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Integrating Carbon Pricing with Existing Energy Policies: Issues for South Africa

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INTERNATIONAL ENERGY AGENCY

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Table of Contents

List of Figures

List of Boxes

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Introduction

South Africa is the 18th largest CO_2 emitter in the world (IEA, 2012a), and its geography makes it more vulnerable than most to the effects of climate change. South Africa is exploring the introduction of a carbon tax as part of a set of policies to put economic growth onto a more sustainable path, resulting in a greenhouse gas emissions trajectory that peaks, plateaus then declines. As part of this policy process, one important question is how the proposed carbon tax will be integrated with existing energy policies. A number of other policies also reduce greenhouse gas emissions to some extent, such as policies to support low-carbon technologies and energy efficiency programmes. These policies and the carbon tax could either be mutually supportive or conflicting, depending on the design choices made. In other countries that have introduced carbon pricing (either carbon taxes or emissions trading), policy integration has not always been good from the outset.

The IEA's 2011 report *Summing up the parts - Combining policy instruments for least-cost climate mitigation strategies* examined policy interactions at a generic level. This report builds on that thinking by undertaking a specific analysis of South Africa's energy policy mix. It explores issues that may arise with implementation of a carbon tax in South Africa, based on the draft proposal released for consultation in May 2013.

This work is part of a project funded by the UK Foreign and Commonwealth Office to develop a "guidance document" to help countries contemplating the introduction of CO_2 pricing to integrate this well with existing and planned energy policies. The guidance will help countries identify what may be the core of their climate policy and, starting from that carbon price instrument, identify a cost-effective approach to integrate policy development now and in the future. As part of this project, the IEA is partnering with two countries, South Africa and Chile, to understand their specific CO_2 pricing proposals and how these could best be integrated into their existing energy systems. This will assist these two countries to develop cost effective climate-energy policy packages that are robust to future change.

Background: interactions in policy packages

Emission reduction policy usually requires multiple, often intertwined, policies. Sometimes the combination is reinforcing, sometimes undermining. This section draws on Hood (2011) to explore the ongoing need for other emission reduction policies after the introduction of a carbon tax, and how to manage interactions within the policy mix.

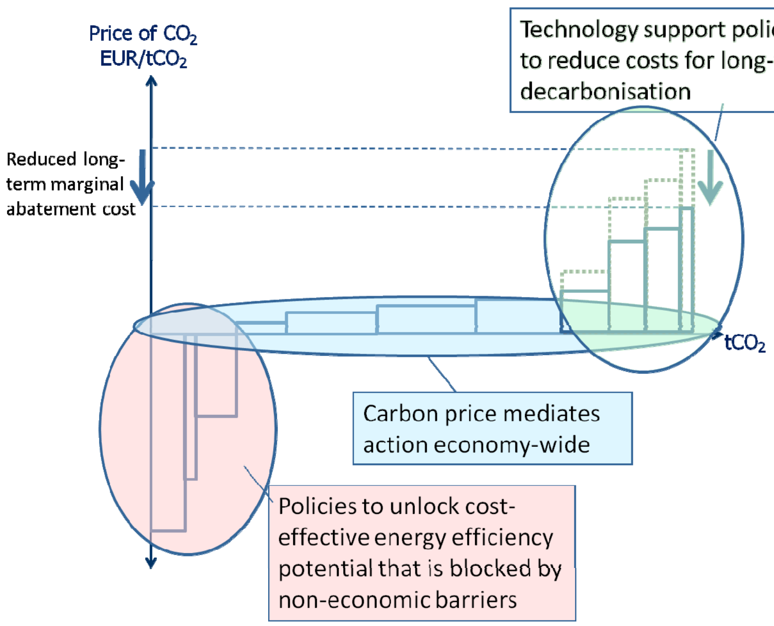
Why retain energy policies alongside a carbon tax?

Carbon pricing is an efficient, effective policy tool for emissions reductions, and should be a core policy for reducing emissions at least cost. When emissions have a price, both producers and consumers can see the value of improving efficiency, cleaner operations and technologies, and have a direct incentive to deliver them. Some therefore argue that other policies to reduce emissions are redundant, a distraction or counterproductive, and should stop. But this assumes both a perfect market – with rational actors armed with information and foresight of future prices – and that the carbon price is high enough to reflect the full costs to society of emissions and the subsequent climate change.

This is not the case in reality: there may not be good information on mitigation opportunities, or visibility of the future carbon price to guide long-term technology investment. Consumers do not always act in their own economic interest (Ryan et al., 2011). Carbon taxes are often introduced at a low level to be increased with time, but that level can be below what is socially optimal and thus an inadequate lever to drive low-carbon investment. These factors can result in higher emission infrastructure being locked in, compounding the challenge.

This means there is still a role for supplemental clean energy policies. Though details and need vary, the policies in Figure 1 are generally needed (Matthes, 2010; Hood, 2011). Infrastructure and financing barriers for the initial costs of low carbon investment may also merit further policy.

