Integrating carbon pricing mechanisms with existing energy policies

Guidance for Policymakers

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- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
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Executive Summary

Policies to reduce greenhouse gas emissions are expanding around the world. They are being implemented to deliver countries’ own ambitions to move onto a cleaner development path, and in support of their international climate change commitments. When policymakers are developing their domestic policy packages to drive emissions reductions in the energy sector, an important issue to consider is the alignment of energy and climate policies. Poor policy integration can undermine energy policy objectives such as energy security and affordability, as well as making climate objectives more difficult to meet. Conversely, a well-integrated policy package can reduce the trade-offs and advance the synergies between energy and climate objectives.

This paper focuses in particular on integrating carbon pricing with energy policies that also reduce emissions, such as policies to support low-carbon technologies (such as renewable energy) and energy efficiency programmes.

Policy packages

There is a distinction between climate policies – those with emissions reductions as the primary goal and primary outcome, and energy policies – those implemented primarily for other reasons with emissions reductions one of a number of their benefits. Although the focus of this paper is carbon pricing, important climate policies also include regulation of greenhouse gas emissions, subsidy for emissions-reducing activities, and policies to develop carbon capture and storage.

Energy policies that reduce emissions include:

- Energy efficiency programmes to overcome barriers to cost-effective investment in energy-savings, such as 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.
- Technology deployment policies (including renewable energy support), which drive the deployment of cleaner energy options, for example feed-in tariffs or green certificate systems for renewable energy, or under-writing of nuclear investment.
- Research, development and demonstration support for new energy technologies, which can have a critical impact on emissions over the long-term, but does not reduce emissions significantly in the short term.
- Regulations of conventional pollutants from fossil-fueled power stations to improve air quality.

A carbon price is generally considered necessary for enabling least-cost emissions reductions, and should be cornerstone element of a climate-energy policy package. However, it alone is not usually sufficient. The costs to society as a whole of decarbonisation over the short and long term can be reduced by implementing a package of policies including energy efficiency, technology development and deployment, and support to overcome underlying infrastructure or financing barriers (Figure 1). A key question to ask in developing this package is what each policy is intended to achieve (Matthes, 2010). Multiple policy objectives can justify multiple policies.

Policy interactions

While there is a case for integrated policy packages to respond to climate change, the elements of such a package can interact and either reinforce or undermine one another. In particular, the launch of a carbon pricing policy will create new interactions if it reduces emissions in the same sectors, and over the same timeframe as existing energy policies. The nature of these
interactions can be different for carbon taxes and emissions trading systems.

With a carbon tax, energy policies that also reduce emissions in the same sector and over the same timeframe can either:

- increase the total emissions reductions for a given fixed carbon tax level. Companies see an economic incentive to make emissions reductions where this is cheaper than paying the carbon tax. Energy policies (energy efficiency, renewable energy support) can drive abatement that would not have occurred with just the carbon tax, giving greater total abatement.

- decrease the carbon tax level needed to achieve a given emissions outcome. If the government intends to set the carbon tax level to deliver a particular emissions goal, the required tax level will depend on how much additional abatement the energy policies deliver. The abatement expected from energy policies must therefore be well understood when the carbon tax level is set.

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

An emissions trading system (ETS) can interact strongly with energy policies that also reduce emissions in the same sectors and over the same timeframe, particularly energy efficiency and technology deployment policies. The precise details of this interaction will depend on the design of the ETS chosen: 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 CO₂/MWh). If energy policies rather than the ETS market deliver most of the emissions reductions required to meet an ETS cap, this can leave the ETS market more vulnerable to changing economic circumstances, and can make carbon prices highly dependent on the success of the energy policies.

Policymakers also need to consider pre-existing fuel taxes or subsidies, as a carbon price will not act as expected if these are counteracting its effect. Similarly, policy choices for how revenue raised from carbon pricing will be used can exacerbate or mitigate the effect of policy interactions.
Better management of policy interactions

Because national circumstances will make the optimal policy mix unique to each country, there is not one single set of “solutions” to integrating carbon pricing with energy policies. We propose a set of key stages of policy integration (Figure 2), and a checklist of key questions (Box 1) for policymakers to consider at each stage, to help them uncover relevant policy overlaps which need to be taken into account.

Figure 2: Steps for integration of energy and climate policies

Through answering these key questions, policymakers will be in a better position to understand the specific purposes of different energy policies, the degree of overlaps and interactions (and therefore whether they are complementary or conflicting with each other and with the carbon price), and how these interactions can be managed better at both a technical and institutional level. Understanding these elements sets the stage for the successful introduction of a robust, well-integrated carbon pricing policy, a critical element of a cost-effective climate policy package.
Box 1: Key questions for policymakers seeking to integrate carbon pricing with energy policies

Mapping the energy and climate policy landscape

- What energy policies already exist that also contribute to emissions reductions in the sectors (and over the same timeframe) that the carbon price has effect?
- Do these policies target the emissions externality (i.e. do they seek to price greenhouse gas emissions directly), and/or do they have other objectives?
- Do existing energy efficiency policies have clearly-defined objectives that are complementary to the carbon price?
- Are existing energy efficiency policies on track to deliver the full cost-effective potential for energy savings? (If not, what are the key barriers?)
- What are the objectives (e.g. technology learning, local economic development, energy security, investment certainty) of direct support policies for deployment of renewable energy, carbon capture and storage, or nuclear?
- What quantity of deployment is justified in the local context by these benefits, and at what price?
- What is the nature of the energy sector (regulated, market based), and how will a carbon price be passed-through into energy prices?
- Is there adequate competition and liquidity in energy and carbon markets that the functioning of the carbon price relies on, and do they facilitate entry of new players?
- Are there infrastructure barriers to the integration of clean technologies, and if so do the long-term benefits of addressing these barriers outweigh the costs?
- Are there barriers to financing the higher up-front cost of low carbon technologies? Can cost-effective solutions be devised?
- Are there existing fossil fuel subsidies (explicit or implicit) or taxes that would distort the operation of the carbon pricing policy?

Initial alignment of energy policies and the carbon price

- Are the likely emissions reductions from energy efficiency policies taken into account in the carbon price settings?
- Are the likely emissions reductions from technology R&D, demonstration and deployment policies taken into account in the carbon price settings? Over what timeframe are these emissions reductions expected, and how does this overlap with reductions expected from the carbon pricing policy?
- Do the design of energy efficiency and technology deployment policies need to change to reflect the introduction of a carbon price?
- Does the carbon pricing policy still have “room to operate” after the emissions reductions from other policies are taken into account?
- Do the choices for how carbon pricing revenue is recycled affect supplementary policy delivery (or vice-versa?)
**Designing the package to maintain alignment over time**

- How would the carbon price be affected if energy policies over- or under-deliver on their expected emissions reductions?
- How would the carbon price be affected if economic conditions diverge significantly from forecasts?
- Do energy policies deliver a large share of the required emissions reductions, making the carbon price more sensitive to changes in economic conditions?
- What other “game changing” developments are possible other than economic shocks that would also affect the way the carbon price functions? (e.g. that would result in significant changes in primary energy supply composition, energy demand, or energy prices)?
- Can energy policies be designed to provide certainty of emissions reductions, to facilitate the operation of the carbon pricing policy?
- Even if an energy policy can be justified on a cost-benefit basis in addition to the carbon price, does the complexity added by pursuing this policy (and therefore the potential for misalignment) outweigh the potential benefit of the emissions savings? [That is, could it be better sometimes to have a simpler policy package that is easier to keep aligned but sacrifices some abatement potential?]

**Managing the phase-in of carbon pricing**

- How does the level of the actual carbon price (or emissions cap if an ETS) compare to that theoretically justified by the emissions externality?
- If the carbon price level is initially low (or if it is undermined by existing fossil fuel subsidies), or ETS cap is weak, how will the appropriate level of energy efficiency and technology deployment policies be judged? Against actual energy prices? Or against “shadow” prices that would reflect more optimal carbon pricing?
- How much are rising energy prices expected to influence deployment of energy efficiency actions? If policies to overcome energy efficiency barriers are referenced to current energy prices, does a rising energy price justify greater policy intervention?
- Would supplementing the carbon price with policies to guide investment in long-lived infrastructure be helpful (e.g. guiding investment and retirement decisions in the power sector)?, or would this undermine the carbon pricing policy?

