INTERNATIONAL ENERGY AGENCY

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Integrating carbon pricing with existing energy policies

Issues for Chile

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International Energy Agency

INTERNATIONAL ENERGY AGENCY

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1. Introduction

Like a number of other countries, Chile is exploring the introduction of carbon pricing to curb growth in energy-related CO_2 emissions. One important issue to consider as part of this process is how the carbon pricing policy fits with other energy policies that also reduce CO_2, such as policies to support low-carbon technologies and energy efficiency programmes. Overlapping policies can either reinforce or undermine the effectiveness of carbon pricing, and similarly the carbon pricing policy can affect the performance of other programmes. The question of policy integration was often raised late when CO_2 pricing schemes were introduced in other countries, and not always in a comprehensive fashion.

This paper explores issues that Chile may need to consider if it chooses to proceed with introduction of emissions trading. The analysis builds on the IEA's report *Summing up the parts - Combining policy instruments for least-cost climate mitigation strategies* (IEA, 2011), but is tailored to Chilean circumstances. Because Chile is still at the early stages of exploring whether to introduce an emissions trading system (ETS), the specific design for a Chilean ETS has not yet been developed. Therefore, the analysis in this paper is of generic issues that could help inform this process, rather than of specific detailed design questions.

This work is part of a project funded by the UK Foreign and Commonwealth Office, under which the IEA is collaborating with two countries - South Africa and Chile - to understand how CO_2 pricing policies could best integrate with existing energy policies and measures. The purpose of the project is to assist these two countries to develop cost effective climate-energy policy packages that are robust to future change. In addition to conducting specific analyses for these two countries, an important output from the project will be a more general "guidance document", to help other countries contemplating the introduction of CO_2 pricing to integrate this well with existing and planned energy policies.

2. Background: policy packages and interactions

There is a strong case for a package of policies to form the "core" response to the challenge of emissions reductions. However these multiple policies can overlap and interact, either supporting or undermining one another. Based on Hood (2011), this section explores the case for retaining supplementary policies when an ETS is introduced, and the types of interactions that may need to be managed.

2.1 Why retain supplementary policies alongside an ETS?

If a least-cost strategy for reducing greenhouse gas emissions is the goal, carbon pricing should be a core part of the policy framework. Through appropriate pricing of CO_2 emissions, energy producers and consumers see the right incentives for investment in cleaner technologies, and for more efficient and cleaner operations.

A distinction should be made between *costs* and *prices*. Carbon pricing policies such as emissions trading inevitably change relative and absolute energy prices: this is their purpose. However this does not necessarily mean increased *cost* for the economy as a whole: the negative economic impact of energy price rises can be counterbalanced by use of revenue from ETS allowance auctions in ways that stimulate the economy (Parry et al, 1999). An analysis of the macro-economic impact of ETS induced energy price rises will depend critically on these decisions on how revenue is recycled.

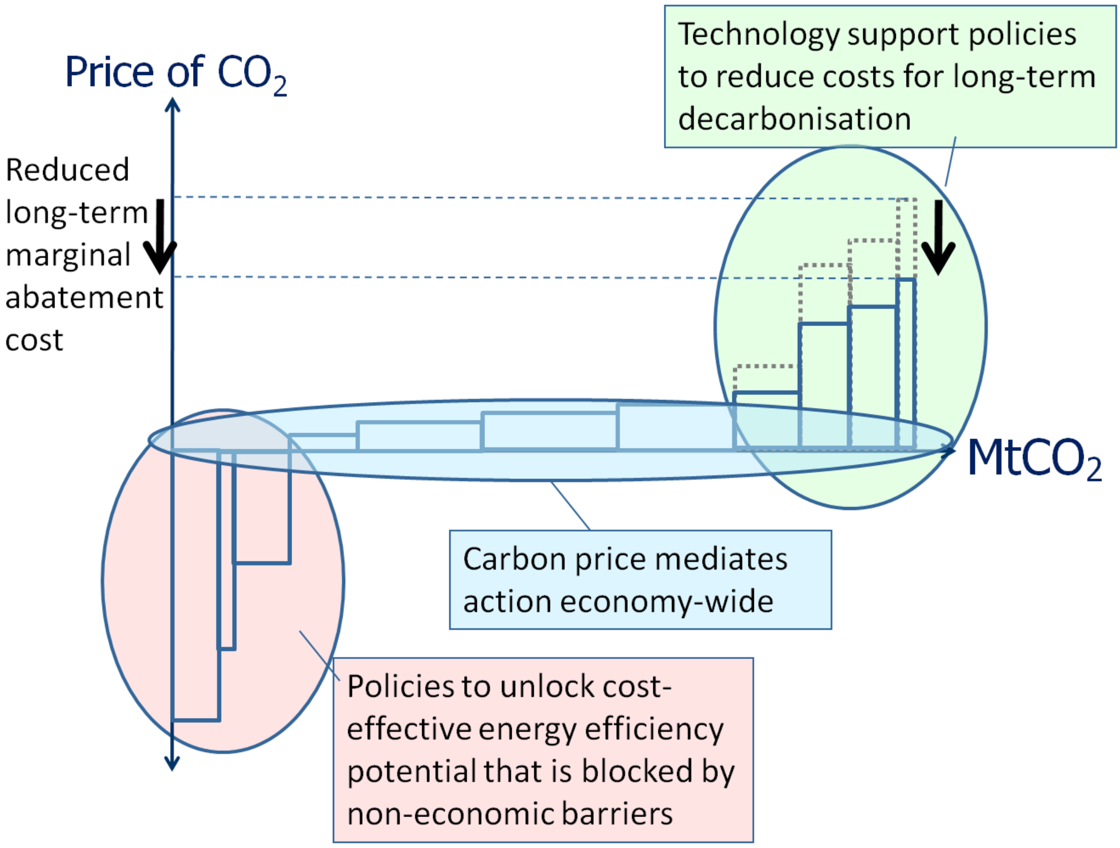
Some argue that given the inherent cost-effectiveness of carbon pricing, other energy policies that also reduce emissions could be scrapped when a carbon price is introduced. However a carbon price alone is not usually sufficient to deliver least-cost emissions reductions. First, some abatement can be blocked by non-market barriers, particularly in energy efficiency. Second, technologies will be needed for the longer term that need early investment now, both to bring down their costs, and to begin to scale them up to the levels that will be needed for deeper emissions reductions. While the details of policy will vary between countries and regions, in general a package of policies is therefore needed (Matthes, 2010; Hood, 2011), as illustrated in Figure 1. Additional policy may also be justified in for underpinning infrastructure such as electricity grids, or to help overcome barriers to the high up-front costs of low-carbon investment.

Energy efficiency

Ignoring energy efficiency opportunities can be costly. There are often low or even negative-cost abatement options available that are blocked by split incentives between those making investments and those paying energy bills, lack of information at the time of investment, or human nature that means consumers do not always act in their best economic interests (Ryan et al., 2011). These barriers can be overcome with cost-effective targeted energy efficiency policies. This means that some higher-cost measures are no longer needed to meet a given emissions reductions target, lowering the overall cost of the policy response.

If a carbon price has been introduced, delivering energy efficiency can also lower the economy-wide carbon price necessary to meet the emissions target. In Figure 2(a), a carbon price of P* is needed to deliver an emissions reduction goal of Q*. Figure 2(b) shows that if energy efficiency is left untapped, a higher price P would be needed. Given that energy price rises are a key economic concern in the introduction of carbon pricing, making sure the carbon price is not unnecessarily high is an important outcome.

