam

Summary

Rigid foams blown with HFC or HCFC have superior insulating and foam formulation properties to alternative blowing agents but are more expensive to produce. An HFC mixture is being used by at least three companies but the high price (3 to 5 times higher than the HCFC) makes it uneconomic for most purposes.

Three tonnes of HFC were used in 2006 and total emissions were 0.4 tonne but there could be major emissions growth as the main HCFC is due to be phased out in New Zealand by 2015.

Importers of products containing HFC foam (like refrigerators) could be made points of obligation to be consistent with equipment refrigerant points of obligation. It is difficult to see sufficient benefits to justify the administrative complexity of calculating the liability for a large range of products.

HCFC is well suited to foam-blowing and it is likely to be used for as long as possible until the 2015 phase-out. Consequently the ETS impact on the foam industry could be major in the medium term since there are few practical alternatives to HFCs once HCFCs are phased out.

Internationally, HFCs are increasingly used as replacements for CFCs and HCFCs in foam applications such as insulating, cushioning, and packaging. For open-cell foam, emissions of HFCs used as blowing agents are likely to occur during the manufacturing process. In closed-cell foam, emissions occur over a longer period (e.g. 20 years).

Rigid foams blown with HFC, HCFC or CFC have superior insulating and foam formulation properties to alternative blowing agents like water/CO₂ but are more expensive to produce. HCFC-141b is licensed because of its ozone depleting potential and is due to be phased out in New Zealand by 2015. A HFC-245fa / 365mfc mixture is being used by at least three companies but the high price (three to five times higher than HCFC-141b) makes it uneconomic for most purposes.

The inventory study concluded that 3 tonnes of HFC-245fa / 365mfc were used in 2006 and total emissions were 0.4 tonne (CRL Energy 2007).

7.1 Stakeholders and potential points of obligation

Pacific Urethanes was discussed in Bulk Chemical Importers Section 2.1 because it was importing annually 1 to 3 tonnes of the high-cost HFC-245fa / 365mfc mixture for co-foam-blowing with HCFC-141b. In 2006, as well as its own use, it supplied the HFC to at least two other companies. Three other foam-blowing chemical suppliers (Huntsman, NZ Urethanes, Polymer Developments) had imported small amounts of HFC-245fa / 365mfc for customer trials but found little demand because of the high price.

So currently there would probably be just one importer as a point of obligation because the other three companies might fall below even a 100 tonnes CO₂-equivalent annual HFC threshold. However, it is very difficult to predict how foam-blowers will cope with the transition away from HCFC in future.

It is possible that importers of products containing HFC foam (like refrigerators) could be made points of obligation to be consistent with equipment refrigerant points of obligation. It is difficult to see sufficient benefits to justify the administrative complexity of calculating the liability for a large range of products.

7.2 Export implications

Fisher & Paykel expressed a view that if the ETS is to reflect reality, it should recognise that closed cell foams would retain most of their HFC for around 20 years so there should be ETS rebates or exemptions for clear cases of long-term storage (Roke 2008). A similar argument was addressed in Section 2.1 and could be applied to products sold in New Zealand. While there would be an advantage of linking the ETS to actual emissions, the disadvantage would be the administrative complexity of calculating the exemptions for a large range of products.

However, as for all bulk chemicals, there should be provision for any exported bulk HFC to be exempted from ETS coverage for consistency.

7.3 Compliance costs

Pacific Urethanes commented that reporting costs would not be a problem (Blakeley 2008). No consideration had been given to the costs of market participation.

7.4 Potential for alternatives

Pacific Urethanes commented that large companies like Rheem might follow the example of those who have invested the large capital cost for using pentane (Blakeley 2008). For most companies, HFC-245fa / 365mfc is currently the only realistic alternative to HCFC-141b that meets the increasing insulation requirements for closed cell foams. Some concerns have been expressed about the flammability of the Ecomate alternative (CRL Energy 2007).