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



Source: Hood (2011)

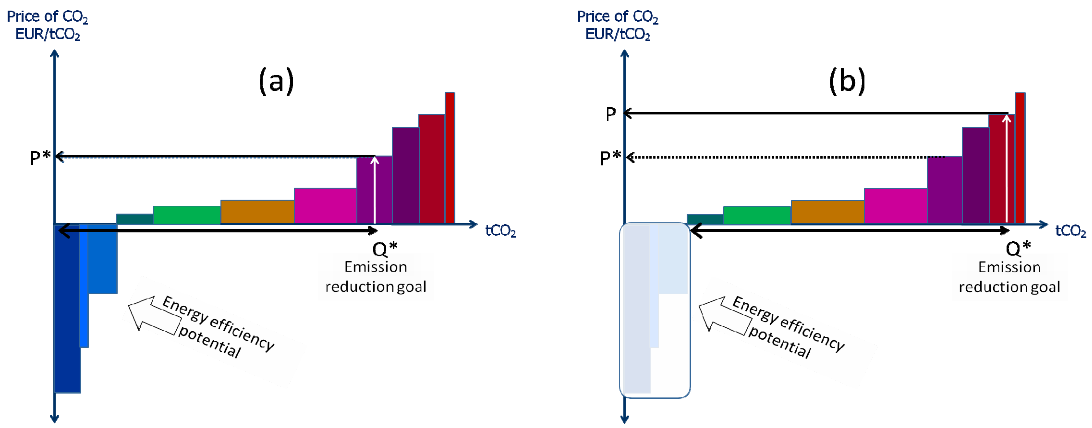
Energy efficiency

Energy efficiency measures offer excellent value carbon abatement thanks to their low or negative cost. But they can be hindered by inadequate information, up front investment costs, consumers choosing not to make cost-effective investments, and split incentives where those who invest are not those who pay the energy bill. These barriers can be overcome with targeted, cost effective policy. Depending on the overall emissions reduction target, this can render higher cost policies redundant, lowering the overall cost to society of meeting emissions reduction goals.

By extension, energy efficiency measures can lower the carbon tax necessary to meet a certain emissions target. In Figure 2(a), a carbon price of P* is needed to deliver an emissions reduction goal of Q*. Figure 2(b) shows that if energy efficiency is left unexploited, a higher price P would be needed. Energy price rises are a key economic concern in the introduction of carbon pricing, so making sure the carbon price is not unnecessarily high is an important outcome.

This is not to say that any arbitrary level of energy efficiency policy investment is appropriate: policies must be assessed to ensure they save more that they cost to implement. Savings include not only avoided carbon taxes, but lower demand, better energy security, better air quality and economic benefits in the development of new technology (Ryan and Campbell, 2012).

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



Source: Hood (2011)

Technology support policies, including renewable energy support[1]

Developing and deploying new technologies can reduce the cost of emissions reductions over the long term. However this requires upfront investment in research and development, deployment and infrastructure. Though technology development can minimise costs in future decades, the necessary upfront investments will not be cost-effective with only a carbon tax. Thus additional technology support policy (such as, for example, renewable energy deployment policies) to clear that initial hurdle can be both warranted and cost effective. Again, other needs – energy security, the local environment, economic stimulus/job creation – may merit additional investment in these policies.

When the costs and benefits of a technology policy are being assessed, the quantity and timing of support warranted will also depend on how much abatement a new technology is expected to

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

deliver, the time it will take for that technology's costs to fall, and the time it will take to scale up deployment of the new technology (IEA, 2012b).

Foundation policies: Markets, Infrastructure and Finance

There is also a role for policies that improve the function of underlying energy and investment markets to provide a least cost response to climate change:

- Healthy markets need liquidity and competition, and must therefore be open to new entrants. Policies that seek to reduce pre-existing price distortions or subsidies will enhance the efficacy of a carbon price.
- Infrastructure barriers, from grid connections to planning permission, affect new technologies. Policies that reduce these barriers enable a greater variety of technology responses and improve the speed of their deployment.
- Policies that make it easier to finance the higher up-front cost of low carbon options make more technologies viable and lower overall compliance costs.

As ever, new policy should pass an individual cost-benefit analysis.

How energy policies interact with carbon taxes

Retaining or adding policies that also reduce emissions alongside the carbon tax can either reduce the carbon price needed to get the same emission reduction, or increase emissions reductions for a given carbon tax level. The long term vision for the carbon tax determines its role and interaction with energy policy:

- If the carbon tax is established as an independent policy with a clearly defined price path into the future, then energy policies can generate additional abatement but will not feed back to influence the carbon price level as they would in an ETS system (Box 1).
- If the carbon tax will be adjusted over time to deliver a certain level of emissions (e.g. the tax level is set to meet a national or sectoral carbon budget), then the energy policies can affect the level of a carbon tax. For example, if energy efficiency policies successfully overcome barriers to significant low-cost emissions savings, a lower carbon tax can deliver the remainder of the goal.

Because carbon taxes are passed through into product prices (electricity, or energy-intensive goods like steel, cement and aluminium), they can also affect wider policies on energy access and affordability, as well as industrial competitiveness. Energy price rises have negative distributional effects, so carbon pricing policies generally couple the tax with compensating measures for low-income households.