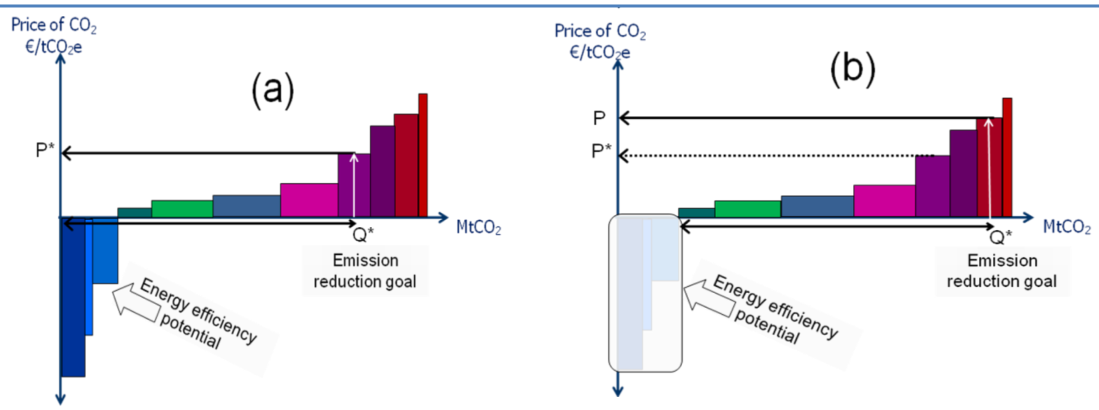
Figure 1: The core policy mix: a carbon price, energy efficiency and technology policies



Source: Hood (2011)

Naturally, the energy efficiency interventions themselves would need to be cost-effective, that is, spending less to overcome barriers than is saved. Transaction costs could sometimes outweigh benefits. Finally it should be noted that the multiple benefits of energy efficiency such as reducing energy demand, improving energy security, health outcomes, competitiveness, and job creation should also be factored into decisions on energy efficiency policy support (Ryan and Campbell, 2012).

Figure 2: Ignoring energy efficiency potential can lead to higher carbon prices.



Source: Hood (2011)

Technology support policies, including renewable energy support[1]

Technology support policies can lower the cost and increase the feasibility of climate policy over the long-term, although to realise these benefits can require higher costs in the short term. There are a number of reasons why some investment in technologies that are more expensive than the current carbon price can be justified:

- To bring down their costs, which will happen with increasing deployment – this can lower the cost of the total transition to low-carbon energy systems.
- To start the scale-up of technologies that will be needed on a large scale in the future. Ramping up some technologies will take time, so may need to begin early to reach a level appropriate for a cost-effective policy response over the long term.
- Domestic priorities such as energy security, local economic development, and reduced local air pollution.

While these provide a rationale for some investment in technology support, the quantity and timing of early technology supported must be carefully considered. This cost-benefit assessment should consider how quickly costs are likely to reduce, the total abatement potential expected from the technology, and whether the technology will be necessary to meet a stringent climate goal (IEA, 2012).

In making decisions on the timing and level of renewable energy or other technology support, the key questions are what are the policy objectives, what benefits does meeting these objectives deliver, and therefore what level of deployment (and financial support) is justified. The benefits beyond emissions reductions may well still justify renewable energy support even when a strong ETS price is in place. Before an ETS is in place, greater support may be justified to act as a "shadow" carbon price to reflect emissions reductions benefits as well.

Underpinning policies: Markets, infrastructure and finance

In addition to specific energy policy interventions in energy efficiency and technology, it should be recognised that underpinning policies are also needed to provide a least-cost response to climate change. For example,

- markets will not function well unless there is adequate competition and liquidity, and they facilitate entry of new players;
- If there are infrastructure barriers to the integration of clean technologies, this will raise the cost of deploying the options; and
- the challenges of financing the higher up-front cost of low carbon technologies could raise the cost and lower the feasibility of deployment.

Targeted interventions that improve functioning of markets, support critical underpinning infrastructure (such as electricity grids), or provide financing mechanisms can lower the cost and increase the quantity of abatement delivered. These interventions would need to be subject to individual cost-benefit analysis.

2.2 Policy interactions with emissions trading

An ETS will interact with other energy policies that also reduce emissions, particularly the energy efficiency and technology support policies mentioned above. The precise nature of this

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[1] Examples of other technology support policies could include a carbon capture and storage mandate or subsidy, or policies to underwrite nuclear construction.

interaction will depend on the design of the ETS: in particular whether there is an absolute cap on emissions, or whether the ETS has output-based obligations (e.g. for power generation, a requirement to surrender allowances for emissions above a target level of CO_2/MWh). The specific design details of the ETS also matter in terms of policy interactions: which sectors are covered, what baselines are chosen, and even details such as how to manage competitiveness concerns and recycling of ETS auction revenue.

ETS with fixed emissions cap ("cap and trade")

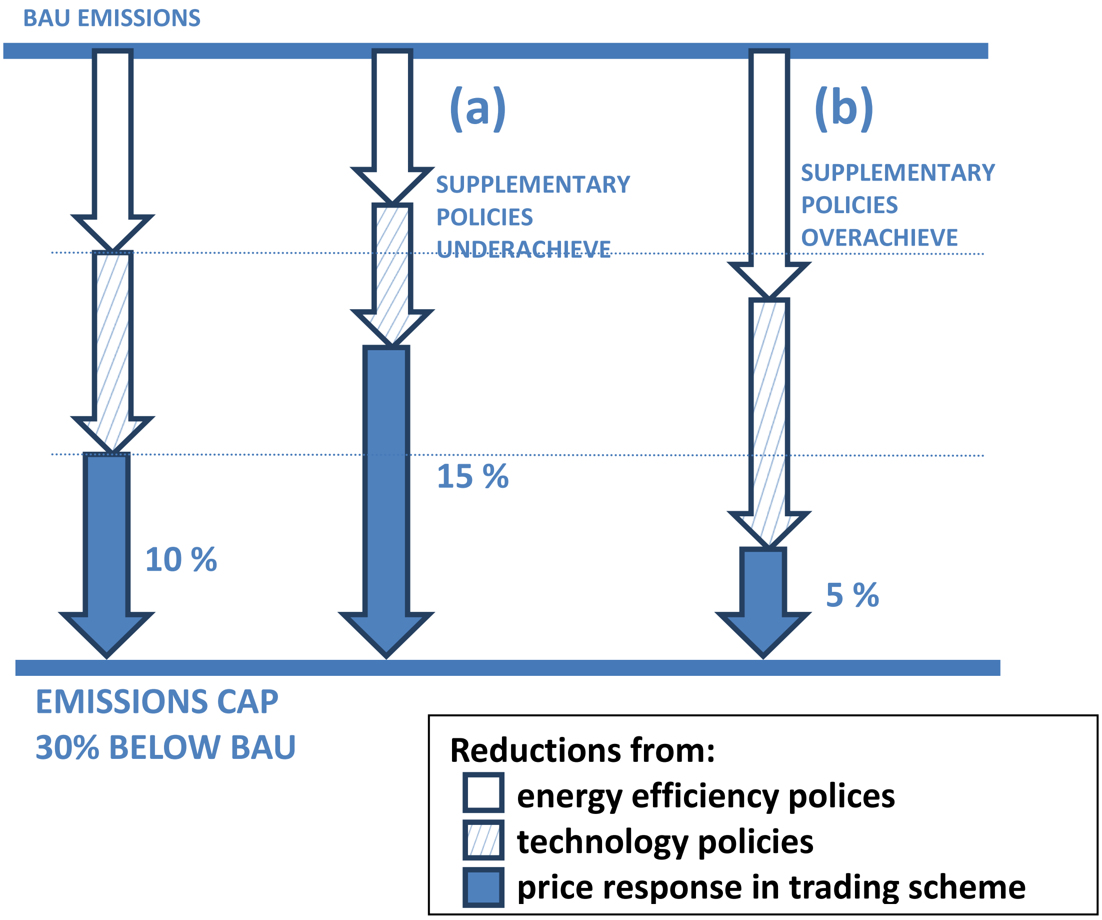
Because energy efficiency and clean technology support policies deliver some of the emissions reductions required to meet the emissions cap, they reduce the emissions reductions that must be delivered by the ETS market, and so reduce CO_2 prices. The energy policies do not lead to additional emissions reductions in the short term, rather they displace abatement that would have otherwise been be delivered by the ETS market. As discussed above, if energy efficiency policies displace more expensive abatement options this can give a more cost-effective overall outcome. However there is a risk that if the energy efficiency policies deliver too much of the abatement required to meet the cap, the ETS market prices could be undermined to the point where the low CO_2 price is no longer a clear signal for clean investment. The challenge is to balance the desire to minimise short-term costs with keeping ETS permit prices high enough to stimulate private investment in low-carbon assets, which in turn minimises costs over the long term.