**Carbon pricing and energy policy reviews**

- How often will the carbon pricing settings and other policies be reviewed?
- How will flexibility to adjust for unforeseen changes be balanced against providing certainty and confidence in the carbon pricing policy design?
- What events could justify interventions between these scheduled reviews?
- What design features in the carbon pricing policy could help maintain coherence between scheduled reviews?

**Institutional issues of policy co-ordination**

- Which government agencies will need to co-ordinate their policies with the carbon pricing policy?
- What co-ordination arrangements would work best (options range from consultative committees through to structural public sector reform)?
- Will these arrangements ensure ongoing policy coordination as well as initial alignment of the policy package?
- Are there issues of split decision-making and implementation responsibilities between different levels of government (local, national, inter-government)? How can these be addressed?
Introduction

An increasing number of countries, both developed and developing, are taking action to shift their economies toward low-emissions development and to reduce their greenhouse gas emissions. One policy being explored and implemented as part of this is carbon pricing, which seeks to level the playing field for low-carbon investment and operations by putting a price on greenhouse gas emissions.

One important issue for policymakers to consider when developing a climate-energy policy package is how climate policies such as carbon pricing can integrate with other energy policies that also reduce greenhouse gas emissions, such as policies to support low-carbon technologies (such as renewable energy) 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.

Poor policy integration can undermine energy security and affordability, leading to higher costs to society than necessary, investment uncertainty, an increased risk of stranded assets, and affect the performance of renewable energy policies and energy markets. Climate objectives can also be undermined, through low and uncertain carbon prices and the risk of stop-start policy.

Identifying areas of policy overlap, duplication and synergies, and understanding how to manage policy interactions can improve a country’s climate and energy policy package, reducing the trade-offs and advancing the synergies between energy and climate objectives. This will benefit the country in terms of a more effective and lower-cost low-carbon development path, as well as supporting a more energy-secure future.

This guidance document builds on a report released by the IEA in 2011 titled *Summing up the parts - Combining policy instruments for least-cost climate mitigation strategies* (Hood, 2011), and also learns from case studies undertaken on the energy mix and carbon pricing proposals of South Africa and Chile, and a workshop held at the IEA in March 2013. It focuses on the integration of carbon pricing with energy policies.

The first two sections provide background on the case for policy packages to address energy and climate objectives, and the types on interactions that can be experienced between a carbon price and other energy policies. The paper then outlines solutions for better policy integration, including the key information to be gathered in mapping the climate-energy policy mix, key questions to ask to uncover potential policy interactions, and institutional issues that can become barriers to good policy integration.

Because national circumstances will make the optimal policy mix unique to each country, the “solutions” in this document are framed as a structured series of questions for countries to answer, rather than a set of prescriptive answers. These questions are preceded by explanatory information to help countries understand why these questions are important, and what options exist for addressing them based on other countries’ experiences.

This document is not intended a complete guide to designing carbon pricing policy. It does not address issues such as fitting carbon pricing design to national circumstances or development goals, or policy design to address competitiveness concerns. Rather, this paper focuses on the specific issue of how to align the chosen carbon pricing and energy policies.
Energy-climate policy packages for greenhouse gas emissions reductions

Addressing climate change is a difficult and complex problem because fossil fuel use reaches throughout our economies and societies. There is no one single policy solution, as there are many individual barriers to a transition to clean energy systems. This highlights the importance of a carefully thought-through policy mix.

With growing experience in climate and clean energy policies, there is now clearer understanding of “best practice” in individual policy areas such as energy efficiency and renewable energy, but there is less knowledge about how policies integrate and overlap. This chapter will look at emissions-reducing climate and energy policies, and how they can be combined in coherent packages.

A brief introduction to emissions-reducing policies

As outlined in Table 1, there is a wide range of policies that have an impact on greenhouse gas emissions, spanning the range of pricing, regulation, subsidy, and information policies.

Table 1: A wide range of energy and climate policies reduce greenhouse gas emissions

<table>
<thead>
<tr>
<th>Policy Type</th>
<th>Policy options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price-based instruments</td>
<td>Taxes on CO₂ directly</td>
</tr>
<tr>
<td></td>
<td>Taxes/charges on inputs or outputs of process (e.g. fuel and vehicle taxes)</td>
</tr>
<tr>
<td></td>
<td>Subsidies for emissions-reducing activities</td>
</tr>
<tr>
<td></td>
<td>Emissions trading systems (cap and trade or baseline and credit)</td>
</tr>
<tr>
<td>Command and control regulations</td>
<td>Technology standards (e.g. biofuel blend mandate, minimum energy performance standards)</td>
</tr>
<tr>
<td></td>
<td>Performance standards (e.g. fleet average CO₂ vehicle efficiency)</td>
</tr>
<tr>
<td></td>
<td>Prohibition or mandating of certain products or practices</td>
</tr>
<tr>
<td></td>
<td>Reporting requirements</td>
</tr>
<tr>
<td></td>
<td>Requirements for operating certification (e.g. HFC handling certification)</td>
</tr>
<tr>
<td></td>
<td>Land use planning, zoning</td>
</tr>
<tr>
<td>Technology support policies</td>
<td>Public and private RD&amp;D funding</td>
</tr>
<tr>
<td></td>
<td>Public procurement</td>
</tr>
<tr>
<td></td>
<td>Green certificates (renewable portfolio standard or clean energy standard)</td>
</tr>
<tr>
<td></td>
<td>Feed-in tariffs</td>
</tr>
<tr>
<td></td>
<td>Public investment in underpinning infrastructure for new technologies</td>
</tr>
<tr>
<td></td>
<td>Policies to remove financial barriers to acquiring green technology (loans, revolving funds)</td>
</tr>
<tr>
<td>Information approaches and voluntary</td>
<td>Rating and labelling programmes</td>
</tr>
<tr>
<td></td>
<td>Public information campaigns</td>
</tr>
<tr>
<td></td>
<td>Education and training</td>
</tr>
<tr>
<td></td>
<td>Product certification and labelling</td>
</tr>
<tr>
<td></td>
<td>Award schemes</td>
</tr>
</tbody>
</table>


Within this range of policies, a distinction can be made between climate policies – those with emissions reductions as the primary goal and primary outcome, and energy policies – those implemented primarily for other reasons with emissions reductions one of a number of their benefits.
This distinction is important when designing a policy package to maximize cost-effective emissions reductions. If energy policies are primarily responding to another need, they will not necessarily be implemented or expanded just in response to an emissions reduction goal. The key to maximizing the emissions-reduction impact of energy policies may therefore be to address these separately based on their own wider benefits, rather than trying to use emissions goals or targets to drive them.

**Key climate policies for the energy sector**

**Carbon pricing**

A growing number of countries have introduced or are exploring carbon pricing (emissions trading systems or carbon taxes) to shift their development toward a lower-carbon path and curb their energy-related greenhouse gas emissions.

The transition to decarbonised energy systems will require systemic change, with all investments on a low-carbon footing. This implies the need for a policy instrument with reach throughout the economy, influencing all production and consumption decisions. Carbon pricing has the potential to achieve this, by putting a price on emissions of greenhouse gases to reflect the societal costs of climate change caused by these emissions. The price can either be structured as a carbon tax (directly pricing emissions), or an emissions trading system (where a limit on emissions is imposed, and trading of obligations establishes the price). This gives a direct price incentive for producers to shift toward cleaner investments and operations, e.g., shifting from coal to gas for power generation. Price increases on fossil-fuel derived energy and products also flow through to consumers, influencing their choices.