However, energy price changes resulting from carbon pricing policies are typically small compared to those from fuel price shifts and other changes. This is the case in both South Africa and Chile, the other country in this study. Chile's electricity prices grew ten-fold over two years (Figure 4) as access to natural gas from Argentina was cut off. The effect of a carbon price on electricity prices is expected to be small in comparison.

Businesses are often concerned that carbon pricing will harm their international competitiveness. In countries where carbon pricing has been introduced, high intensity emitters have generally been protected through tax exemptions or free emission allowances (Hood, 2010). This compensation can interact with energy policies; later this paper explores possible interactions with setting the reference levels for industry compensation under the South African carbon tax proposal.

Box 1 • Policy interactions in Emissions Trading Systems (ETS)

Because targeted energy efficiency and technology support policies directly deliver some of the emissions reductions required to bring emissions down to the level of the cap, they reduce the other reductions that must be made by companies subject to the ETS market. The companies no longer need to exploit their more expensive abatement options, so carbon prices fall.

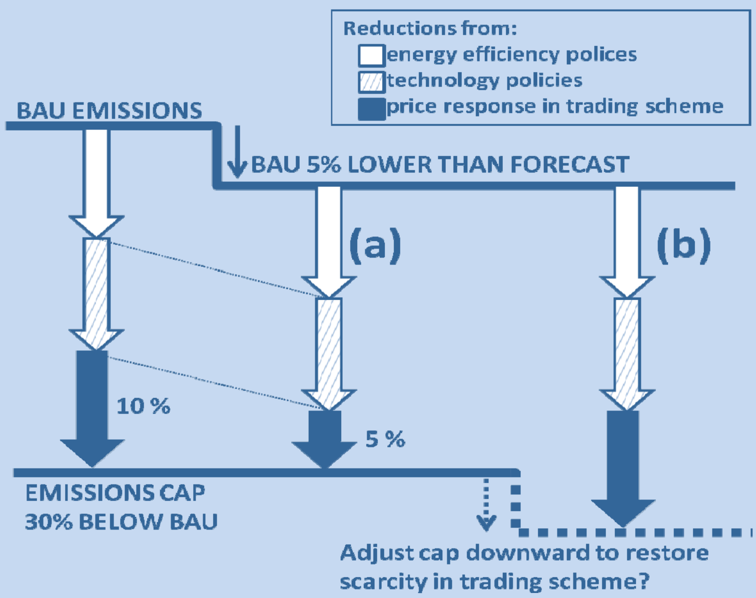
If energy policies deliver too much of the required abatement, ETS market prices could be fall such that companies in the ETS have to take very little action, and there is no longer a clear signal for them to make cleaner investment choices. The challenge is to balance minimising short-term costs with keeping demand for ETS allowances high enough to stimulate private investment in low-carbon. Maintaining strong demand in the ETS in turn minimises long-term costs by avoiding the lock-in of high-emissions infrastructure. Further, any uncertainty in energy policies' abatement creates uncertainty in the ETS market price, which could also undermine investment.

If energy policies deliver a large share of required abatement, the ETS market price becomes more sensitive to changing economic conditions and thus more volatile. This has been the experience in the EU ETS: due to economic contraction, baseline emissions did not rise as expected, but the energy efficiency and renewable energy policies were still in place reducing emissions further. It is now apparent that the EU ETS cap – locked in until 2020 – was set too high. As the system stood in 2012, the combination of renewable and energy efficiency targets alone were more than enough to deliver the emissions reductions required to meet the cap, with no action required from EU ETS entities. As a result, EU ETS allowance prices have crashed from EUR 20-30/tCO_2 in 2008 to EUR 4-5/tCO_2 in 2013. The EU ETS is expected to be carrying up to 2Gt of surplus allowances to 2020 unless modifications are made (European Commission, 2012).

The economic crisis, not energy policies is responsible for the EU ETS surplus. But this experience underlines how such policies can leave the system more vulnerable to changing economic conditions.

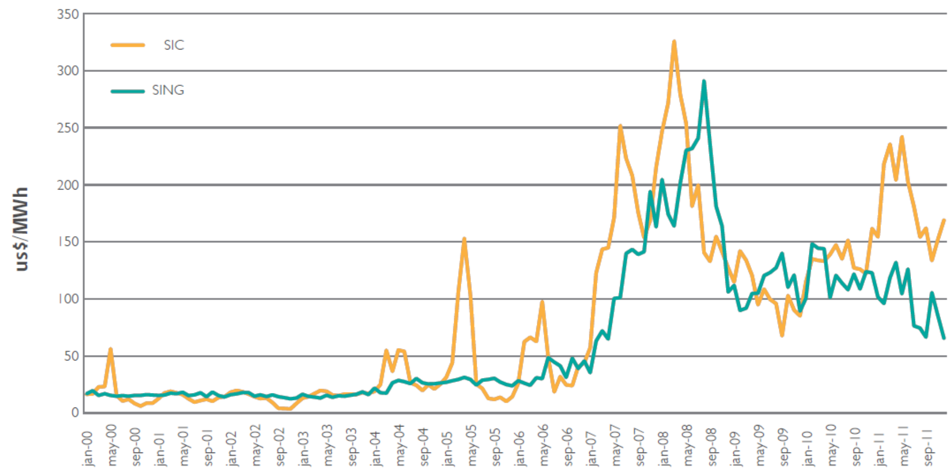
The European Commission has proposed several options to recalibrate the EU ETS to withdraw some of the surplus allowances and restore some of the intended scarcity in the system. There is also work underway to consider longer-term structural change in in the EU ETS, including whether there should be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