Any *uncertainty* in the outcome of the energy policies can also create uncertainty in the ETS market, which could also undermine investment (Figure 3). In the example shown in Figure 3, an absolute emissions cap is set 30% below BAU. Emissions reductions are delivered in part by targeted energy efficiency and technology policies, with the remainder delivered by the ETS market. If the energy policies deliver less than expected, the ETS market must deliver greater reductions, so higher CO_2 prices result. If the energy policies deliver more than expected, pressure on the ETS reduces and prices will fall. Such price uncertainties create an additional risk for investors, and uncertainty has been shown to delay investment decisions (IEA, 2007).

If other policies deliver a large share of emissions reductions to meet the cap, this also makes the ETS more sensitive to changes in economic circumstances. In the example shown in Figure 3, a 5% change in (or miscalculation of) BAU emissions halves the effort required under the ETS, because the energy efficiency and technology support policies deliver such a large share of the required reductions.

In countries like Chile where electricity prices are set in a wholesale electricity market, the introduction of energy efficiency and renewable support policies will also have an effect on the electricity market. If energy efficiency policies reduce electricity demand, this displaces the need for some thermal generation. Policy-driven introduction of renewable generation will tend to displace marginal thermal generation in the market, so the emissions reductions may reflect the marginal, rather than average, emissions of the electricity sector. If the ETS cap-setting process does not take into account this difference between marginal and average emissions factors, the emissions reductions could be underestimated, potentially undermining ETS prices and disrupting the balance intended between the ETS and the other policies.

Figure 3: Policy interactions can significantly impact ETS prices.

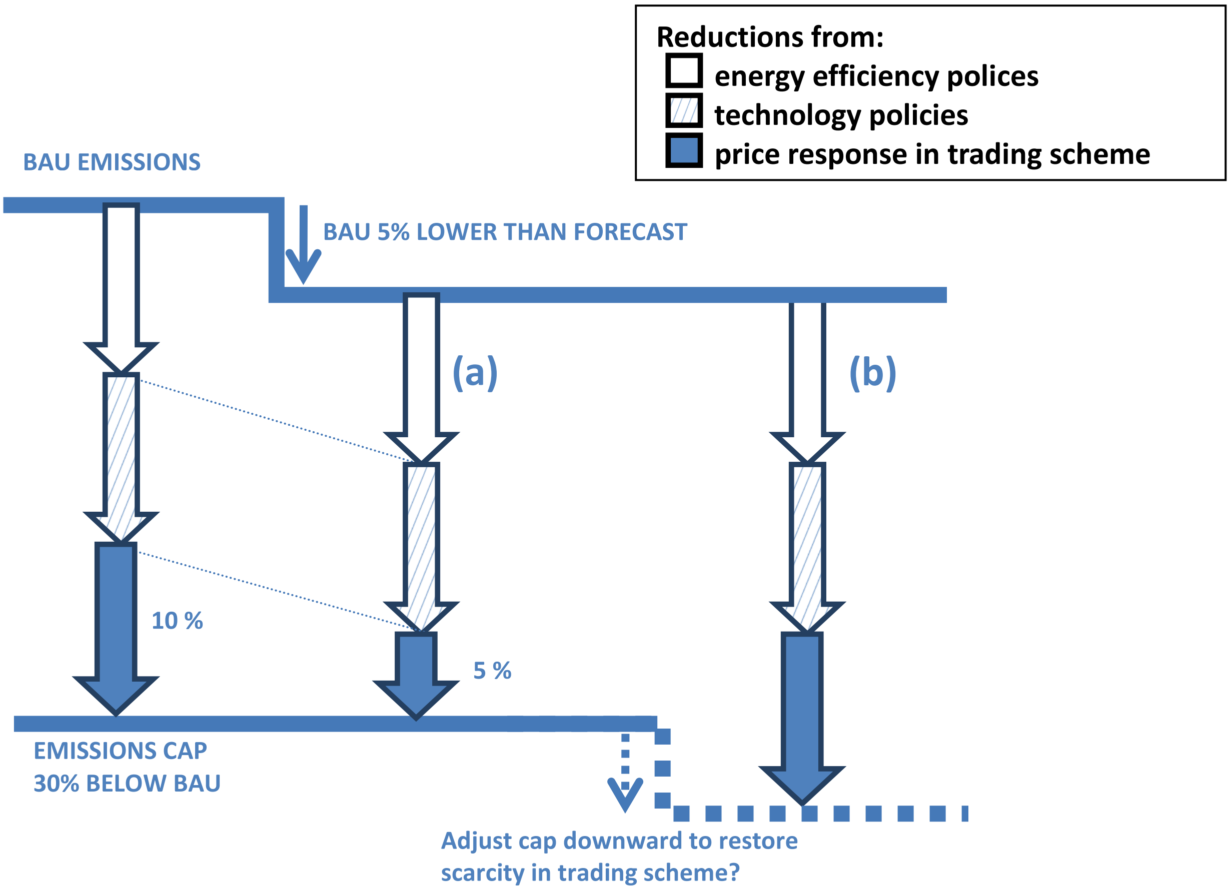


Source: Hood (2011)

Finally, in addition to considering the effect of energy policies on the ETS, the effect of the ETS on energy policies needs to be considered. The introduction of a carbon price could reduce the payments needed under renewable energy support mechanisms, as the resulting electricity price rise would make these technologies more cost-effective. If ETS allowances are auctioned, some of the resulting revenue could also potentially be used to offset the incremental cost of renewables tenders, reducing the need for a consumer surcharge. At the same time, higher energy prices could either increase or decrease the level of policy intervention justified in energy efficiency actions. If the carbon price and associated information campaigns focus consumer attention on cost-effective opportunities, then some of the blocked potential could be unlocked alongside the introduction of the carbon price. Conversely, the carbon price increases the energy efficiency potential that is cost-effective based on current energy prices[2], so if consumers do not respond and this potential remains blocked, it could justify a scaling-up of energy efficiency programmes to unlock this blocked potential.