7.5 Price impacts

Pacific Urethanes has been experimenting with various HFC mixes for its customers. A 13% mix of HFC-245fa / 365mfc in the drum of polyol, isocyanate, catalyst and water increases the cost of the mix by \$1.50/kg compared with a HCFC-141b mix cost of \$6.50/kg.

There are no IPCC (1996) Global Warming Potentials for HFC-245fa / HFC-365mfc but if IPCC Third Assessment Report (2001) GWPs are assumed for a 50:50 mixture, the basic price increase from a \$30 per tonne CO₂ price would be \$28/kg. The current price of this HFC is \$20/kg compared with just \$3/kg for HCFC-141b. Therefore the relative increase from shifting from HCFC to HFC would be much greater than the approximate doubling of the HFC price from a \$30 per tonne CO₂ price.

This underlines the fact that HCFC-141b is well suited to foam-blowing and it is likely to be used for as long as possible until the 2015 phase-out. Consequently the ETS impact on the foam industry could be major in the medium term since there are few practical alternatives to HFCs once HCFCs are phased out (apart from hydrocarbons for large manufacturers). CRL Energy assesses that HFC emissions in 2015 could be more than 50% lower than BAU because of ETS pricing (depending on the alternatives available).

7.6 Uncertainties

For the inventory study, there was a poor level of understanding among foam-blowing companies of whether they were using HCFC or HFC blowing agents. It would be important to investigate this issue further before decisions could be made about the impacts of ETS coverage.

A key question that needs to be resolved is whether it is appropriate for foam-blowing HFCs to be covered by the ETS without agreed GWPs.

8 Solvents and Other HFC/PFC Applications

IPCC (2001) identifies a number of niche applications for which HFCs and PFCs may be used including electronics transfer, dielectric fluid and medical applications. One importer representative commented in a previous survey that they imported some specialised products containing PFCs in the past but these proved to be too expensive for the market. Recent inventory studies have found no other sources of HFC or PFC emissions from surveys and telephone contact with New Zealand chemical importers (CRL Energy 2007).

In particular, no evidence was found that HFCs or PFCs are used as solvents in New Zealand. None of the importers or distributors of HFCs and PFCs into New Zealand reported supplying bulk chemicals for solvent use. Also, none of the halocarbons normally used as solvents were imported into New Zealand in bulk. Because there has been a shift within the electronics industry towards no-clean fluxes there has been no need since at least 1999 to use a solvent cleaning process.

HFC or PFC solvents that have entered the country in pre-loaded aerosol containers are not accounted for separately in Customs data. It is therefore possible for very small quantities of solvent to be imported in these products.

There will be an ongoing need for both inventory purposes and for potential ETS coverage to check with chemical importers and sector experts whether new applications are found for HFCs and PFCs.

9 Recycling and Destruction

Summary

A relatively low proportion of used refrigerants is collected for recycling or destruction in New Zealand compared with Australia. An increasing proportion of the collected refrigerants is HFC for which no recovery levy has been paid. The Recovery Trust and chemical importers are keen to engage with the Ministry for the Environment on the issue of HFC levies on both imported bulk chemicals and equipment.

An incentive scheme could be designed as an effective means of encouraging recycling or collection for destruction. ETS participation by the Recovery Trust would be an inefficient means because market participation costs might be too high to justify the relatively low level of credits granted for exporting for destruction.

In 1993, a trust was formed with the objective to promote and facilitate the collection, storage and disposal of all ozone-depleting substances during the phasing-out period. The trust, now known as Recovery, also consults with environmental groups and reports regularly to the Minister for the Environment.

The Recovery programme is funded through a wholesale levy that is placed on every kilogram of imported ozone-depleting refrigerant. The process, which is provided at no charge to industry participants, includes the provision of secure transfer units and storage tanks to hold unwanted refrigerants. From accredited collection depots in Auckland, Wellington and Christchurch, the refrigerants are transferred to overseas destruction facilities.