**Figure 3: Current and proposed emissions trading systems**

Emissions trading systems are seen around the world: in place or scheduled for implementation in EU, California, Quebec, US Northeast, Kazakhstan, Australia, New Zealand, China and Korea.
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and being considered in several other countries (Figure 3). A number of developing countries are now participating in the Partnerships for Market Readiness Program run by the World Bank, which assists them to explore the use of market mechanisms to help achieve their climate change goals (World Bank, 2013).

Carbon taxes have a longer history, with numerous examples in place European countries since the early 1990s, now operating either alongside or in addition to the EU ETS. Carbon taxes are also present in British Columbia in Canada, and Japan. The government of South Africa proposes to introduce a carbon tax from 2015, and carbon taxes are also being considered in China. Carbon taxes can be designed to meet different specific policy objectives (Box 2).

Box 2: Different purposes and design of carbon taxes in Norway, Switzerland, and Japan

Norway
Norway’s CO₂ tax was introduced in 1991, to provide a cost-effective way to reduce emissions. It is applied to oil products, emissions from oil and gas production, and gas used for heating and transport. This was followed by introduction of a Norwegian ETS in 2005, and Norway joining the EU ETS in 2008. Sectors covered by the EU ETS were generally exempted from the carbon tax, with the exception of the offshore oil and gas sector – here the carbon tax level was reduced so that the combined incentive of carbon tax plus EU ETS price is equivalent to levels prior to the introduction of emissions trading. As this sector accounts for 25% of Norway’s emissions, it was considered important not to reduce the incentive for emissions reductions in this sector when emissions trading began. From 2013 the tax level has been increased to offset the falling EU ETS allowance price. The CO₂ tax on offshore oil and gas production has been the key policy driver of carbon capture and storage at production facilities. (Hertzberg, 2013)

Switzerland
The Swiss CO₂ levy is intended as an incentive for energy efficiency and for shifting toward cleaner heating and process fuels, not to raise revenue. Revenue raised is redistributed to the population and economy. It has been in place since 2008, starting at a level of 12 CHF/tCO₂. The law governing the CO₂ levy provides for automatic increases in the levy level if predefined emissions reduction objectives are not met. As a result, the levy was raised to 36 CHF/tCO₂ in 2010, and further increases up to 120 CHF/tCO₂ are possible from 2014. (Mortier, 2013)

Japan
In October 2012 Japan introduced a new carbon tax, with the aim of raising revenue for energy efficiency and renewable energy programmes, not as a direct price incentive. This is in part because Japan already has high energy prices and efficient use of energy: the government’s analysis found that use of revenue raised is more powerful in reducing emissions than response to the price itself. The tax starts at a level of JPY 289/tCO₂, and will increase gradually over 3½ years. (Kihara, 2013)

For either a carbon tax or emissions trading system (ETS) there is generally revenue raised that can be used to offset the negative macroeconomic impacts of energy price rises. The objective of carbon pricing is to shift economic activity from high- to low-carbon activities, not to reduce economic activity overall.
Subsidies/ crediting for emissions-reducing activities

Another way to level the playing field for clean-energy investment and operations is to subsidise clean alternatives rather than put a price on those that emit greenhouse gases. This can take the form of direct subsidy programmes, or mechanisms that provide “credits” for the emissions reductions arising from projects compared to baseline emissions. The Clean Development Mechanism (CDM) under the Kyoto Protocol is an example of such a crediting mechanism.

Subsidy or crediting schemes can be politically easier to implement than carbon pricing, as they do not raise energy prices to the same extent. However there are downsides to these policies:

- Subsidies generally rely on government budgets, so can be vulnerable to cuts in difficult economic circumstances. Political uncertainty in funding can be detrimental to investor confidence, and slow the growth of clean industries.
- Crediting mechanisms are reliant on external demand for the credits generated, so domestic objectives around economic transformation to low-carbon can be undermined if this demand does not emerge. The CDM is currently oversupplied with credits, because the current modest climate targets of developed countries can be met without extensive purchase of credits.
- In both cases, the price signals are effective only for individual projects or narrow sectors of the economy. Given the all-encompassing nature of the transition to low-carbon, these policies can provide a valuable starting point, but will not be sufficient to drive the long-term decarbonisation transition.

Regulation of greenhouse gas emissions

A number of countries have introduced regulatory controls of the greenhouse gases emitted by new and/or existing fossil fuel infrastructure. Because these policies are more tightly targeted than carbon pricing they are in theory less economically efficient, as specific mitigation actions are required over potentially cheaper alternatives.

However they may also be more effective as there is less ambiguity about what actions companies are expected to take. Regulation may also have an important role to play in driving the retirement of existing old, high-emissions infrastructure, particularly if a high and stable carbon price is not feasible.

Emissions performance standards for new fossil-fuelled power generation are in place in the United Kingdom and Canada, both limiting new construction to be no more emissions-intensive than natural gas. This acts as both a driver to shift from coal to gas-fired generation, and an incentive to develop carbon capture and storage technologies. In September 2013 the United States Environmental Protection Agency (EPA) published regulations to limit emissions of newly-constructed power plants, effectively requiring carbon capture and storage for any new coal-fired generation.

Emissions from existing power plants can also be tackled by regulation. In this case the policy objective being to phase down emissions from the existing generation fleet, providing a necessary complement to regulations addressing new build. In Canada, coal-fired power plants are subject to gradual phase-out provisions: once existing plants reach the end of their economic lifetime, they will have to be upgraded to meet higher emissions standards or closed. In the United States, the President has directed the EPA to propose regulations to control the emissions of existing power stations by June 2014, and finalise these by June 2015.

If regulated emissions-reduction obligations can be traded among the companies covered, these regulations can evolve into a form of emissions trading. An example of this approach is the clean energy standards (CES) in place in some states in the United States, and proposed nationally in
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2012. Under a CES, permits are awarded for each unit of clean electricity generated, on the basis of avoided emissions compared to a baseline of coal generation. The tradability of permits creates a price for emissions savings, mirroring the functioning of an ETS.

Policies to develop carbon capture and storage

The IEA sees carbon capture and storage (CCS) as a key technology for long-term decarbonisation of the energy sector, with the potential to contribute one-sixth of the CO₂ emission reductions required in 2050. Unlike other technologies that contribute to emissions reductions, the motivation for CCS is only to reduce greenhouse gas emissions, so it will be driven by climate rather than energy policies.

The current decade is critical for moving CCS beyond the demonstration phase. The recently-released IEA technology roadmap for carbon capture and storage highlights critical actions and policies over the next seven years that can achieve realistic results across the whole chain of capture, transport and storage technologies and operations (IEA, 2013). Governments are already active in supporting the development of CCS through RD&D support, subsidies, regulation and CO₂ taxes, but these efforts need to be scaled up.

Key energy policies that reduce emissions

Energy Efficiency

Ignoring energy efficiency opportunities can be costly. The primary motivations for energy efficiency policies are generally cost savings to consumers and society as a whole and improved energy security (through reducing electricity or oil demand), with emissions savings a positive by-product rather than the primary motivation.

Because energy efficiency policies can save money, the associated emissions reductions can come at low or even negative cost from a societal or even an individual perspective. Although cost-effective, these options are often left untapped because of 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 targeted energy efficiency policies. If energy efficiency potential is unlocked, some higher-cost policies and measures are no longer needed to meet a given emissions reduction goal, lowering the overall cost to society of decarbonisation.

Energy efficiency policies include performance standards, information and labelling, and energy provider obligations in lighting, equipment and buildings. The IEA’s 25 Energy Efficiency Recommendations provide a basis for action that could save as much as 17% of current annual worldwide energy consumption by 2030. The IEA encourages all countries to consider these policies in context of their economy priorities (IEA, 2011a).