[2] If energy efficiency policies are set using a shadow carbon price to reflect the social cost of carbon, then price changes that internalize these costs do not alter the cost-effective potential.

Figure 4: Energy policies can amplify the impact of changing economic conditions on ETS scarcity



Source: Hood (2011)

ETS with output-based obligations ("baseline and credit")

Emissions trading systems can also be designed as "baseline and credit" systems, where emissions obligations are set per unit of production rather than as a fixed cap. It is beyond the scope of this paper to compare or provide advice on the benefits and detriments of cap and trade vs. baseline and credit. This paper simply focuses on issues of integration with existing energy policies, and how these would be different under the two types of market mechanisms.

The use of output-based obligations can decrease the severity of interactions between the trading scheme and energy efficiency policies, and reduce the impact of changing economic conditions. In such as system, the CO_2 obligation is indexed to the quantity of energy sold or industrial production: that is, the obligation *per unit of production* stays the same even if production levels change. As a result, if energy efficiency improvements reduce electricity demand, or if industrial output is lower than expected due to economic conditions, this does not directly substitute for the requirement to increase clean energy as a percentage of the generation mix, or to decrease emissions per unit of industrial product. In terms of the ETS market, total demand for allowances falls with decreasing production, but supply falls in line with this as it is linked to production levels. As such, energy efficiency policies and economic conditions do not directly change the price signals in the ETS market. However technology support policies do affect the ETS: these contribute directly to reducing emissions per unit of energy supply, so will reduce demand for ETS allowances, and hence their price.

Interactions mediated through the electricity market are still seen in this situation. The energy efficiency policy will tend to displace higher-emissions thermal plants from the electricity market, reducing emissions per unit of electricity generated, and decreasing pressure on the ETS permit market. Similarly, deployment of additional clean power generation through alternative policy support would generally displace thermal generation from the electricity market, again lowering CO_2/MWh and contributing to delivery of the ETS target. As with a fixed cap, lower permit prices indicate that targets are being met easily in the short term – the challenge is to balance the desire to minimise short-term costs with keeping ETS permit prices high enough to stimulate private investment in low-carbon assets.

An output-based ETS would have less impact on energy prices than a fixed cap, because the costs passed through are only those for emissions exceeding the target level. As such, there is likely to be less need to adjust energy efficiency or technology support policies' levels of support.

2.3 Summary: thinking about energy policy interactions with an ETS

In making the case for whether energy policies should be kept, discarded, or amended when an ETS is introduced, the key question is to ask ***what the policy is intended to achieve*** (Matthes, 2010). Multiple policy objectives can justify multiple policies. Clear identification of these objectives is necessary to avoid duplication of effort with the carbon price, and to determine what level of support for targeted clean energy policies justified. An ETS sets a carbon budget (or emissions target per unit of production), and trading encourages this to be delivered at least-cost. Energy policies that have exactly this same objective – simply to deliver an emissions budget – may be redundant with the introduction of an ETS, and should be re-evaluated.

However most energy policies will have objectives other than direct emissions reductions, so can be complementary to an ETS. These additional objectives need to be understood and quantified in order to judge the merits of keeping the policy in place alongside the ETS, and to consider whether the policy design should be adjusted. For example, energy efficiency policies are generally designed to overcome specific barriers (information, incentive, behavioural) that prevent low-cost energy savings from being realised, so these have little overlap with carbon pricing (Ryan et. al, 2011). Support policies for renewable energy can have multiple objectives: to bring down technology costs, build national capacity in use of new technologies, and to provide local economic benefits. If these renewable technologies are more expensive than other abatement options, they may still be worthwhile due to these benefits. A narrow focus only on the short-term abatement costs would miss this.

Interactions with an ETS can also be experienced with a wider range of policies beyond energy efficiency and technology support. Characteristics to look for in policies that could interact strongly with an ETS are those that significantly:

- Change primary energy supply characteristics (e.g. policies that affect the thermal fuel mix, penetration of renewable supply, or share of natural gas);
- Change energy prices (for example changes in energy taxation), or
- Reduce energy demand

Each of these will have a significant impact on the level of emissions in sectors covered by an ETS cap. The next section will seek to identify and analyse key elements of the Chilean energy policy mix that could overlap and interact with an ETS, should Chile decide to introduce this policy.

3. Potential overlaps between a Chilean ETS and energy policies or developments

The precise nature of any overlap or interaction will depend on the detailed design of the ETS. As the details of an ETS for Chile have not yet been developed, the analysis is at a generic level only. For the purposes of understanding these generic interactions, two broad types of ETS will be considered:

- 1) a standard "cap and trade" system similar in design to the EU ETS, which might apply to large emitters in the power and industrial sectors, and
- 2) an ETS with output-based obligations/allocations (i.e. obligation to surrender permits per unit of production), that is, a "baseline and credit" type approach, again applying to the power and industrial sectors.

It is beyond the scope of this paper to advise on the advantages and disadvantages of these two types of market-based climate policies. This paper simply focuses on issues of integration with existing energy policies, and how these would be different under the two types of market mechanism.

As discussed in Section 2, policies or developments that could strongly interact with an ETS are those that significantly:

- Change primary energy supply characteristics (e.g. policies that affect the thermal fuel mix, penetration of renewable supply, or share of natural gas);
- Change energy prices (for example changes in energy taxation), or
- Reduce energy demand

Based on these criteria, the following policies or developments potentially have a strong interaction with an emissions trading system.

3.1 Energy Efficiency Policies and Targets

As part of the 2012 National Energy Strategy, Chile has developed an Energy Efficiency Action Plan 2020, which aims to decouple economic growth from energy demand, reducing energy demand by 12% in 2020 compared to projected levels. Some of the measures proposed include building codes, promoting energy management in industry, energy efficiency labelling, Minimum Energy Performance Standards (MEPS) for equipment and appliances, and promotion of efficient lighting. The Action Plan also establishes an Interministerial Commission to ensure the coordination of energy efficiency policy development across various sectors and institutions (Government of Chile, 2012). The Chilean Ministry of Energy provides policy advice on energy efficiency, and the Chilean Energy Efficiency Agency (ACHEE) is responsible for programme delivery (IEA, 2009).

Where the energy demand reductions arising from these policies occurs in sectors covered by the ETS, there could be a policy interaction. Sectors covered by the ETS include facilities that have direct ETS obligations, but also the entire electricity end-use sector. This is because reductions in electricity end-use mean that power generators (who are covered by the ETS) need to generate less than they would have otherwise, saving emissions. This in turn reduces the pressure on prices in the ETS market. Moreover, as described in Section 2, the marginal generation displaced could be expected to be high-emissions thermal generation, amplifying the emissions savings.

In a cap and trade system, allowance prices will be directly affected by the quantity of emissions reductions made via energy efficiency policies, as these deliver some of the abatement required to meet the fixed cap. The 12% target is currently a goal rather than a binding target, so the actual level of savings expected from energy efficiency programmes could be unclear at the time the ETS cap is set. Flexibility may therefore be needed in the ETS cap to be able to make adjustments if assumed level of energy savings turns out to be incorrect. Finally, it should be remembered that if low-cost energy efficiency opportunities are left untapped, higher cost savings will need to be made elsewhere to reach the ETS cap, raising costs and carbon prices. There is a strong argument for clear, stable and ambitious energy efficiency policy as a complement to emissions trading.