An increasing proportion of the collected refrigerants is HFC for which no recovery levy has been paid (17% of 12 tonnes destroyed in 2006). The Trust and the Importers and Wholesalers Group (a RACCA committee) are keen to engage with the Ministry for the Environment on the issue of HFC levies (on both imported bulk chemicals and equipment) for recovering used refrigerants for destruction.

A member of the Trust board, Ivan Tottle (2008) stated it was very difficult to recycle HFCs (by a cleaning process) in New Zealand and they might need to be sent offshore. He considered it would be important to capture recycled HFCs in the ETS – the exemption of recycled HCFCs from licensing requirements created a perverse outcome for the environment.

Fisher & Paykel commented (Roke 2008) that Australian legislation provides a range of incentives that have resulted in a significantly higher proportion of refrigerants being collected for recycling or destruction in Australia than is the case in New Zealand. The company operates a number of appliance recycling centres throughout New Zealand that collect refrigerant from household refrigerators and freezers, but the quantity is a relatively small proportion of what could be collected. With the right incentives, it would become profitable for a range of companies to recover refrigerants rather than rely on corporate responsibility to absorb the collection costs.

Installers / servicers of remote refrigeration cabinets, commercial air-conditioning units, MAC units and fire protection systems have commented that recycling is practised when the servicing history is well known and there is little risk of contamination.

ETS participation by the Recovery Trust would be an inefficient means of encouraging HFC collection for destruction. Extra recording costs would be minimal but market participation costs might be too high to justify the relatively low level of credits granted for exporting for destruction. An incentive scheme could be designed as a more effective means of encouraging recycling or collection for destruction.

10 Summary

Applying the ETS to HFCs will have a major impact on the price of these chemicals (mainly refrigerants) in the various sectors. For a \$30 per tonne CO₂ market price, the prices for the three common refrigerants would increase by factors of three to seven times the current wholesale prices (plus any mark-ups and the significant costs of market participation).

Many users of HFCs will simply absorb the price increases because refrigerant (or propellant) costs are a relatively small proportion of total equipment operating costs. Other users will have significant cost increases that may impact on their competitiveness and/or encourage a shift to alternative refrigerants or technologies where these are available. To minimise these cost increases, it will be important to design the ETS in a way that addresses competitiveness and equity concerns with low compliance costs.

Table 2 summarises the ETS design issues around maximising coverage while minimising compliance costs and competitiveness / equity concerns.

The following options for points of obligation are assessed in detail:

1. Upstream border point of obligation: bulk chemical importers are the only points of obligation for simplicity with relatively simple exemptions for four significant exporters of HFC-containing equipment. There would be a negative impact on the competitiveness of four New Zealand manufacturers from imported equipment containing HFC not covered by the ETS. There would also be no price signals for imported equipment. As well as 100% of refilling HFC (replacing leakage), about 19% of HFC in new equipment (mainly commercial refrigeration / air-conditioning) would be covered by the ETS in 2010.
2. Upstream border point of obligation + limited equipment exemptions: the same chemical importers as (1) with exemptions for new self-contained equipment filled in New Zealand (not just exports) that faces competition from imports. Competitiveness impacts would be overcome with relatively low compliance costs but there would be no price signals for imported equipment. As well as 100% of refilling HFC, about 15% of HFC in new equipment would be covered by the ETS in 2010.
3. Widespread border obligation: the same chemical importers as (1) plus up to about 100 equipment importers for an annual 1000 tonnes CO₂ equivalent threshold (or up to perhaps 600 for 100 tonnes). Competitiveness impacts would be overcome and there would be price signals for imported equipment but with high compliance costs. As well as 100% of refilling HFC, more than 99% of HFC in new equipment (at the lower threshold, including Mobile air-conditioning) would be covered by the ETS in 2010.

The following options for points of obligation have been rejected because of their limited benefits and/or relatively high compliance costs:

4. Upstream sales point of obligation: the same chemical importers as (1) except applying the point of obligation on sales rather than imports may provide less incentive for avoidance behaviour (extra stocks of HFCs before 2010) for somewhat higher compliance costs. Otherwise the same impacts as (1).