Figure 3 • In an ETS, energy policies can amplify the impact of changing economic conditions



Source: Hood (2011)

Figure 4 • Electricity prices in Chile's two major electricity grids



Source: Chile's Ministry of Energy (Government of Chile, 2012)

Finally, one should consider the effect of a carbon tax back on energy policy design. Creating a carbon tax raises energy prices and could reduce the subsidy necessary to make renewables competitive with fossil fuel based generation or, similarly, the subsidies given for energy efficiency measures. Higher energy prices from a carbon tax could also make a greater quantity of efficiency measures worthwhile, which could change eligibility and extent of efficiency support funding. In short, introducing a carbon tax is an opportunity to assess the function and compatibility of all energy policy, thinking carefully about their effects both at the initial carbon tax level, and as carbon and energy prices rise.

Negative and redundant policy combinations

Not all policy combinations are mutually supporting: some can be counterproductive or redundant.

For example, policymakers could try to prompt greater emissions reductions by adding a carbon tax to sectors already covered by an emissions trading system (ETS) or other market mechanism, in the hope of increasing the carbon price. However because total emissions are fixed by the ETS cap, the reductions arising from the carbon tax are not additional but rather displace effort that the ETS market would have delivered. The resulting total carbon price (tax + ETS allowance) does not increase, because the ETS price falls to reflect the lower effort required to meet the remaining emissions goal. On the other hand, a carbon tax and ETS can work together if the policy intent is to create more certainty for investors (by creating a price floor in the system) rather than to raise the carbon price overall.

A second example is the introduction of technology standards or regulation for activities covered by a carbon price, if the policy intention is to drive further emissions reductions. A carbon price should incentivise the market to find and refine technologies to deliver abatement at least cost. Standards limit this flexibility, incurring higher costs. However, if the regulations have a different purpose, there is potential for them to be complementary. For example, the United Kingdom will require new power stations to have the same or better emissions intensity than gas plant as part of its Electricity Market Reform initiative. In theory, blocking new coal generation is unnecessary because the EU ETS and the UK's own carbon price floor should make new coal plant uneconomic. But given uncertainty around the EU ETS, this third layer of policy is intended to give investors confidence that clean technology will pay back. In this case, the cost-benefit analysis of the regulation would compare any quantifiable cost savings associated with increased investment certainty, weighed against the costs of implementing the policy.

Summary: approaching energy policy interactions with a carbon tax

When deciding to keep, amend or discard a policy with the advent of a carbon price, one should ask **what the policy objective is** (Matthes, 2010).

If carbon taxes are set at an optimal level and there are no existing distorting energy taxes or subsidies, then energy policies that exist to just reduce emissions may be redundant and should be reconsidered. However if the tax starts at a low level or is affected by other pricing distortions (such as implicit or explicit fuel subsidies), supplementary energy policies may be justified to prevent 'lock-in' of high-emissions infrastructure being built in the interim.

Most energy policies will have objectives beyond pricing emissions, which need to be quantified so government can decide whether to drop, modify or just retain them. For example, though energy efficiency policy affects the carbon price, it combats specific barriers that block low cost savings, such as information, behaviour, and incentives to act, and so can complement a carbon tax (Ryan et al, 2011). Similarly, renewables policy can have benefits beyond short-term abatement, such as research and development that lowers technology costs, increasing capacity or stimulating a local economy. Focussing on short term abatement costs would not value these benefits (IEA, 2012b).

It is generally counter-productive to apply more than one policy with exactly the same purpose: for example to drive emissions reductions both through a carbon price and a cap and trade mechanism, or through both regulation and pricing. However more careful analysis is necessary if the two policies have different purposes: in this case seemingly redundant policies could both be justified.

A carbon price can interact with a range of policies beyond energy efficiency and technology support. Overlap with a carbon tax is likely when policies:

- 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 impact of these overlaps can be significant; the next section will consider how South African energy policy could overlap and interact with the proposed carbon tax.

South Africa's climate and energy policies

Climate policy in South Africa

South Africa's emissions of 435MtCO2e (Department of Environmental Affairs, 2009) are 77% carbon dioxide, 14% methane, 5% nitrous oxide – a large volume seen absolutely, per capita, by economic output, or relatively as a developing nation. This is a function of a coal-intensive energy system, which creates over 80% of emissions, and substantial mining and mineral processing sectors. Just under 40% of total emissions are from electricity generation, which is 92% fuelled by coal (Government of the Republic of South Africa, 2011). Industrial processes are a further 14%, followed by transportation and energy in industry at just under 10%. Agriculture and land use are just 5% (Department of Environmental Affairs, 2009). South Africa's emissions are highly concentrated in a few firms: Eskom and Sasol alone produce 60% of total emissions (Carbon Disclosure Project, 2012). On the consumption side, 40% of South African electricity consumption is by the 38 members of the Energy Intensive Users Group (Camco Clean Energy, 2012).