Development and deployment of low-carbon supply (renewable energy, nuclear)

Technology support policies span a continuum from research and development (R&D), to demonstration projects, then to support for deployment. Individual technologies will move along this continuum as they mature (IEA, 2012a). Policies targeted at early-stage technologies (that is, R&D and demonstration project support) will have limited impact on current emissions levels, but could have a significant impact on longer-term trends. As such they are unlikely to cause troublesome policy interactions in the short term, but should be considered in long-term settings of the carbon pricing policy. On the other hand, policies that support the deployment of cleaner energy options, for example feed-in tariffs or green certificate systems for renewable energy, or
under-writing of nuclear investment can significantly reduce emissions in the short term. There is a growing evidence base for which policies are effective and cost-effective in driving development and deployment of renewable energy (IEA, 2011b). The objectives of these policies usually go beyond short-term emissions reductions, including:

- Domestic priorities such as energy security, local economic development, and reduced local air pollution.
- To start the ramp-up of technologies that will be needed on a large scale in the future. Scaling up some technologies will take time, so may need to begin early to reach a level appropriate to reach a cost-effective low-carbon energy system over the long term (Vogt-Schilb and Hallegatte, 2012).
- To bring down technology costs with increasing deployment. This can lower the cost to society of the total transition to low-carbon energy systems. The prospect of a rising future carbon price should spur innovation to develop future technologies, but uncertainty in forward prices or the level of political commitment to carbon pricing could reduce innovation activity. Even with ideal and certain policy, investors do not capture the full economic benefit of developing new technologies, so there is a case for some research and development and deployment policy support (Philibert, 2011). However the quantity and timing of early deployment must be carefully considered. This cost-benefit assessment should consider how quickly technology 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, 2012a).

Support for technology development and deployment can lower the cost to society and increase the feasibility of low-carbon development over the long-term, although to realise these long-term benefits can require some higher costs in the short term.

**Regulation of conventional pollutants from fossil-fuel power generation**

Regulations of conventional pollutants from fossil fuel generation will also have an impact on greenhouse gas emissions, but in this case the regulations should be considered energy rather than climate policy: the emissions reductions are a secondary benefit. For example, United States regulation of conventional pollutants is expected to reinforce incentives for retirement of inefficient coal plant, which are already affected by low gas prices. One study found 59 to 77GW of coal capacity is likely to be retired, depending on the stringency of regulations (Brattle, 2012).

**Underpinning policies: markets, infrastructure and finance**

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

- Carbon pricing will not function well in a market setting if there is not adequate energy market competition and liquidity, and if markets do not facilitate entry of new players.
- Regulatory barriers to passing through a carbon price, or pre-existing pricing distortions such as uneven energy taxation or energy subsidies can also undermine the functioning of the carbon pricing policy.
- If there are infrastructure barriers to the integration of clean technologies or behaviours (such as shifting to public transport), this will raise the cost of deploying these options.
- 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 address these issues can lower the cost and increase the quantity of abatement delivered, by improving functioning of markets, the ability of carbon prices to be
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passed appropriately through the economy, supporting critical underpinning infrastructure (such as smarter electricity grids or public transport networks), or providing financing mechanisms. These interventions would still need to be subject to individual cost-benefit analysis – in some cases it may cost more to overcome the barrier than is saved.

**The case for packages of energy-climate policies**

Having looked at the broad range of possible climate and energy policies that reduce emissions, the question is how these can or should be combined in coherent policy packages.

A carbon price is generally considered necessary for enabling least-cost emissions reductions, and should be the cornerstone element of a climate-energy policy package. However, it alone is not usually sufficient. First, low-cost emissions reductions (particularly in energy efficiency) can be blocked by non-price barriers. Second, the long-term costs to society of moving to a cleaner development path can be reduced by the development and deployment of new technologies. Integrating these three key policy areas therefore has the potential to reduce the cost to society of decarbonisation over the short and long term.

As already discussed, the reality is that both energy efficiency and technology deployment policies usually also have other primary objectives, such as enhancing energy security, so they are likely to play some part in the energy policy mix regardless of emissions goals. Climate policies therefore need to take into account these pre-existing policies.

Further policies may also be justified given the social benefits of underpinning infrastructure such as electricity grids, improved functioning of markets, or to help overcome financing barriers to the high up-front costs of low-carbon investment. Finally if there is significant unavoidable policy uncertainty (for example because of the lack of internationally-agreed climate targets), then additional targeted policies may be needed to guide investment more clearly and avoid short-sighted investment decisions that would lock-in high emissions infrastructure, increasing societal costs over the long term.

**Energy efficiency policies alongside a carbon price**

If a carbon price has been introduced, energy efficiency savings can also lower the economy-wide carbon price necessary to meet a given emissions target, and the costs to society as a whole of meeting the climate objective. In Figure 4(a), a carbon price of $P^*$ is needed to deliver an emissions reduction goal of $Q^*$. Figure 4(b) shows that if negative-cost 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 important.

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 whether energy efficiency policies are cost effective: assessing emissions reductions alone is insufficient (Ryan and Campbell, 2012).
Figure 4: Ignoring energy efficiency potential can lead to higher carbon prices

Policies to deploy clean energy supply technologies (e.g. renewable energy) alongside a carbon price

When a carbon price is introduced, the question is often raised as to whether more expensive emissions reductions from direct support to renewable energy, nuclear or CCS are still justified. The answer is that they can be, because these policies are generally targeted primarily at other policy objectives.

Once the carbon price reaches a level that fully reflects climate change damages, this price should stimulate the correct level of emissions reductions in the short term. From the narrow perspective of the short-term climate target, higher-cost emissions reductions from targeted renewable energy or technology support simply raise costs.

However these policies may still be worthwhile on the basis of their other objectives such as energy security, local environmental benefits, and technology learning that can lower costs over the long term. The question of what quantity of targeted renewable energy and other clean energy deployment policies to continue (and at what level of subsidy) should therefore depend on an assessment of whether these benefits exceed costs over the long term.

Summary: policies and policy packages for emissions reductions

In making the case for whether individual energy and climate policies should be kept, discarded, or amended when developing an integrated policy package, a key question is to ask what each 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 within the policy package, and to determine what level of support for each policy is justified. In all cases, a cost-benefit analysis can help decide whether it is worth intervening to overcome the barriers identified, making sure however to assess all relevant costs and benefits.

If the carbon price set at an optimal level and there are no existing distorting energy taxes or subsidies, then energy policies that have the same objective as climate policies – simply to reduce emissions – may be redundant and should be re-evaluated. Of course if the carbon price starts at a lower level, other policies may be justified to prevent inefficient lock-in of high emissions infrastructure in the interim. Similarly, if there are pre-existing price distortions (such as implicit fuel price subsidies), then an equal carbon price does not necessarily lead to efficient and cost-effective investment.
While the details of a cost-effective policy package will vary between countries and regions, in general, a package of policies incorporating energy efficiency, some renewable energy and other clean energy technology development and deployment, and a carbon price is usually appropriate, as illustrated in Figure 5.

**Figure 5: The core policy mix: a carbon price, energy efficiency and technology policies**

Most energy policies will have objectives other than direct pricing of emissions, so can be complementary to a carbon price. These additional objectives need to be understood and quantified in order to integrate these with the carbon price, and to consider whether their policy design should be adjusted. For example, energy efficiency policies are generally designed to overcome specific barriers (information, incentive, behavioural) that prevent realising low-cost energy savings, 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 (IEA, 2012a). A narrow focus only on the short-term abatement costs misses these critical aspects.
Interactions between carbon pricing and energy policies

The previous section argued that there is a case for integrated policy packages to respond to climate change. However the elements of such a package can interact and either reinforce or undermine one another. There is therefore a need to consider how existing and planned policies can be integrated into a coherent package to ensure an efficient balance of action across the economy, and therefore the most cost-effective policy response.

In particular, the launch of a carbon pricing policy will create new interactions with the existing energy policy mix. This section explores these potential interactions separately for carbon taxes and emissions trading systems, because although these are both carbon pricing instruments they interact differently with existing energy policies.

Energy policy interactions with carbon taxes

Energy policies that also reduce emissions in the same sectors and over the same timeframe as the carbon tax can either increase total abatement for a given carbon tax level, or alternatively will decrease the carbon tax level needed to achieve a given emissions outcome. Policies applying in different sectors do not interact in this way. The nature of interactions will critically depend on the long-term vision for the carbon tax policy:

- The carbon tax could be adjusted and re-adjusted over time to achieve particular emissions objectives (e.g. the tax level is set and adjusted to meet a national or sectoral carbon target). In this case, the energy policies can affect the level of a carbon tax. For example if energy efficiency policies are successful in overcoming barriers to significant low-cost emissions savings, a lower carbon tax will be needed to deliver the remainder of the goal. In this case, it is important to assess the emissions reductions expected from other policies, so that the tax level can be set accurately.