5. Upstream border point of obligation + exemptions for all equipment: the same chemical importers as (1) with exemptions for all equipment (self-contained and remote systems) filled in New Zealand. Competitiveness impacts would be overcome with very high compliance costs (due to complexity and lack of verifiability) and there would be no price signals for imported equipment.
6. Upstream border point of obligation + equipment exemptions based on projected collection for destruction: the same chemical importers as (1) with exemptions for all equipment (self-contained and remote systems) filled in New Zealand based on a range of negotiated emission factors related to projected collection for destruction. This could provide good recovery incentives and competitiveness impacts would be overcome but with very high compliance costs (due to complexity and lack of verifiability) and there would be no price signals for imported equipment.

Bulk importers, local equipment manufacturers and others would have major concerns about equity and competitiveness if HFCs in imported equipment were not covered by the ETS. It would be relatively easy to overcome the competitiveness concerns for the four major manufacturers affected, but to overcome equity concerns the compliance costs of widespread equipment importer points of obligation would be high.

A number of the larger equipment importers have current mandatory appliance efficiency reporting requirements so extra compliance costs to include refrigerants would be minimal (to achieve an auditable standard). However, there is a large range of other equipment importers (including up to 500 vehicle importers) that would face significant reporting costs as well as market participation costs that all would experience. Some form of HFC import licensing may be required.

In terms of projected HFC usage and emissions, CRL Energy assesses that there may be surprisingly little impact from the ETS pricing by 2015 (assuming the equivalent for \$30 per tonne CO₂ in 2008 dollars). These projections are highly speculative. Based on the assumption that the business as usual (BAU) case will include major international technology developments and corporate decisions to reduce 'carbon footprints', these shifts will happen regardless of the ETS price level. Consequently, it is assessed that the ETS pricing will have negligible impact compared with BAU on HFC imports or emissions in the household, self-contained refrigeration, refrigerated transport and MAC sectors.

The major price influence (assuming competitiveness concerns are addressed) is likely to be increased investment in preventing leakage and helping to drive supermarket chains away from HFCs to CO₂ refrigerant in up to 20% of installations by 2015. Because the lifetimes of these systems are about 15 years before total overhaul, the pricing impact on total emissions from this sector is likely to be less than 10% below BAU. Similarly, the shift for new coolstores (and dairy refrigeration systems) to ammonia and other alternatives will largely be driven by the HCFC phase-out and corporate environmental policies rather than ETS pricing, so the overall emissions impact from ETS pricing may be much less than 10% below BAU.

The ETS pricing may however influence the sales of the lower-priced brands of household air-conditioning units (because of the relatively large charge of refrigerant and shorter lifetimes). This might result in 10% fewer imports by 2015 than BAU (and consequent lower retirement emissions about 10 years after the ETS introduction).

While there would be minimal impact on inhaler use from the ETS pricing by 2015 (compared with BAU), imports of aerosol cans (with a much higher proportional price increase) could be reduced by up to 30%. If the ETS covers imported fire protection equipment, there may be no new HFC installations. With a low leakage rate, the ETS pricing will have a negligible impact on emissions by 2015.

HCFC-141b is well suited to foam-blowing and it is likely to be used for as long as possible until the 2015 phase-out. Consequently the ETS impact on the foam industry could be major in the medium term since there are few practical alternatives to HFCs once HCFCs are phased out (apart from hydrocarbons for large manufacturers). CRL Energy assesses that HFC emissions in 2015 could be more than 50% lower than BAU because of ETS pricing (depending on the alternatives available).

There exists the potential for the perverse outcome that until the 2015 phase-out, some HCFCs (with ozone depleting and global warming properties) would be cheaper alternatives to HFCs covered by the ETS. This would appear to be a strong possibility in the coolstore sector, meaning that the lives of ageing, inefficient equipment are likely to be extended to avoid the costly HFC alternative.