Though the global economic downturn has trimmed South African growth (IMF forecasts 3% GDP growth in 2013), development continues apace. Without action, greenhouse gas emissions will grow substantially, up to fourfold by 2050.

South Africa announced at Copenhagen in 2009 that it would reduce its greenhouse gas emissions by 34% by 2020 and 42% by 2025 below business as usual (on condition that it receives finance and technical support from the international community). The 2011 National Climate Change Response White Paper (Government of the Republic of South Africa, 2011) reaffirmed the local and global risk, and the Government's commitment to act. It set out a strategy to deliver the National Climate Change Response Objective, mainly through:

- A National GHG Emissions Trajectory Range, to measure the total impact of mitigation policy
- Defining target reductions for each significant sector and sub sector after careful potential-cost-benefit analysis
- Requiring companies and/or those sectors to submit plans to deliver the identified target
- Carbon budgets and target reductions for companies in certain sectors and sub sectors
- Deployment of a range of specific mitigation policies that support job creation and development
- Deployment of a range of economic measures – including pricing carbon, which could be in the form of a carbon tax, as well as offsets or emission reduction trading for entities covered by carbon budgets
- A Greenhouse Gas Inventory and Monitoring and Evaluation System to monitor progress and identify opportunities

Through these opportunities, the Government aims to keep to a three phase National GHG Emissions Trajectory. The first, 'peak', phase will see emissions of between 398-583MtCO_2 from 2020 to 2025, the second, plateau, phase 398-614MtCO_2 will be up to ten years. The final reduction phase runs from 2036 onwards; emissions should fall to 212-428MtCO_2.

Box 2 • South Africa's proposed carbon tax design

In May 2013 South Africa released a revised carbon tax design for consultation. From 2015, large emitters (producing more than 100,000 tonnes of greenhouse gases annually) will pay a carbon tax of R120 per tCO_2e on their fuel use, increasing 10% annually.

The key tax features are:

- companies will benefit from a 60% tax-free threshold for first 5 years. That allowance will then shrink by a factor to be determined. The tax-free allowance is calculated per unit of output, it is not a fixed quantity.
- certain sectors (e.g. cement, iron, steel, aluminium, glass) get an extra 10% exclusion for process emissions.
- graduated additional exclusion allowance for trade intensive sectors, up to 10%, to maintain businesses' international competitiveness
- the basic 60% threshold is adjusted based on company emissions intensity compared to a sectoral benchmark: companies that are cleaner than the benchmark have a higher percentage of their emissions covered for free.
- entities may offset 5-10% using verified projects from the CDM or national offsets schemes
- the maximum tax-free limit is 90%, except for those sectors excluded completely during the first five years. This means that all companies will have some obligation under the carbon tax, even if small.

The use of output-based thresholds for free allocation will limit the pass-through of the carbon price into final product prices: only the 10-40% of tax that is paid will be passed through[2].

The Treasury modelled the 25 year impact of a carbon tax imposed upstream on fossil fuel inputs, implemented gradually over ten years, under a number of scenarios. It indicates that the tax has limited negative impact on growth when coupled with revenue recycling options.

Revenue raised from the carbon tax is not specifically tagged for funding emissions reducing policies. As argued in this paper, the efficient level of investment in energy efficiency and technology support policies needs to be determined alongside consideration of the carbon tax. The most beneficial level of funding for these will not necessarily match the revenue available from the carbon tax: it could be more, or less. While the introduction of a carbon tax certainly creates a revenue stream that can be used for this purpose, the case for doing so needs to be assessed individually.

South African energy policies that could overlap/interact with a carbon tax

There are several main policy groups a carbon tax would interact with: the planning process for new investment in electricity capacity, pricing, renewables and energy efficiency support and 'game changing' infrastructure. These policies are described in this section. Issues of managing the interactions that arise are discussed subsequently.

Planning process for new electricity investment

South Africa's power sector development is directed by the Integrated Resource Plan (IRP), which is revised every two years by the Department of Energy (DoE) to ensure it is delivering security of supply and greenhouse gas emission reduction objectives. It identifies a twenty-year

[2] If on the other hand a fixed-quantity threshold were used, the full carbon price would be expected to be passed through.

demand profile for electricity, and how it could be met while meeting wider government policy objectives.

The current plan (Department of Energy, 2011) enacted in May 2011 targets approximately 35% energy efficiency improvement in the base case. Renewable electricity (primarily wind and solar photo-voltaic generation) would make the largest contribution to expansion of capacity, followed by investment in new nuclear generation. It introduced grid expansion commitments for South Africa to meet fast growing electricity demand while dramatically cutting dependence on coal. The coal share of installed capacity is to fall from 93% in 2011 to 46% in 2030. By then, nuclear should be 12.7% of total capacity, hydro 12.7%, wind 10.3%, concentrated solar power 1.3% and PV 9.4%. The resulting “balanced” scenario has a 30% carbon reduction over the “least cost” scenario, but cost just 8% more.