- The carbon tax could be established as an independent policy with a clearly defined price path into the future that will not be adjusted. The energy policies could generate additional abatement but will not feed back to influence the carbon tax level. In this case, the energy and climate policies act more independently, but the overall outcome in terms of emissions reductions is uncertain.

- The carbon tax could be set at a low level with its purpose to raise revenue for energy efficiency or renewable energy programmes, rather than being intended to directly influence producer or consumer behavior by the price itself. In this case, the quantity of energy policy action is determined by the tax level, so there is a close linkage.

Under carbon pricing policies introduced to date, emissions intensive industries have usually been given protection in the form of free allowance allocation (in an ETS) or negotiated tax exemptions (Hood, 2010). The detailed design of these mechanisms can lead to interactions with other policy instruments. For example, if negotiated carbon tax exemptions are linked to an obligation to undertake energy efficiency activities, then policymakers will need to decide how these companies can use other energy efficiency financing or support programmes to meet these obligations. Overall energy efficiency targets should also be set taking any additional energy efficiency actions prompted by the climate policy into account.

Finally, in addition to considering the effect of energy policies on the carbon tax, policymakers will need to review the effect of the carbon tax on energy policy design. The introduction of a
carbon price, resulting in higher energy prices, could reduce the payment levels needed in renewable energy or energy efficiency support policies if they are designed as top-ups to electricity prices. 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 tax and associated information campaigns focus consumer attention on effective energy saving opportunities that will offset the impact of the carbon tax, then some of the blocked energy efficiency potential could be unlocked alongside the introduction of the carbon tax. Conversely, the carbon price increases the energy efficiency potential that is cost-effective based on current energy prices\(^1\), so if consumers do not respond, it could justify a scaling-up of energy efficiency programmes to unlock this additional blocked potential.

### Energy policy interactions with emissions trading systems

An emissions trading system (ETS) can interact strongly with other energy policies that also reduce emissions in the same sector and over the same timeframe, particularly energy efficiency and technology deployment policies. The precise details of this interaction will depend on the design of the ETS chosen: 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). Each of these two basic designs can be modified in a multitude of ways, for example by introduction of ceiling and floor prices to provide greater price certainty. This section will consider only the policy interaction characteristics of the two basic policies: modifications will be considered in Section 4 as part of the discussion on how to manage policy interactions.

**ETS with a fixed emissions cap (“cap and trade”)**

Because energy efficiency and technology deployment policies reduce emissions, they deliver some of the emissions reductions required to meet the ETS cap. This reduces the quantity of emissions reductions that must be delivered by the ETS market, and so reduces demand for ETS allowances and hence their price. The energy policies do not deliver additional reductions on top of the ETS cap, rather they displace abatement that would otherwise have been delivered by companies covered by obligations in the ETS market. There is a risk that if the energy policies deliver too much of the abatement required to meet the ETS cap, the ETS allowance price could be reduced to the point where it no longer provides a clear signal for clean investment. The challenge is to balance the desire to minimise short-term compliance costs for participants by keeping ETS allowance prices low, with keeping prices high enough to stimulate private investment in low-carbon assets, which in turn will reduce societal costs over the long term.

Any uncertainty in the emissions reductions that will be delivered by the energy policies can create uncertainty in ETS allowance prices, which could also undermine investment. In the example shown in Figure 6, an absolute emissions cap is set 30% below BAU. Emissions reductions are delivered in part by targeted energy efficiency and technology deployment policies (for example a renewable energy feed-in tariff), with the remainder delivered by the ETS market. If the energy policies deliver less than expected, pressure on the ETS market increases, raising allowance prices. If they deliver more than expected, pressure on the ETS market reduces and allowance prices will fall. Such price uncertainties create an additional risk for investors, and this type of uncertainty has been shown to delay investment decisions (IEA, 2007).

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\(^1\) 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 6: Policy interactions can significantly impact ETS prices.

If energy policies deliver a large share of the emissions reductions required to meet the cap, this also makes the ETS more sensitive to changes in economic circumstances. In the example shown in Figure 7, a 5% change in (or miscalculation of) BAU emissions halves the effort required under the ETS, because the energy efficiency and technology deployment policies deliver such a large share of the required reductions.

Figure 7: Energy policies can amplify the impact of changing economic conditions on ETS scarcity

In countries where electricity prices are set in a wholesale electricity market, energy efficiency and renewable support policies will also have an effect on the supply-demand balance of the electricity market. Energy efficiency policies can reduce electricity demand, displacing high-
emissions marginal generation. Policy-driven deployment of renewable generation will also displace marginal thermal generation in the market. In both cases the emissions reductions may reflect the marginal, rather than average, emissions of the electricity sector. If the ETS cap is set without taking into account this difference between marginal and average emissions factors (effectively underestimating the emissions reductions expected from the energy efficiency and renewable support policies) it could be set too weakly, potentially undermining ETS prices and disrupting the intended balance between the ETS and other policies.

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 for renewable energy support, if payments are structured as a top-up to market energy prices. The optimal level of policy intervention in energy efficiency may change, with the carbon price stimulating some response by consumers but simultaneously increasing the cost-effective potential based on current energy prices.

**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 versus 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 mechanism.

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 a system, the CO₂ obligation is indexed to the quantity of energy sold or industrial production: that is, the obligation per unit of production stays the same if production levels change. For example 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 decrease emissions per unit of industrial product. In terms of the dynamics of the ETS market, total demand for allowances falls with decreasing production, but allowance 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 supply-demand balance in the ETS market. However technology deployment policies such as renewable energy feed-in tariff or green certificate schemes 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 CO₂/MWh and contributing to delivery of the ETS target. As with cap and trade, 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 compliance costs with keeping ETS permit prices high enough to stimulate appropriate long-term investments.

An output-based ETS can have less impact on energy prices than a fixed cap, if obligations (and therefore costs passed through to energy consumers) are only for emissions exceeding the target level rather than for all emissions. In this case, there is likely to be less need to adjust energy efficiency or technology deployment policies’ parameters in response to electricity price rises. Given the lower price impact there may also be less need to compensate energy-intensive
industries, so interactions between energy policies and these exemption mechanisms should be less problematic.

Negative or redundant policy combinations

Some examples of negative policy interactions should be emphasised. One theoretically redundant (and hence costly) policy combination is to attempt to increase carbon prices by adding a carbon tax on emissions already covered by a trading scheme or other market mechanism. Because total emissions are set by the ETS cap, the additional emissions reductions prompted by the tax simply enable equivalent emissions to be generated elsewhere, up to the level of the cap. The lower demand for ETS allowances means their price drops, so that the total (tax + permit) price is unchanged. However the situation can be more subtle if the tax and trading scheme have different purposes. For example, a carbon tax can be introduced in the same sectors as an ETS to create a price floor in the ETS system. The objective of this policy is to create more certainty for investors, rather than to raise the price, so in this case the two policies can potentially work together. If the carbon tax were introduced in different sectors to those covered by the ETS, there would not be a conflict.

A second potentially counterproductive combination is the addition of a technology standard or regulation for activities already covered by a carbon price. In theory, the carbon price should drive an efficient least-cost level of investment and operational changes, so targeted regulations that require particular solutions to be implemented will raise costs. However, there can be subtleties depending on the precise purpose of the regulations. As part of its package of electricity market reforms, the United Kingdom is introducing an emissions performance standard (EPS), requiring new generation be no more emissions intensive than natural gas. The EU ETS carbon price, and UK carbon price floor are already expected to make new investment in coal-fired power generation unattractive, so the EPS is not expected to be binding. As such, it can be argued that it is redundant. However the justification given for this policy is that it provides a backstop to give greater investor certainty and confidence, given current uncertainty about the future settings of the EU ETS. To the extent that this regulatory backstop really does improve confidence in low-carbon investment (and therefore lowers the required cost of capital for investment), it may be justified even if it is never a binding constraint. In this case, the assessment on whether the EPS is worthwhile would depend on the cost savings associated with increased investment certainty (if this is in fact the outcome, rather than a delay in all new investment in favour of running existing plants), weighed against the costs of implementing the policy.