In conclusion, assuming that re-exported chemical in equipment is not counted and an import threshold is applied of say 1000 tonnes of CO₂ equivalent, the competitiveness impacts identified in this report from a border obligation on HFC chemical importers would be on four major companies. (There might be a few extra companies for a 100 tonnes threshold.) A widespread border obligation on all equipment imports would remove any competitiveness concerns for relatively high compliance costs while limited exemptions on locally manufactured equipment would achieve the same result for relatively low compliance costs. Instead of limited exemptions, these manufacturers could be given free ETS allocations to protect their competitiveness, but there would be extra compliance costs from market participation.

In the transition to 2010, there will be an important role for the Ministry for the Environment and industry associations in capacity building to facilitate participation in the ETS. Improved knowledge of potential participants would be required before ETS coverage could be considered for the self-contained commercial refrigeration, refrigerated transport and mobile air conditioning sectors (in particular).

Table 2: Options for points of obligation

	Upstream border obligation	Upstream border obligation + limited equipment exemptions	Widespread border obligation
Participant numbers (2006)	11 (>1000 tonnes CO ₂ equivalent) or 12–14 (>100 t CO ₂ -e).	Same	Same for chemical importers plus (estimated) ⁸ : Household refrigeration 7? (>1000 t CO ₂ -e), or 10–15 (>100 t CO ₂ -e) Commercial refrigeration None? (>1000 t CO ₂ -e), or 20?? (>100 t CO ₂ -e) Household and commercial AC 10? (>1000 t CO ₂ -e), or 20–30 (>100 t CO ₂ -e) Refrigerated transport 10? (>1000 t CO ₂ -e), or 20–30 (>100 t CO ₂ -e) Mobile AC 50?? (>1000 t CO ₂ -e = 1000 cars or 600 trucks), or 500?? (>100 t CO ₂ -e) Aerosols 5? (>1000 t CO ₂ -e), or 10?? (>100 t CO ₂ -e) Fire protection 1–2 (>1000 t CO ₂ -e), or 4? (>100 t CO ₂ -e) Foam 1 (>1000 t CO ₂ -e), or 4? (>100 t CO ₂ -e).
Coverage of 2010 emissions	100% of refilling (replacing leakage) + about 19% of new equipment.	100% of refilling + about 15% of new equipment (non-self-contained).	100% of refilling + >90% of new equipment (>1000 t CO ₂ -e) or >99% of new equipment (>100 t CO ₂ -e).
Export implications	For consistency with inventory methodology, exports of bulk chemicals and equipment should be exempted.	All new self-contained equipment exempted, not just exports.	For consistency with inventory methodology, exports of bulk chemicals and equipment should be exempted.
Compliance costs	Reporting costs likely to be minimal for chemical importers. Minimal extra costs in providing accurate records for exempting exports of four major manufacturers. Market participation would add significant costs – each company will weigh up management time vs utilising permit brokers.	Reporting costs likely to be minimal for chemical importers. Minimal extra costs in providing accurate records for exempting exports and New Zealand sales of four major manufacturers. Market participation would add significant costs – each company will weigh up management time vs utilising permit brokers.	Reporting costs likely to be minimal for chemical importers. Minimal extra costs in providing accurate records for exempting exports of four major manufacturers. Extra reporting costs for large importers of equipment likely to be minimal if already MEPS reporting. Significant extra costs in reporting accurate records for smaller commercial refrigeration/ air-conditioning, refrigerated transport, mobile AC and aerosols importers in particular. Market participation would add significant costs – each company will weigh up management time vs utilising permit brokers.