Eskom’s investments are required to follow the IRP. If all electricity investment is planned, this raises the question whether the carbon tax contributes a real reduction or simply raises electricity prices. This can be seen as a particular example of the overlap of regulatory and price policies discussed above.

Electricity pricing and dispatch

The Electricity Pricing Policy of 2008 provides broad direction and principles. It is compatible with a carbon tax, though some of its general principles merit attention. First, the policy provides that an efficient licensee be able to recover its costs and a reasonable margin, so a carbon tax on fuels would be passed on to end consumers. Low income households have some protection against rises in that they must have access to maintenance and operating cost only tariffs, and providers can cross subsidise these tariffs from other customers. However they would likely have to bear some increase if an input carbon tax were introduced.

Electricity prices have been rising steeply in South Africa, and this will be a challenge to the public acceptability of carbon pricing. In 2012 prices rose 16%, having risen 25% in the three years before, as Eskom move prices back toward a level that recovers system costs. Eskom’s request for a five-year 16% annual increase was recently declined by the regulator, but rises of 8% per annum for five years were approved. Tight capacity margins in the electricity supply limit the potential for short-term emissions savings from operational decisions: limited spare capacity means there is currently little scope to change the dispatch order towards cleaner plants.

A levy of ZAR 0.035/kWh is applied to generation of non-renewable electricity. This funds repair of roads damaged by coal trucks, the solar water heater programme, and energy efficiency programmes.

Policies to support renewable energy

The Renewable Energy White Paper in 2003 set out the Government’s vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. In 2003 11,278GWh came from renewables, mainly fuelwood and waste. The Paper set the aim to add an extra 10 000 GWh (0.8 Mtoe) of renewables to final energy consumption by 2013, mainly from biomass, wind, solar and small-scale hydro. A number of actions followed:

- The Energy Development Corporation (EDC) was established in January 2004 to invest in renewable energy and alternate energy fields to accelerate those markets. EDC primarily makes long-term commercial equity investments in solar, wind, hydro, biomass, biogas and low-smoke fuel technologies. Partnerships with development organisations and donor funds, as part of EDC's investment management, ensure funding stability and that benefits continue to be delivered.

- The Department of Minerals and Energy (DME) first launched a programme to provide grants to renewable energy projects in 2005-06. Projects had to have a minimum output of 1 MW (or equivalent in the annual production of liquid fuels). DME set up the Renewable Energy Finance and Subsidy Office (REFSO) to manage the programme, and now various renewable energy subsidies from both national and international sources.

- From 2009 to 2011 the National Energy Regulator of South Africa (NERSA) ran a renewable feed in tariff (REFIT) scheme for grid connected renewable energy. Eskom was obliged to purchase the output of qualifying renewable generators (including landfill gas, small (less then 10MW) hydro, wind, concentrated solar power, large scale PV, biomass and biogas) at pre determined prices between 0.9-4.0 ZAR/KWh, based on the levelised cost of electricity. That cost was passed on to consumers. REFIT power purchase agreements last 20 years, and the tariff was adjusted yearly for inflation.
- In 2011, the Department of Energy revised its renewable energy strategy. It switched from feed intariffs to price-competitive procurement for chosen volumes of renewable energy. The new scheme was an alternative to lowering the 2009 tariffs, as scheduled for June 2011. That year NERSA tendered 1GW of new renewable energy generation capacity from onshore wind, solar thermal, solar photovoltaic, biomass, biogas, landfill gas, or small hydro. The 2009 REFIT levels are a ceiling price which bidders must undercut.

If the carbon tax level is fixed into the future, and is set at an optimal level, then these renewable energy policies will generate additional abatement, but generally at higher cost than the carbon tax level. Whether or not this is justified depends on the other benefits arising from these policies in energy security, industry development, and technology learning: emissions savings alone may be no longer a sufficient motivation, as the carbon tax should deliver this more efficiently. However to the extent that the carbon tax is at a lower than optimal level, or if there are implicit fossil fuel subsidies that cannot be removed in the short term, then there may also be a case for a greater level of clean energy direct support as a compensating mechanism.

Energy efficiency and demand-side management policies

In March 2005, the Cabinet approved the Energy Efficiency Strategy of South Africa to tackle eight social, environmental and economic sustainability goals. It linked energy sector development with national socio-economic development plans and set the target for improved energy efficiency in South Africa at 12% by 2015. The Minister for Energy and Minerals, together with the CEOs from 24 major energy users and seven industry associations, then signed the Energy Efficiency Accord, voluntarily committing to work to implement these goals.

More businesses joined the initiative in 2006 and 2007. An Energy Efficiency Technical Committee was established to implement the Accord, and the National Business Initiative acts as Secretariat to the Technical Committee. It has developed measurement and verification guidelines, executive guides, an energy management performance matrix, reporting guidelines, and has conducted case studies.