The impact of pre-existing fuel taxes or subsidies

The theory of carbon pricing is that it will correct fuel prices to account for the environmental impacts of greenhouse gas emissions, leading to efficient energy supply and consumption decisions to be made on a market basis across the economy. However if pre-existing fuel taxes or subsidies distort the pricing of fuels (and therefore distort the relative prices between cleaner and dirtier fuels), then adding a carbon price alone will not result in efficient pricing.

IEA analysis has found that global fossil fuel consumption subsidies totalled USD 523 billion in 2011, compared to subsidies for renewable energy at USD 88 billion worldwide. Fossil fuel subsidies are an inefficient way of addressing fuel poverty concerns, with much of the benefit from subsidies going to higher-income consumers. While energy pricing reforms can be politically difficult, they can have significant economic, social and environmental benefits (IEA, 2012b).
The introduction of carbon pricing is therefore a good opportunity to assess the overall energy taxation and subsidy regime and set a timetable to move to more efficient pricing if necessary. If pre-existing price distortions cannot be corrected in the short term, then this should be factored into decisions on which energy policies will be packaged with the carbon price: additional transitional policies may be justified to compensate for the lack of an efficient price signal for some fuels or in some sectors.

**Use of carbon pricing revenue and policy interactions**

The revenue generated from carbon tax or ETS can be used in various ways. If used to stimulate the economy such as reducing labour or capital taxation (offsetting the dampening macroeconomic effect of energy price rises), there can even be a net positive economic result overall from the introduction of a carbon price (Parry et al., 1999).

Because carbon prices are passed through into product prices (electricity, or energy-intensive goods like steel, cement and aluminium), there can also be an interaction with wider policies relating to energy access and affordability, and industrial competitiveness. Carbon pricing policies are therefore generally coupled with compensating measures for strongly affect industry and low-income households to help them cope better with energy price rises, funded with part of the proceeds from the carbon tax or ETS auction revenues. Revenue can also be used to fund further efforts to address climate change, including through energy efficiency programmes, incentives for clean energy deployment, and RD&D for new technologies.

It is important to note that choices on the use of revenue can affect the balance of the overall energy-climate policy package, which can in turn affect carbon prices over the long term. For example, the European Union’s policy for funding RD&D for new technologies has been the “NER300” policy, under which some EU ETS allowances are auctioned to fund technology development. While this provides a dedicated revenue stream (so is less vulnerable to the reduced availability of public funds after the financial crisis), the low price of allowances in the EU ETS means that there is far less funding available than was originally anticipated for technology development. If key technologies are delayed, this could significantly raise costs and carbon prices over the long term. The IEA’s WEO2011 found that if CCS is delayed by ten years, then the costs of staying on track for limiting temperature rise to below 2C rises by USD 1.1 trillion globally.

**Box 3: Managing electricity price rises from a carbon price**

There can be a tension between electricity price rises sending a signal for changed consumption patterns, versus energy affordability and energy access priorities. There are several options to manage this in carbon pricing design:

- Carbon tax or ETS auction revenues can be used to offset the impact of price rises for low-income consumers and companies whose competitiveness is threatened.
- Cost-effective energy efficiency potential should be unlocked to the maximum extent possible. Greater efficiency means a lower carbon price is necessary for a particular emissions goal.
- Output-based emissions trading with free allocation (or tax-free thresholds in a carbon tax) can be used to maintain the correct price signals for investment and operational decisions at the margin, but reduce overall price impacts for consumers.

These types of interventions come some at a cost from a macro-economic perspective, reducing efficiency compared to a situation where revenue is used to reduce existing labour or capital taxation.
Solutions for better policy integration

National circumstances and energy systems are unique, as are the design details of policies that are implemented to reduce emissions in each jurisdiction. As such, the particular issues of policy overlap and interaction will be different, so there is not one set of answers to solve the challenge of policy integration.

However the general areas that need to be addressed by policymakers are common, so in this Section we propose a “checklist” approach to key issues that policymakers should consider when introducing carbon pricing or reviewing energy-climate policy packages that include a carbon price.

The issues fall into six categories, as show in Figure 8.

Figure 8: Steps for integration of energy and climate policies

Mapping the energy and climate policy landscape

The first step in assessing and managing policy interactions is collecting key information on both the carbon pricing policy and relevant energy policies and developments. This will involve both the agency developing the carbon pricing policy and those agencies in charge of energy policies. The carbon price will significantly overlap with those energy policies that act in the same sectors over the same timeframe and 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

The policies and actions identified could be energy efficiency, technology deployment (e.g. renewables), but also fuel taxation or subsidy, decisions on underpinning infrastructure (LNG terminals, transmission lines), energy access goals/policies, public transport infrastructure investment etc. If carbon pricing parameters are being set or signaled for a long time into the future, the impacts of RD&D funding could also become relevant. Note in particular that if electricity generation is covered by the carbon price, any major policies that affect electricity supply and demand are relevant, even if the demand reduction occurs in sectors not facing a direct carbon price obligation such as the residential sector.
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For both the carbon pricing policy and energy policies, important information to assess the potential for interactions (and how to manage them) includes:

- the agencies/branches of government responsible for development and implementation of policy;
- the purpose of policy (i.e. is it to raise revenue, or to drive emissions reductions via price changes, to address non-market barriers, to develop technology etc.);
- sectoral coverage;
- anticipated emissions reductions in sectors covered over the chosen timeframe;
- anticipated impact on energy demand and energy prices;
- what review process is planned or anticipated, and whether there are natural review points for the policy;
- the nature of carbon pricing policy: if a carbon tax, is the level fixed long term, or will it be adjusted in line with a carbon budget or target? If an emissions trading system, does it have a fixed or intensity-based cap?;
- what consideration of policy overlaps has already been taken (if any); and
- the structure of the energy sector and energy price formation: e.g. whether markets or regulation set prices, existing taxes and implicit or explicit subsidies, pass through of carbon prices.

In assessing policy interactions, it makes sense to address the largest overlaps first: focusing on top 5-10 policies (or groups of policies e.g. an energy efficiency programme) that have the largest impact on reducing emissions.

Finally, it is also useful to ask whether the policy landscape complete. Generally, if cost-benefit analysis supports them, in addition to a carbon price most countries would want some form of:

- technology deployment policies (e.g. renewable energy feed-in tariffs or green certificate schemes). Choices here will strongly reflect national circumstances: what are key technologies that will be relevant for the future, and what role does nation want to play in developing these? Decisions on technology support will often be based on energy security and other drivers.
- energy efficiency policies, to make sure that cost-effective emissions reductions are maximized, lowering costs to consumers and society.
- Support for critical underpinning infrastructure and financing.

Although this analysis deals with the integration of carbon pricing with energy policies, similar issues of policy overlap and interaction can occur with other climate policies, including regulatory obligations such as emissions performance standards. In particular, where regulatory obligations are tradable, such as under a clean energy standard (CES) that requires an increasing share of clean energy over time, overlapping policies may go some way to delivering the regulatory requirement, affecting prices in the CES market.
Managing interactions in the policy package

The introduction of a carbon price 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. It is possible that some energy policies could be redundant and able to be phased out. For other energy policies, design details may need to be adapted to ensure the climate-energy package is, and remains, well aligned. The design of the carbon pricing policy must also take existing energy policies into account.

Assessing energy policies in light of the carbon price introduction

A first step is to consider whether any existing policies are made redundant by the introduction of a carbon price. If there are policies that have the same objective – to directly price greenhouse gas emissions – then this could be the case.