In a baseline and credit system, ETS obligations scale with the level of production, for example power generators would have an obligation to surrender allowances for emissions in excess of a target level of emissions per MWh generated. Because this obligation scales with production levels, reductions in demand will not directly lead to increased demand for allowances. However reductions in electricity demand will go some way towards reducing the emissions intensity of the power sector if it is primarily high-emissions marginal generation that is displaced – so there may still be a more minor effect on allowance prices.

When an ETS is introduced, energy efficiency policies may need to be reviewed for consistency. For example, higher energy prices could make additional energy efficiency investments cost-effective, so the scope of existing programmes might need to expand to unlock this newly cost-effective potential. Similarly, energy price forecasts are a factor in the setting of MEPS, so carbon prices could make stronger standards appropriate.

3.2. Promotion of non-conventional renewable energy (NCRE)

The 2008 *Law for the Development of NCRE* requires electricity companies that sell power in Chile's two major electricity grids – the northern SING and southern SIC systems[3] – to deliver a percentage of their electricity from non-conventional renewable sources. The obligation starts at 5% of supply in 2010-14, then scales up to 10% by 2024. In the *2012 National Energy Strategy*, a new goal was set to more than double this target, and legislation is current in the Chilean parliament that would set a more ambitious target.

Non-conventional renewables are currently promoted largely through a renewable certificates (REC) scheme. In theory, this provides good certainty on the level of NCRE deployment expected to be delivered by this policy rather than through electricity and ETS market prices. As such, this "extra" quantity of renewables could be taken into account when setting the ETS cap. However if the REC scheme has an alternative compliance payment that is set low and companies choose to pay the fine rather than building extra NCRE, then the quantity of abatement could be less than anticipated, increasing ETS market prices. Conversely if some renewable energy options are commercially attractive without support, the quantities could exceed the level stipulated in the REC scheme. The current situation is that NCRE targets have been exceeded for three years in a row.

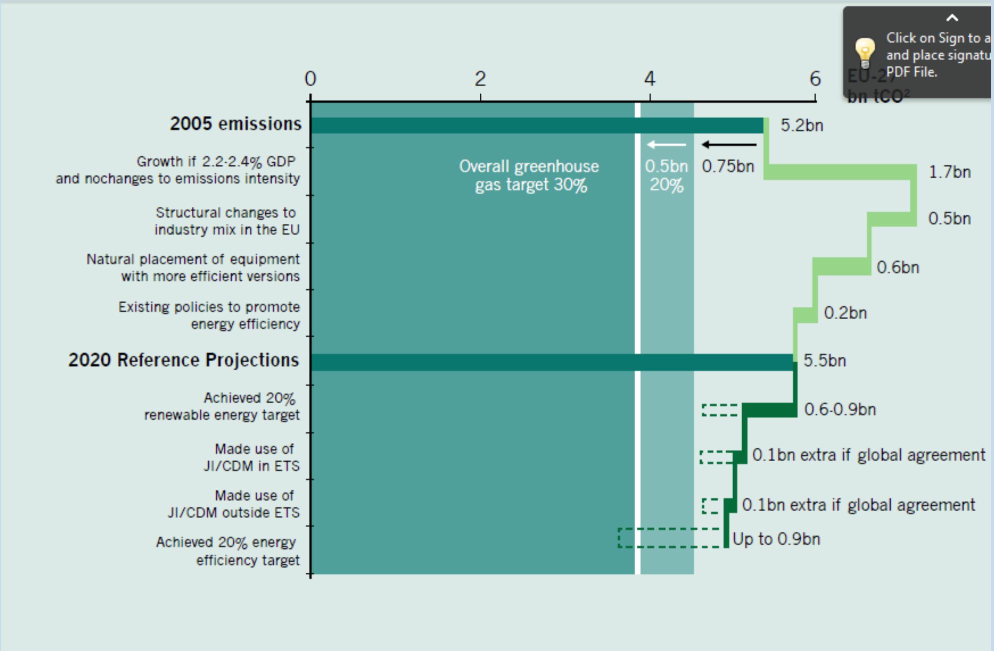
[3] The Sistema Interconectado del Norte Grande (SING) and Sistema Interconectado Central (SIC)

Box 1: Policy interactions in the European Union climate and energy package

In 2008 European Union countries agreed a climate-energy package of policies for the period to 2020 of a 20% decrease in greenhouse gas emissions on 1990 levels (to be increased to 30% if other countries are taking strong climate action), raising the share of renewable generation to 20%, and a 20% improvement in energy efficiency. In the development of this package, stakeholders had highlighted long-term certainty as a key objective, so targets for 2020 were set without significant flexibility for adjustment.

This policy package was calibrated to so that some abatement would be provided by each of the three major policies. The Carbon Trust (2009) calculated that the renewable energy target would deliver around half of the abatement required to meet the 20% emissions target, and that the energy efficiency target could deliver a similar amount if fully achieved. However given that the energy efficiency target was not made mandatory in the 2008 package, the actual expected savings were lower. Following slow progress, a new Energy Efficiency Directive was passed in 2012 to make energy savings mandatory.

Figure 5: Expected contribution of policies toward delivering European climate goals calculated *before* the impacts of the 2009 recession



Source: Carbon Trust (2009)

The results of recession on the system have been significant. Due to lower economic activity, baseline emissions did not increase as forecast, and it is apparent that the EU ETS cap – locked in until 2020 – has been set too high. As the system stood in 2012, the combination of renewable and energy efficiency targets alone are more than enough to deliver the emissions reductions required to meet the cap, with no action required from EU ETS entities. As a result, EU ETS allowance prices have crashed from EUR 20-30/tCO_2 in 2008 to EUR 4-5/tCO_2 in 2013. The EU ETS is expected to be carrying up to 2Gt of surplus allowances to 2020 unless modifications are made (European Commission, 2012).

This EU ETS surplus is not the fault of the supplementary policies, which were introduced for good reason. However the large share of abatement delivered by these policies left the system more vulnerable to changing economic conditions, as described in Section 4.3.

The European Commission has proposed several options to recalibrate the EU ETS to withdraw some of the surplus allowances, to restore some of the intended scarcity in the system. There is also work underway to consider longer-term structural change in in the EU ETS, including considering whether more flexibility to adjust to unforeseen shocks would be desirable (European Commission, 2012).

The *National Energy Strategy* proposes to move to a system of tenders for support of new NCRE generation, supported by enhanced financing, a geo-referenced information platform of NCRE resources, and addressing planning issues to facilitate investment. If the schedule for annual tenders is signalled well in advance, the abatement arising from this policy will be able to be factored into ETS cap setting. However if tenders are expected to be more dynamic and flexible from year to year, then it could be difficult to anticipate the impact of this policy on the ETS market. Consideration should be given both to maximising the certainty of the NCRE policy (increasing investment certainty both for NCRE investors and in the ETS market), but also providing some flexibility in the ETS settings to allow for unforeseen results from NCRE policy.

With the introduction of an ETS, it should also be considered whether the details of NCRE policies need to be adjusted. The market-based REC scheme will in theory adjust to a changing electricity price: with a rising carbon price the required REC price is lower. If ETS market prices are high enough to drive deployment of NCRE without support of RECs, then the REC price could collapse and this policy become redundant. The tender process similarly is self-adjusting: tenders will incorporate the higher electricity price expectations driven by the ETS. Because of these feedbacks, the situation for NCRE investors could be complex: the balance of payments between market electricity prices (incorporating the ETS market price), and NCRE support payments may be uncertain. Again, maximising policy certainty around quantities of NCRE to be deployed through targeted support would benefit investors in both schemes.