The Energy Efficiency Strategy's targets were revised in 2008 and 2009 to a final energy demand reduction of 15% by 2015 in the industry and mining sector, 20% in the commercial and public building sector, 10% in the residential sector and 9% in the transport sector. Meanwhile there were a number of direct support projects:

- During 2006, Eskom distributed over 7 million compact fluorescent lightbulbs (CFLs) to replace incandescent bulbs. After a successful pilot, distribution targeted areas with existing or impending capacity problems. Distribution is still being carried out by various ESCOs in the country, with the help of unemployed local residents. An additional 5 million CFLs were distributed in the Western Cape area, half were free and half offered at discount.

- In 2007 Eskom launched a one year Energy Efficient Motors Programme pilot to promote the replacement of old, inefficient motors with new efficient ones, by subsidising the purchase cost. Efficient motors were discounted at purchase and registered motor suppliers claimed the subsidy back from Eskom directly. The purchaser had to trade in their old motor (and components) for scrapping. Several motor types were eligible, using ratings based on European Union standards. Subsidy ranged from ZAR 400 to ZAR 3,500. Eskom performed random audits, while an independent body measured and verified savings.
- In 2008 Eskom launched a programme to support the large-scale introduction of solar water heating. The programme was funded by a tariff levied on consumer electricity bills by the NERSA. Buyers submit a claim to Eskom's auditors and receive a direct rebate. As of September 2011, 156,000 systems have been installed, resulting in energy savings of approximately 60GWh/annum. South Africa's solar water heating market has expanded from 20 suppliers in 1997 to more than 400 in 2011.

In 2010 the Energy Efficiency Strategy and direct support were rolled into a national Energy Efficiency and Demand-Side Management (EEDSM) initiative. EEDSM set out to audit energy use in the industrial, commercial and residential sectors and provide a Standard Offer Incentive Scheme, under which utilities can buy demand side resources at a predetermined rate (effectively a "feed in tariff" for energy efficiency actions). The standard offer payment excluding monitoring and validation costs grew from ZAR 0.54/kWh in 2010 to ZAR 0.58/kWh in 2012. The DSM audits support Eskom's long-term strategy to reduce South Africa's electricity demand during peak periods. It is estimated that the programme will save 10,000GWh per annum and 10-12MtCO_2 by 2013-2015.

Major energy infrastructure changes

There is also the potential for significant "game changers" in the South African energy supply. Natural gas does not feature in short term planning, but shale gas could provide a less carbon intensive alternative to coal. South Africa could have 485TCF of recoverable shale gas reserves (Energy Information Administration, 2011), and there may also be potential for coal bed methane. Interconnection could provide access to less carbon intensive generation: Ethiopia and Mozambique have hydro potential, Kenya geothermal. Alternatively South Africa could import cleaner fuel, such as LNG or gas by pipeline from Mozambique. PetroSA, South Africa's state-owned petroleum company, signed a strategic memorandum of understanding between the company and its state-run Mozambican counterpart, Petromoc, in December 2011. However there will be competition for neighbours' exports (primarily from China and India), and building the transmission infrastructure could be as expensive as building generation in South Africa. Improving electricity transmission links with neighbours could ease pressure on the power system, and provide access to lower-carbon supply. Whether or not major new nuclear investments proceed could also have a major impact on the scale of carbon price needed to meet climate goals.

Policy co-ordination arrangements

Co-ordination of energy policies and carbon pricing will require different parts of government to work together well. The Departments of Economic Development, Energy, Environmental Affairs, Mineral Resources, National Treasury, Science & Technology, Social Development, Trade & Industry, Transport and Water Affairs, all have interests in this sphere.

The Department of Environmental Affairs and National Treasury are the leading departments responsible for coordination and implementation of the carbon tax: the Treasury would oversee a carbon tax and the Department of Environmental Affairs the monitoring, reporting and validation of greenhouse gas emissions. In turn, they work through the Intergovernmental Committee on Climate Change (IGCCC), which has representation from all departments. Under these co-ordination arrangements, Departments must make the IGCCC aware of any issue arising from their competence area that affects energy demand, price or mix. Broader engagement is delivered through the National Committee on Climate Change (NCCC), which has representation from all ministries, civil society, business and labour organisations.

Managing policy interactions in the South African context

South Africa's current wide set of clean energy policies reflects a clear understanding that a package of policies is needed for this complex policy area. As discussed previously, there are sound reasons to retain energy policies when a carbon tax is introduced: energy efficiency policies can lower carbon prices and the cost of meeting climate commitments, and South Africa may also see a case for deployment of new technologies to gain experience and for their benefits beyond immediate emissions reductions. The introduction of a carbon tax is a good opportunity to asses the whole policy mix, and check that settings are aligned.

Keep, modify or phase out energy policies?