⁸ Figures denoted with ‘?’ should be considered speculative and ‘??’ highly speculative

	Upstream border obligation	Upstream border obligation + limited equipment exemptions	Widespread border obligation
Potential for alternatives	<p>Use of alternative HFCs or technologies in almost all sectors will be driven by international developments rather than New Zealand prices.</p> <p>Long equipment lives mean that shifts will mainly be in new installations, e.g. supermarkets, coolstores and fire protection.</p> <p>Potential perverse outcome that some HCFCs would be cheaper alternatives to HFCs covered by the ETS.</p> <p>ETS pricing would encourage recycling but collection for destruction may need incentives.</p>	Same	Same
Economic impacts	<p>Costs of market participation will be passed from bulk HFC importers to purchasers.</p> <p>Reduced business for chemical importers as HFC usage decreases in medium term (perhaps replaced by alternatives).</p> <p>Main impacts likely to be investment in commercial leakage reduction and perhaps a shift to new supermarket CO₂ systems and ammonia in new large coolstores. Some foam industry impacts could be major as few alternatives once HCFCs phased out.</p> <p>Reduced competitiveness for locally manufactured refrigeration and air-conditioning equipment sold in New Zealand.</p>	Same but no reduced competitiveness for locally manufactured equipment sold in New Zealand.	<p>Same except costs of market participation will be passed to purchasers of bulk HFC and of HFC equipment and no reduced competitiveness for locally manufactured equipment sold in New Zealand.</p> <p>Additional main impacts (to leakage reduction and new supermarkets / coolstores shifts) likely to be reduced sales of relatively low priced aerosol cans and air-conditioning units.</p>
Equity Issues	<p>Bulk importers and manufacturers would have major concerns about equity and competitiveness if imported equipment not covered. Perhaps some avoidance behaviour by equipment importers.</p> <p>Small chemical importers may find ETS participation too costly and leave HFC importing to larger suppliers leading to a reduction in competition.</p> <p>Potential barrier to competition if an exempted manufacturer wants to change supplier but is concerned about confidential sales data held by previous supplier.</p>	Same but no equity issue about imported equipment being exempted if also limited exemptions for New Zealand manufactured equipment.	<p>Same but equity and competitiveness and avoidance concerns removed by covering imported equipment.</p> <p>Some will argue a portion of equipment HFC should be exempted based on projected collection for destruction on retirement.</p>

	Upstream border obligation	Upstream border obligation + limited equipment exemptions	Widespread border obligation
Transition issues	Some suppliers may import large quantities before January 2010 to avoid the obligation. Capacity building to facilitate ETS participation.	Some suppliers may import large quantities before January 2010 to avoid the obligation. Capacity building to facilitate ETS participation.	Same.
Uncertainties	Chemical importers' records of HFC imports are likely to be extremely accurate and readily verified by comparison with Customs records. Most of the major manufacturers already have accurate equipment sales records that could be adapted for use by chemical importers for exempting exports.	Most of the major manufacturers already have accurate equipment sales records that could be adapted for use by chemical importers for exempting exports and New Zealand sales that face competitiveness risks.	Chemical importers' records of HFC imports are likely to be extremely accurate and readily verified by comparison with Customs records. Similar for equipment importers reporting for MEPS. Uncertainties in identifying from Customs records all appropriate points of obligation then establishing their equipment sales reporting to sufficient accuracy.
Advantages	Simplicity and minimising compliance and verification costs. Relatively easy to exempt exports of four major manufacturers. Some future retirement emissions covered.	Relatively easy to exempt exports and New Zealand sales of four major manufacturers. No competitiveness issues over imported equipment.	Equity and competitiveness and avoidance concerns removed by covering imported equipment. Relatively easy to exempt exports of four major manufacturers. Future retirement emissions covered for all equipment purchased from 2010.
Disadvantages	Inconsistent for ETS to cover some future potential rather than all actual emissions. Bulk importers and manufacturers would have major concerns about equity and competitiveness for locally manufactured refrigeration and air-conditioning equipment if imported equipment not covered. Also potential avoidance behaviour by equipment importers. Small confidentiality issue for exemptions. Small importers may find ETS participation too costly and leave HFC importing to larger suppliers leading to a reduction in competition. Some suppliers may import large quantities before January 2010 to avoid the obligation.	Bulk importers would still have major concerns about equity and avoidance if imported equipment not covered. Limited coverage of future retirement emissions.	Significant extra costs in reporting accurate records and market participation for smaller commercial refrigeration / air-conditioning, refrigerated transport, mobile AC and aerosols importers in particular.

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