3.3 Major energy infrastructure changes

Chile has a fast growing and very dynamic energy system, fuelling its rapidly growing economy. According to the *National Energy Strategy 2012-2030*, between now and 2020, growth rates of 6-7% per annum are projected for electricity consumption in Chile, requiring 8000 MW of new generation (Government of Chile, 2012). Investment decisions on generation and fuel importation are made by the private sector.

There are many major energy sector infrastructure uncertainties in Chile in the period to 2020, each of which could significantly shift the primary energy supply mix, or change energy prices. As such, the process of ETS design needs to take account of these possibilities, to ensure that the ETS system will still drive low-carbon investment under this wider range of circumstances. Particular major uncertainties include:

- Whether or not the HydroAysén or similar large hydro projects will proceed.
- How quickly LNG infrastructure will scale up in Chile. These decisions will be influenced by global LNG prices, and regulatory climate for new coal investment (such as the Supreme Court’s 2012 rejection of the Castilla project)
- Whether the SIC and SING grids could be interconnected, raising efficiency and therefore lowering emissions.

Whether prompted by government policy settings or simply by private investors responding the fuel prices, changes in the energy mix on this scale have the potential to significantly shift emissions. This would result in ETS prices much higher or lower than anticipated. The dynamic nature of Chile’s energy system and magnitude of some of these potential uncertainties suggests that flexibility in the ETS design would be beneficial. This would allow the system to be adjusted for major changes in infrastructure that were not included in the original baseline.

3.4 CDM projects and NAMAs

Chile has taken a leading role in Latin America in the Clean Development Mechanism. As of December 2010, 73 projects had been approved by Chile's designated National Authority for the CDM, in small hydro, landfill methane capture, wind generation and biomass. These projects imply emissions reductions of nearly 5Mt of CO_2 equivalent (Ministry of Energy, 2012).

Chile has been similarly forward looking in exploring potential new international climate policy tools, registering the first Nationally Appropriate Mitigation Action (NAMA) for recognition with the United Nations in October 2012. This NAMA covers Clean Production Agreements with industrial sectors, and is estimated to reduce emissions by 18.4Mt between 2012 and 2020 (UNFCCC, 2012).

With relation to interactions with a domestic Chilean ETS, two issues arise where CDM projects or NAMAs occur in sectors covered by the ETS:

- ETS baselines need to be set to take into account the emissions reductions from these subsidiary policies and agreements, and the ETS baseline/cap may need flexibility to adjust for any further NAMAs or CDM projects that are instigated after the ETS is launched. On the other hand, the information on industrial abatement potential found through the Clean Production Agreements process will be helpful in setting realistic ETS caps and appropriate industry allocations.
- Because emissions reductions make under CDM projects receive credits that are sold internationally, the ETS must be designed to ensure that there is no double-claiming of the emissions reductions arising from these projects. Similarly, if under future UNFCCC arrangements NAMAs can be credited, then any credits from these NAMA projects will need to be ring-fenced from the ETS to avoid double-counting of emissions reductions.

This does not necessarily mean that emissions covered by a NAMA would not be able to participate in an ETS, rather it means that the two policies need to be integrated to ensure emissions reductions are not counted twice at the international level.

3.5 Regulations affecting greenhouse gas emissions

It is often the case that regulations controlling conventional pollutants also have some impact on greenhouse gas emissions. In Chile, the Emissions Regulation for Thermoelectric Plants constrains the level of sulphur and nitrogen oxide pollutants emitted by new power stations. This regulation was introduced as an air quality control, but it will also have some influence on favouring lower-emissions power generation, which is also (generally) lower in conventional pollutants. The expected impact of this regulation on investment patterns should be taken into account when the ETS cap is set, to ensure that the ETS is driving additional emissions reductions beyond those induced by the regulation.

Another example is Decree 189, the Health Ministry regulation on landfills. According to this regulation, all landfills must have a biogas management and utilization system. Because this biogas capture is already required by law, the ETS design would need to take account of the likely quantity of biogas entering the market (in the same way that the ETS market must take account of generation brought forward by NCRE regulations).

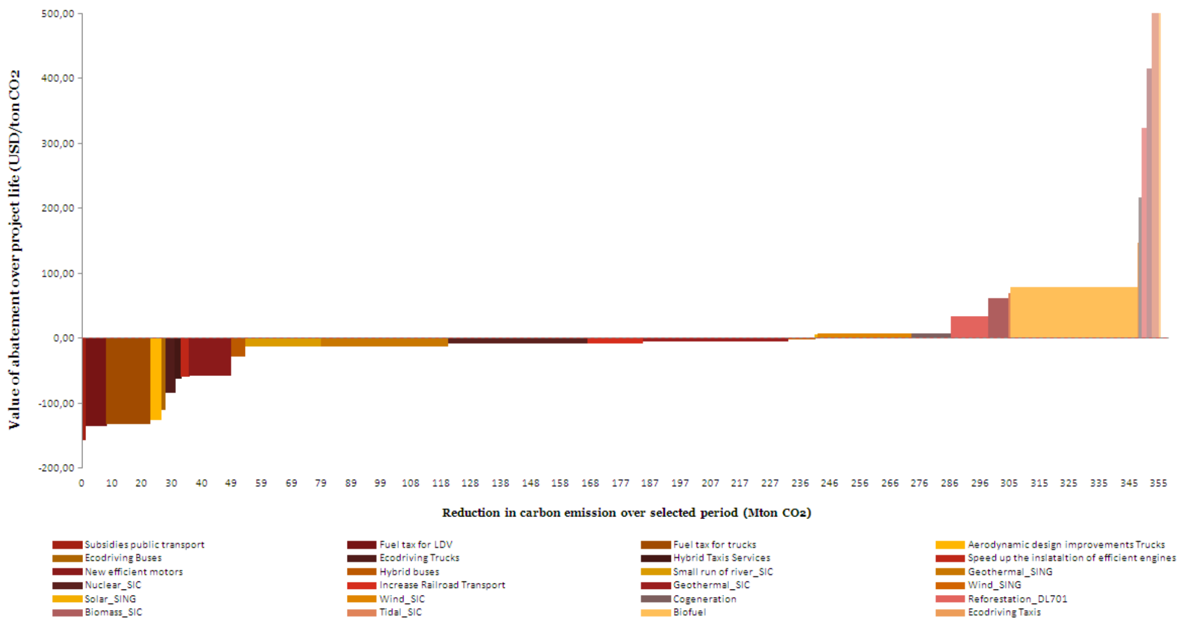
4. Managing policy overlaps in the Chilean context

4.1 Policy packages in the Chilean context

The presence of policy overlaps and interactions should not be taken as a reason to scale back these programmes: as discussed in Section 2 there are good reasons to supplement a carbon price. Unlocking blocked energy efficiency potential can lower carbon prices and the overall cost of mitigation. Some early scale up of more expensive technologies may also be in Chile's interest to gain experience with these and due to supplementary benefits beyond immediate emissions reductions.

A preliminary marginal abatement cost curve (MAC curve) for Chile's mitigation opportunities to 2030 has been developed by PWC (2012) based on work by GreenLab UC (2011), reproduced here as Figure 6. A more in-depth analysis of Chile's mitigation potential is being undertaken through the MAPS project led by the Environment Ministry and there will also be future detailed work as part of Chile's ETS exploration under the Partnerships for Market Readiness programme of the World Bank. This curve should therefore be seen as indicative and is presented here simply to illustrate policy concepts.