However as discussed previously, when policies have different objectives they can be justified as long as their benefits exceed costs. 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 objective of doing so is to provide greater investment certainty via a price floor, or if the two policies cover different sectors. However if the objective of both were simply to introduce a price on emissions within the same sector, then there would not be justification for both.

This does not mean that any policies identified as theoretically beneficial should be pursued. As each additional policy beyond the “core” set of a carbon price, energy efficiency and technology support policies 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 can stay aligned and work properly.

Policymakers therefore need to assess whether the additional abatement or other benefits from each policy are sufficient to justify the additional difficulty of including it in 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). This highlights the importance of ex-ante modelling of interactions for the assessment of policy packages, as was undertaken during development of the European climate and energy package.

As part of this assessment of energy policies, a key consideration is which policy overlaps/interactions are significant enough to have a strong interaction with the carbon price. 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 emissions target, or simply focusing first on the top 5 to 10 overlapping policies. This would allow government to focus its effort only on the most significant overlaps, ignoring others with a minor effect.

The design details of energy policies that will continue alongside the carbon price should also be reviewed. For example higher energy prices could make higher level of intervention in energy efficiency cost-effective based on current energy prices, if the carbon price does not itself stimulate greater consumer attention to energy efficiency. If renewables support mechanisms are indexed to electricity market prices, the carbon price could reduce level of support needed.

**Managing interactions with a carbon tax**

*Initial policy alignment with a carbon tax package*

Because the emissions reductions resulting from energy policies do not change the level of the carbon tax, the price signal seen by companies and consumers subject to the carbon tax is not affected by them. As such, companies’ decisions to invest in emissions-reducing options should be unchanged. Energy policies can therefore deliver additional abatement to the carbon tax if they target opportunities that would not have been delivered by the carbon tax alone. On the other hand, if the carbon tax level is to be set (and adjusted) in order to deliver a specific climate goal, then the inclusion of energy efficiency or technology (e.g. renewable energy) deployment policies can allow a lower tax level to be set than would otherwise be the case to achieve a given level of abatement.

Cost-benefit analysis can guide target-setting for energy efficiency and technology policies, based

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2 Documentation relating to the modeling exercises undertaken during initial policy design and as part of the 2010 review can be found at [http://ec.europa.eu/clima/policies/package/documentation_en.htm](http://ec.europa.eu/clima/policies/package/documentation_en.htm)
on their specific policy objectives. However policymakers still need to ensure there is a balance between price-driven reductions, technology policy and energy efficiency. This means setting a sufficiently ambitious emissions reduction target so that there is still the need for the carbon tax after emissions reductions from other policies are taken into account.

**Policy design to keep a carbon tax package aligned over time**

Because one of the major benefits of a carbon tax (compared to emissions trading) is price certainty, consideration should be given ex-ante to how and whether the carbon tax will be adjusted over time (e.g. identification of triggers for considering adjustments), and how this could change the interaction with energy policies.

If the approach being taken is to keep the carbon tax fixed on a known price path over a long period to support investment certainty, then there is no guarantee of the price delivering a particular emissions objective. In this case, other policies may need to be scaled up to deliver a given climate goal, raising costs and unbalancing the policy package.

Alternatively, if the intention is to adjust the carbon tax periodically based on what price is needed to deliver emissions goals, then there could be significant swings in the carbon price between target periods. In this case, the quantity of abatement to be delivered by other energy policies needs to be balanced with abatement from the carbon tax. Additional investment in renewables and other energy policies can mean that a lower carbon price is needed to achieve a given carbon budget. However if the energy policies deliver all the reductions required, then the carbon tax level would be too low to provide any real incentive for low-carbon investment, reducing the long-term efficiency of the system. In this case, a solution would be to move to a more ambitious climate target, allowing the carbon tax to work as intended and balancing effort across the economy.

Any significant shifts in underlying infrastructure or primary energy supply could significantly affect how much abatement can be expected for a given tax level, or what tax level is needed to deliver a particular emissions reduction goal. If significant quantities of less carbon-intensive energy enter the supply mix, this could lower the carbon price needed to meet climate goals, or equally could make a more ambitious target possible. If the carbon price is intended to give long-term price signals for clean investment, consideration should be given of how to manage these potentially large swings in abatement potential (and hence carbon tax prices), against confidence in delivery of the country’s climate targets. It may be necessary to strike a balance: for example signalling a price “band” for the carbon tax, while allowing some flexibility to adjust it for changing circumstances.

To balance the policy package, it is important to undertake modelling to test the tax and linked energy policy settings over a reasonable range of varying circumstances (delivery of energy efficiency and technology policies, BAU emissions), to find a balance that will enable all policies to function and climate goals to be met over time.

The appropriate level of other policies can also change over time: for example the rising electricity price would make more energy efficiency opportunities cost-effective at current energy prices, which may justify a greater level of intervention to overcome market failures and unlock any blocked energy efficiency potential.

**Managing interactions with an ETS**

**Initial policy alignment with an ETS package**

In addition to the general principle of phasing out targeted support policies as energy prices rise,
the design of energy efficiency and low-carbon generation support should also be designed to give as much certainty of delivery of CO₂ 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 recent 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 ETS cap is being set.

The ETS cap should be set to ensure that a reasonable degree of scarcity remains after emissions reductions from energy efficiency and technology deployment 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 other policies deliver a greater-than expected 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.

If the ETS target has output-based allocations, the sensitivity to economic conditions illustrated in Figure 7 is reduced (but not completely eliminated) due to scaling of overall production with economic conditions. In this case interactions with energy efficiency policies are also reduced, but not eliminated. As technology deployment 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 deployment policies will be the most critical issue.

**Policy design to keep an ETS 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.

The ETS cap should be reviewed frequently enough to avoid significant build-up of surplus allowances. As many ETS system caps are set to implement national and international climate goals, cap adjustment is not just a matter of keeping policies balanced: the impact on climate targets must also be kept in mind. Mechanisms to consider could include:

- 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 significant surpluses being carried forward, while still allowing early action to be rewarded.

Flexibility mechanisms that automatically adjust auction volumes if emissions are significantly lower than had been forecast when the cap was set.

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.

Energy efficiency and technology policies also will 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 and an unnecessary burden on public finances.

**Other policies as a carbon price is phased in?**

A factor to consider when balancing the carbon pricing policy with other policies is whether the carbon price is set at a level that fully reflects the damages caused by greenhouse gas emissions. Carbon pricing policies often start with a slow phase in; in this case a decision is needed on whether other policies should be referenced to the level of the current carbon price (so both phase in slowly), or whether other policies should be referenced to a higher, more optimal, shadow carbon price. Similarly, if energy prices are artificially low because supply costs are not being fully recovered in tariffs or because of implicit or explicit fossil fuel subsidies, should decisions to fund energy policies (for example energy efficiency programmes) be benchmarked against this lower electricity price, or a higher shadow price? Is transitional policy support to guide low-carbon investment warranted until the carbon price reaches higher levels?

The answers to these questions will primarily be based on political, rather than economic, judgements. On the one hand, if greater reliance on other policies is used to avoid or delay appropriate levels of pricing, then this could undermine the carbon pricing policy and raise costs over the long term. On the other hand, it is often the reality that it takes time to phase in efficient pricing levels, so additional policies may be needed in the interim to keep investment on track and avoid lock-in of inappropriate infrastructure. In either case, the primary focus should be on bringing pricing to efficient levels over time.
Box 5: 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 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 9: Expected contribution of policies toward delivering European climate goals calculated before the impacts of the 2009 recession

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/tCO₂ in 2008 to EUR 4-5/tCO₂ 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 other energy 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 the earlier section on ETS interactions.

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

Review mechanisms will be needed to allow policies to be updated for significantly changed circumstances beyond the range anticipated during the system’s design, whether this is the introduction of new overlapping policies, or “game-changing” circumstances. This adjustment can either take place at the end of the carbon price commitment periods, or on an ongoing basis depending on system design.

If there are strong interactions within the policy package, any initial policy calibration is likely to drift out of alignment over time. In general and for investment certainty, carbon pricing policy settings should be changed only at scheduled reviews, and be subject to criteria well-understood in advance 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).