Figure 6: Preliminary MAC curve for the energy, transport and industrial sectors



Source: PWC (2012) based on GreenLab UC ,(2011)

When examining this MAC curve it is useful to consider what policies would be most appropriate to deliver the abatement potential identified. It is apparent that:

- There is a large quantity of negative-cost abatement potential in this timeframe. These emissions reductions are cost-effective even without a carbon price, suggesting that other barriers exist, and that policies other than a carbon price are needed to realize these savings. For example in the energy sector, 170Mt of emissions reductions are identified from low-carbon generation that is expected to be cost effective without a carbon price. The National

Energy Strategy's integrated approach to considering transmission and regulatory barriers to development alongside improving consumer information (Government of Chile, 2012) should help unlock this potential. In transport, a range of negative-cost abatement opportunities exist, relying on changes to fuel taxation, eco-driving training, upgrades to the vehicle fleet, and moving more transport to rail. While a carbon price would help reinforce the economic case for these activities, again, they already make sense. Across energy, transport and industry, around 2/3 of the abatement identified to 2030 is negative cost.

- Some moderate cost abatement options exist that could be stimulated by a modest ETS price of under \$20/tCO_2: in energy some solar (SING) and wind (SIC), in industry co-generation and other abatement. There are no moderate-cost opportunities identified in transport.
- There are also higher-cost options (>\$50/tCO_2) would not be delivered by a modest carbon price alone, particularly in the transport sector. The case for whether to support some quantity of these cannot be made solely on the basis of their immediate emissions savings: The ETS will deliver cheaper options. Instead, the case for investment in these options would depend on a separate cost-benefit analysis of whether these are worthwhile to support for technology learning, local energy security, and domestic economic benefits in addition to emissions reductions.

This preliminary MAC curve likely do not capture Chile's full potential for emissions reductions: for example the significant potential to displace new investment in coal with LNG is not identified. There is also likely to be scope for greater energy efficiency improvements, and the Government's Clean Production Agreements NAMA could help to identify more of this potential in the industrial sector. Finally of course any MAC curve should only be treated as an estimate of abatement potential: a key rationale for emissions trading is that a market price for emissions will encourage innovative businesses to uncover low-cost opportunities that were not foreseen.

In summary, based on the MAC curve analysis it seems that a package of policies will be essential for a cost-effective response in Chile, and indeed this is the approach the Government is taking. Dealing with the overlaps and interactions within this policy package will involve both elements of technical design (covered in Section 4.2), and institutional arrangements (Section 4.3) that ensure policies can be integrated at the introduction of the ETS, and this integration maintained over time.

4.2 Initial alignment of ETS and supplementary policies

The introduction of an ETS is an opportunity to re-assess the national energy policy mix, to check that the design details of policy are well aligned and meeting their desired objectives.

Assessing supplementary policies in light of the ETS

With the introduction of carbon pricing, it is possible that some energy policies could be redundant, and able to be phased out. If policies have exactly the same intention as the ETS (i.e. meeting a short-term emissions target), this may be the case. For example, a regulated CO_2 emissions performance standard for industry or power generation would generally be considered redundant in the presence of a carbon price: the goal of both is to reduce CO_2 emissions, and forcing the covered companies to select particular technology options increases the cost of compliance[4]. However there can be subtleties: the same set of policies could be considered complimentary in other circumstances, if they had different objectives. For example,

[4] An emissions standard focused on pollutants other than CO_2 would be complementary rather than overlapping.

the emissions performance standard (EPS) proposed in the United Kingdom is intended to act as a "backstop" to the EU ETS price, to reinforce investor confidence in the long-term viability of low-carbon investments. The EPS is not expected to be binding as a direct carbon constraint, as the carbon price floor introduced at the same time already underpins low-carbon investment, so the EPS could be seen as redundant. However its intention is to improve investor confidence in the overall policy direction, so its success should be measured on that basis, not on whether it is directly controlling emissions levels.

When a supplementary policy has a different intention to the ETS, they can both be justified – for example energy efficiency and technology support policies. Even two price mechanisms can work together if they have different intentions: for example cap and trade and a carbon tax can be combined if the intention of doing so is to provide greater investment certainty via a price floor. However if the intention of both were simply to introduce a price on emissions, then there would not be justification for both.

This does not mean that any supplementary policies identified as theoretically beneficial should be pursued. As each additional policy is added, it will become more and more difficult to co-ordinate the entire package. If it is not possible to adequately manage the interactions between policies because the package is too complex, it may be better to forgo some minor abatement opportunities (even if cost-effective) for the sake of ensuring that the more important elements of the policy package are aligned and work properly.

It is therefore necessary to assess whether the additional abatement or other benefits from a supplementary policy are worthwhile to justify the additional difficulty of brining this policy into an already-complex package. The costs and benefits will be different in presence of other policies, so policies also need to be assessed as a package not separately. Some policies will lose some impact with carbon pricing introduction, others may gain: positive reinforcements between energy efficiency and carbon pricing are identified in Ryan et al. (2011).

As part of this assessment of supplementary policies, a key consideration is which policy overlaps/interactions are significant enough to matter in terms of affecting the functioning of the ETS. A quantitative criterion could be set for this evaluation, such as focusing only on those policies that deliver more than (say) 10% of the abatement required to meet the ETS cap. This would allow government to focus its effort only on the most significant overlaps, and just allow other less significant interactions to have a minor effect on the ETS cap.

If it has been decided to keep existing energy policies when the ETS is introduced, the design should still be reviewed to take into account introduction of ETS. For example higher energy prices can make higher level of intervention in energy efficiency cost-effective. If renewables support is indexed to electricity market prices, the ETS could reduce level of support needed. The design of energy efficiency and low-carbon generation support should also be designed to give much certainty of delivery of CO_2 reductions as possible, in order to reduce unnecessary price uncertainty in the emissions trading scheme.

With a flexible cap-setting process in the ETS (see below), the ETS can adjust for other energy policies, up to a point. However if alternative policies contribute too much of the required abatement, it can be difficult to keep whole system aligned, as evidenced by the experience of the EU ETS. The total scale of abatement from these energy policies therefore needs to be considered at the same time as the overall climate goal and ETS cap are being set.

Setting the initial ETS cap to take into account energy policies

The ETS cap should be set to ensure that a reasonable degree of scarcity remains after emissions reductions from energy efficiency and technology support policies are taken into account. This is basically a re-statement of the principle that emissions trading does not work well if the cap is set too close to BAU emissions: reliable scarcity is needed to generate a positive allowance price and a well-functioning market. During the process of ETS cap setting, modelling should be undertaken to test the settings over a reasonable range of varying circumstances (delivery of energy efficiency and technology policies, BAU emissions). If it is found that the supplementary policies deliver a greater-than desired share of abatement, this is a signal that the cap is not ambitious enough, rather than a signal to scale back cost-effective energy efficiency programmes. The level of investment in high-cost options could however be re-evaluated.

If the ETS target has output-based allocations, the sensitivity to economic conditions illustrated in Figure 4 is reduced (but not completely eliminated) due to scaling of overall production with economic conditions. In this case interactions with both energy efficiency policies are also reduced, but not eliminated. As technology policies still deliver some abatement required under the ETS target, strong interactions still occur and the technology policies will lower ETS prices. In this case, exploring the alignment between the ETS targets and technology support policies will be the most critical issue.

4.3 Policy design to keep the package aligned over time

In addition to aligning energy policies and the ETS at the outset, design elements need to be put in place to ensure alignment over time. Some changes in conditions are to be expected, and indeed one of the benefits of an ETS that it is counter-cyclical with normal variations in economic circumstances, with lower allowance prices when economic conditions are weak. However some economic or policy developments could go beyond the anticipated bounds, causing significant policy imbalances. It can be problematic if misaligned policies are locked in for a long time (e.g. EU ETS at present), as the banking of ETS allowances can mean that this misalignment affects the scheme for a long time into the future. It has been the case for all ETS schemes that caps have been set too high in the early stages of emissions trading, so some flexibility for cap adjustment is a critical feature.

Possible ETS design elements

The ETS cap should be reviewed frequently enough to avoid significant build-up of surplus if cap has been set incorrectly. Mechanisms to consider could be:

- Definition of a rolling cap, set annually but 5 years in advance as introduced in the Australian ETS design. The Australian cap is backed by a long-term default cap in legislation, so there is a balance between medium-term flexibility and long-term certainty.
- Moderate length commitment periods (e.g. 5 years), with a well-understood mechanism to adjust the subsequent period's cap for any significant surplus carried forward due to misalignment of the system.
- Some limitations to banking to avoid "hot air" surpluses being carried forward, while still allowing early action to be rewarded.
- Ceiling and floor price mechanisms in an ETS, which can assist by maintaining coherence between scheduled reviews, as carbon prices cannot diverge wildly from the anticipated values. However this option would complicate international linking (Tuerk et al, 2009).

International linking itself can help mitigate the price impact of energy policy interactions, if a small trading system is linked to a larger international market. For example, permit prices in the New Zealand ETS, which allows unlimited use of Clean Development Mechanism credits (CERs), are strongly affected by CER prices rather than being driven by domestic scarcity. As such, domestic policy overlaps have little influence on the ETS.

It could seem that introducing flexibility in cap setting could create policy uncertainty. It is true that the precise level of allowance supply in any period is less certain under some of the flexibility options listed, but at the same time they create a most consistent requirement of effort from the sectors covered by the ETS, providing investors with greater certainty in terms of investment and operational decisions. Any flexibility mechanism must be agreed and understood well in advance however, as ad-hoc interventions do run the risk of undermining confidence in the system.

Energy efficiency and technology policies also need to be set taking the longer-term carbon price development into account, such as phasing out renewable energy support in line with increasing carbon and electricity prices, to avoid over-payment.

Balancing flexibility and certainty

If there are strong interactions within the policy package, any initial calibration is likely to drift out of alignment over time, or become significantly misaligned by unforeseen shocks, such as the recent global financial crisis. In general, for investment certainty, resetting emissions targets and permit allocations should be initiated only at scheduled reviews, and be subject to criteria well-understood by all involved. Energy efficiency and technology policies should also be tracked and updated to ensure they remain both effective and cost-effective (while bearing in mind the need for investment certainty within these schemes as well). However, it is also possible that a misalignment within the core set of energy efficiency, technology and carbon price policies, or misalignment with economic conditions could be so severe that the benefits of re-establishing policy balance outweigh the damage to investment certainty caused by intervening in the market – as is the case with the current EU ETS intervention. In this case, having pre-established criteria for when such interventions would be contemplated could help maintain investor confidence.

The balance to be struck between providing flexibility to adjust for changing circumstances and certainty around scheme parameters is a difficult one. In the EU ETS, the length of Phase III was extended to eight years to provide greater certainty, yet this has also reduced the flexibility to be able to adjust caps to account for the economic crisis. Learning from this experience, the Australian ETS design proposes to set annual caps on a rolling basis – but to lock these in five years in advance to provide certainty.

4.4 Institutional issues of policy integration

The co-ordination of energy and carbon pricing policies typically requires inter-agency cooperation. In Chile's case, the Ministry of Energy's role as focal point for the ETS project and policy agency for key clean energy policies means that a single agency is responsible for many of the key interactions.

However decisions led by the Ministry of Environment on air quality regulations and other Governmental agencies working on specific projects such as NAMAs, could affect the functioning of the ETS, and conversely the ETS could affect the policies being developed by these agencies. Examples could include tax policy, electricity market reform (if this changes price-setting characteristics), or industrial policies.

Chile has chosen to address this question of inter-agency co-ordination at both the working level (through the steering committee established for Chile's MRP proposal, with representation from the Ministries of Agriculture, Economy, Environment, Finance, Mining and Transport/Telecommunications) and at a high ministerial level through the Council of Ministers for Sustainability (Ministry of Energy, 2012). Other countries such as the United Kingdom have chosen more significant structural reform: in their case creating a new Department of Energy and Climate Change to ensure policy in these two areas is integrated.

Good policy integration across these Ministries will depend on clear direction from the Council of Ministers that the most critical outcome is a coherent package of policies. ETS design will need to accommodate existing energy policies. Equally, other Ministries may need to adjust policy design and implementation to minimise adverse impacts on the functioning of the ETS, for example timing introduction of new policies to fit with ETS commitment periods, and designing policies for certainty of emissions abatement. In some circumstances policies that overlap with the ETS may need to be limited so as not to undermine the ETS: this may not be welcomed by other Ministries unless they are a part of the ETS decision-making process.

This work will need an active inter-ministerial collaboration through the steering committee and Council of Ministers for Sustainability. This process will work best if each Ministry recognises that good policy integration may mean some limitations in their individual policy-making authorities, but gives better result for Chile overall.

5. Conclusions

Emissions trading is a powerful tool in climate change mitigation, but is not a complete solution on its own. Chile's identified mitigation opportunities suggest that a package of policies will be essential in its case. In considering how to manage policy interactions within this package, key findings are:

- Carbon pricing, supplemented by cost-effective energy efficiency and technology policies to improve its short- and long-term efficiency are the "core" policies in a least-cost climate mitigation package. Without the energy policies, a higher carbon price than necessary would result. Policies to address infrastructure lock-in and barriers to financing of high capital-cost clean energy options and the perceived higher risk of these technologies may also be needed.
- The introduction of an ETS is a good time to review existing energy policies for consistency with the ETS. Energy efficiency and technology support policies and the ETS interact and have the potential to undermine one another, so policies need to be designed as a package, taking interactions into account.
- Energy policies that deliver a large share of the required emissions reductions in an ETS with a fixed cap introduce uncertainty in the carbon price: the price has increased vulnerability to economic conditions, and to the delivery of the supplementary policies.
- Policies that have different objectives than the ETS (e.g. they target specific energy efficiency barriers, or seek to bring down technology costs rather than simply aiming to meet a short term emissions objective) can be complementary to an ETS.
- Even where there is theoretical justification to supplement the ETS with further targeted energy policies, the complexity introduced by adding further policies to the package may outweigh the potential benefits of the additional abatement.
- Policy packages should be regularly reviewed to maintain coherence over time. To promote investment certainty, reviews should generally be limited to scheduled intervals and follow understood criteria. In the event of a major unforeseen shock, a judgement is needed on whether the benefits of restoring policy balance outweigh the damage to investment certainty caused by intervening. Having pre-established criteria for such interventions could assist in maintaining confidence.
- Design elements of the ETS can help maintain coherence between these scheduled reviews, e.g. use of rolling cap-setting, output-based allocations, price ceilings and floors, or mechanisms to adjust subsequent commitment period caps to take into account significant surpluses carried forward.
- Good inter-ministerial co-ordination will be essential to delivering this policy integration in practice.

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