The policy package could also become significantly misaligned by unforeseen shocks, such as the recent global financial crisis, that go beyond the range of normal conditions that was anticipated during scheme design. In rare circumstances this misalignment could be so severe that the benefits of re-establishing policy balance outweigh the damage to investment certainty caused by intervening – as with the EU ETS now. In this case, having pre-established criteria for when such interventions would be triggered could help maintain investor confidence. This is a case of signalling in advance whether the carbon pricing policy will be fixed until the end of the period, come what may, or if not under what circumstances it would be revised. If the carbon pricing policy has short commitment periods, reviews could take place at the end of each period, whereas if the carbon price settings are locked in for a longer period there may be benefit in pre-agreed triggers for review.

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. A similar approach could be foreseen for a carbon tax: setting the rate a number of years in advance on a rolling basis. Another option would be the definition of policy “gateways” that define in advance the criteria for any policy shift to be triggered, what policy changes would result, and how the government would react if milestones are missed (IEA, 2012c).

It will also not be possible to deal with every possible interaction and align all policy elements at the outset, so reviews give the opportunity for policy to evolve and become more aligned over time. For example in the case of the European Union, energy infrastructure and budget decisions followed the initial climate-energy package. If reviews, and criteria for these, are signalled in advance this can also offer companies and regulators the chance to see how policy is working and make improvements, while maintaining the understanding that policy stringency will remain.
Box 6: Key questions: managing interactions in the policy package

Initial alignment of energy policies and the carbon price
- Are the likely emissions reductions from energy efficiency policies taken into account in the carbon price settings?
- Are the likely emissions reductions from technology R&D, demonstration and deployment policies taken into account in the carbon price settings? Over what timeframe are these emissions reductions expected, and how does this overlaps with the carbon pricing policy?
- Do the design of energy efficiency and technology deployment policies need to change to reflect the introduction of a carbon price?
- Does the carbon pricing policy still have “room to operate” after the emissions reductions from energy policies are taken into account?
- Does carbon pricing revenue recycling affect supplementary policy delivery (or vice-versa?)

Designing the package to maintain alignment over time
- How would the carbon price be affected if energy policies over- or under-deliver?
- How would the carbon price be affected if economic conditions diverge from forecasts?
- Do energy policies deliver a large share of the required emissions reductions, making the carbon price more sensitive to changes in economic conditions?
- What other “game changing” developments are possible other than economic shocks that would also affect the way the carbon price functions? (e.g. that would result in significant changes in primary energy supply composition, energy demand, or energy prices)?
- Can energy policies be designed to provide certainty of emissions reductions, to facilitate the operation of the carbon pricing policy?
- Even if an energy policy can be justified on a cost-benefit basis in addition to the carbon price, does the complexity added by pursuing this policy (and therefore the potential for misalignment) outweigh the potential benefit of the emissions savings? (That is, could it be better sometimes to have a simpler policy package that is easier to keep aligned but sacrifices some abatement?)

Managing the phase-in of carbon pricing
- How does the level of the actual carbon price (or emissions cap if an ETS) compare to that theoretically justified by the emissions externality?
- If the carbon price level is initially low (or if it is undermined by existing fossil fuel subsidies), or ETS cap is weak, how will the appropriate level of energy efficiency and technology deployment policies be judged? Against actual energy prices? Or against “shadow” prices that would reflect more optimal carbon pricing?
- How much are rising energy prices expected to influence deployment of energy efficiency actions? If policies to overcome energy efficiency barriers are referenced to current energy prices, does a rising energy price justify greater policy intervention?
- Would supplementing the carbon price with policies to guide investment in long-lived infrastructure be helpful (e.g. guiding investment and retirement decisions in the power sector)?, or do they undermine the carbon pricing policy?

Carbon pricing and energy policy reviews
- How often will the carbon pricing settings and other policies be reviewed?
- How will flexibility to adjust for unforeseen changes be balanced against providing certainty and confidence in the carbon pricing policy design?
- What events could justify interventions between these scheduled reviews?
- What design features in the carbon pricing policy could help maintain coherence between scheduled reviews?
Institutional issues of policy integration

The co-ordination of energy and carbon pricing policies requires inter-agency cooperation both during policy development and ongoing implementation, typically including Environment, Energy, Industry and Finance Ministries. Experience from countries that have already introduced carbon pricing suggests that strong political will behind the carbon pricing policy is a key factor in guiding this inter-agency cooperation.

Decision-making authority can also be split between different levels of government at the local, national and inter-governmental levels, requiring co-ordination of decision-making and implementation vertically between these branches of government. In the European Union, climate policy is decided at the EU level, whereas energy policies are generally developed by individual member states. In Switzerland, local government has a significant role in the delivery of energy policies, so they are a key stakeholder in policy development and alignment.

To end up with a fully integrated policy package, government agencies may need to adjust their own proposals to accommodate others’ policies, for example in timing new energy policy interventions to fit with carbon pricing reviews. This could represent some intrusion into traditional responsibilities, which will be more acceptable if all agencies are part of the decision-making process. This implies the need for true inter-agency collaboration (for example via inter-ministerial steering committees), not just consultation.

The critical importance of broader engagement across society should also not be underestimated. This can help build buy-in to the process and outcomes of climate policy development, so every effort should be made to develop policy in conjunction with stakeholders. Achieving societal acceptance of the introduction of carbon pricing is not easy, and has usually involved a negotiation between government and stakeholders on phase-in, and how the concerns of vulnerable sectors will be addressed. In these discussions, it is important to keep the entire energy-climate policy mix in mind, so that policies remain integrated even as details are negotiated. In fact, the other energy policies can play a role in mitigating some of the impacts of energy price rises, potentially helping build support for the carbon pricing policy.

Box 7: Key questions: institutional issues of policy co-ordination

- Which government agencies will need to co-ordinate their policies with the carbon pricing policy?
- What co-ordination arrangements would work best (options range from consultative committees through to structural public sector reform) ?
- Will these arrangements ensure ongoing policy coordination as well as initial alignment of the policy package?
- Are there issues of split decision-making and implementation responsibilities between different levels of government (local, national, inter-government)? How can these be addressed?
Conclusions

Carbon pricing is a powerful tool in climate change mitigation, but is not a complete solution on its own. A package of energy and climate policies is generally necessary to cover the full range of actions needed to reduce emissions most cost-effectively. In considering how to manage policy interactions within this package, key findings are:

- Carbon pricing and 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. Policies that have different objectives than the carbon price (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 a carbon price. Without the energy policies, a higher carbon price than necessary could result. Policies to address infrastructure lock-in and investment barriers may also be needed.

- Even where there is theoretical justification to supplement the “core” policies with further targeted energy policies, consideration should be given to the complexity introduced to the package, and whether this may outweigh the potential benefits of the additional abatement.

- The introduction of a carbon price is a good time to review existing energy policies for consistency amongst themselves and with the carbon price. Energy efficiency and technology deployment policies and the carbon price overlap, so policies need to be assessed as a package, taking interactions into account. The design of the carbon pricing policy will also need to take into account the existing energy policy landscape.

- It is important to understand the nature of the energy sector (regulated vs market-based), how energy prices are determined and how carbon prices will be passed through, and any pre-existing energy taxes or subsidies (implicit or explicit) that could affect the functioning of a carbon price.

- Choices made for the use of carbon pricing revenue can also affect interactions with other policies. For example if carbon tax or ETS auction revenue is used to fund technology or energy efficiency programmes, then this provides dedicated funding for these programmes, but a low carbon price could lead to under-funding and a higher-cost transition over the long term.

- Energy policies that deliver “too much” of the required emissions reductions in an ETS with a fixed cap may increase uncertainty in allowances prices: the ETS market price has increased vulnerability to economic conditions, and is sensitive to the success of the energy policies. Energy policies should therefore be designed for as much certainty of delivery as possible, and the ETS cap should be set to ensure enough room for the trading system to function after taking energy policies into account.

- 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.

- Good inter-ministerial co-ordination will be essential to delivering this policy integration in practice.
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