Given the range of objectives covered by South Africa's energy policies, it seems unlikely that the introduction of a carbon tax would make these other policies redundant. In making this assessment, it is key to consider the objectives of each policy. There needs to be a clear benefit to merit the additional cost for Government, providers and end users of additional policies. This means being very clear who policies are supposed to influence, and how, e.g. consumption versus production versus behaviour versus efficiency changes.

If an energy policy has the precisely the same objective as the carbon tax, to drive immediate emissions reductions, the Government should consider whether it is redundant. One example raised by stakeholders is that of the existing electricity levy on non-renewable electricity generation, which the Government has signalled will be phased down as the carbon tax is phased in. As well as being a means of raising revenue for renewable and energy efficiency programmes, the levy was designed to signal the intent of the forthcoming carbon tax, by targeting non-renewable generation. With the slow phase-in of the carbon tax, it will be some time before the tax level reaches commensurate with climate damages. Electricity and coal prices in South Africa are also low (OECD, 2013) and the South African government does not intend to immediately move to cost-reflective pricing. As such, the existing electricity levy serves to bolster the carbon tax level and partially correct for pre-existing price distortions in the short term.

If a policy overlapping the carbon tax has mixed objectives (for example both reducing emissions and delivering benefits such as energy security or industry development), then the assessment of costs and benefits should take this wider picture into account. Once an appropriate carbon tax is in place, short term emissions reductions alone can no longer be used to justify the energy policy, but the other benefits might. For example, renewable energy policies would need to be judged on their energy security, economic and technology benefits. Where overlapping policies are complementary to the carbon tax and cost-effective, government should still assess whether it is worthwhile to retain them, considering:

- What is the potential emission abatement (or other benefit) of one versus both policies?
- What coordination would overlapping policies require if kept?

It may sometimes be the case that keeping multiple policies in place, while theoretically justified, creates a complex policy package that is harder to manage and keep aligned over time. In some instances, it may be better to forego some abatement in order to keep the policies manageable: hence increasing the chances of the entire framework delivering well over time. The costs and benefits will be different in presence of other policies, so policies also need to be assessed as a package, not only 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).

Managing interactions of overlapping policies

As already identified by South African officials as part of the IGCCC co-ordination process, policies that affect energy demand, price or mix will have climate change implications, and can affect the calibration of other climate policies. For practical purposes, it may be useful to focus efforts on a small number of key policies, because seeking to perfectly align all policies would be impractical and time consuming. A quantitative threshold could be set, for example policies expected to deliver more than (say) 10% of the emissions goal should be actively aligned with other policies.

This means that the carbon tax and other energy policies should be aligned at the introduction of the carbon tax, but also that their design should allow for them to remain coordinated over time. It is important to build review mechanisms into all policies, to allow them to be updated for changing circumstances (including introduction of new overlapping policies, or "game-changing" events). Deciding how frequently all policies can be adjusted is a balance between providing certainty to investors, and having flexibility to respond to unforeseen circumstances (witness, for example, how the EU ETS is "locked in" to poor settings until 2020 unless it is amended).

Carbon tax

In working towards meeting a particular emissions reduction goal, government needs to ensure there is a balance between price-driven reductions, renewables policy and energy efficiency. This means setting a sufficiently ambitious emissions reduction target, and leaving room for the carbon price to act without being crowded out by other policies. Though it is tempting to review the interaction between the carbon tax and other policies frequently, significant swings in the carbon price from one period to the next aimed at delivering a particular level of emissions reductions could deter investment: the major benefit of a carbon price is its certainty. It is therefore important to undertake modelling to test target settings over a reasonable range of varying circumstances (delivery of energy efficiency and technology policies, BAU emissions), so that the carbon tax and supporting policies can form a stable package.

Planning process for new electricity investment

The Integrated Resources Plan (IRP) is the current policy process determining investment in new electricity generation. Given that the future generation mix is currently specified by this regulatory process, it could be questioned what role the carbon tax will have in influencing investments, and therefore whether the carbon tax and IRP policies conflict.

In the long term, as the carbon tax phases in, it will gradually come to reflect the full externalities associated with carbon emissions, and therefore provide a solid basis for investment decision-making. The IRP process could therefore become redundant in the long term (or equivalently, the planned investment portfolio under the IRP will simply reflect the cost-effective portfolio with carbon tax included).

However in the short to medium term, the IRP process can provide greater certainty for investors in low-carbon electricity infrastructure, by adjusting the new generation portfolio to account for the benefits of clean energy that are not reflected in current carbon and electricity prices. IEA analysis has shown that avoiding "lock in" of high-emissions infrastructure (arising from weak or uncertain climate policy in the short term) is critical to reduce the costs of climate response (IEA, 2011), so policies to guide current investment can make sense. As such, there is a case for retaining the IRP as the carbon tax is phased in. Over time, as the carbon tax rises, the carbon tax could be expected to take over much of the current role of the IRP, naturally creating a cost-effective low carbon investment plan.

The move over time towards investment driven by a carbon price also has potential to assist with long-term policy stability. The IRP is revised every two years, and the analysis underpinning its development starts with an assessment of cost-effective generation investment to meet energy demand. This is then adjusted to meet the government's other policy priorities, including greenhouse gas reductions. This process of "policy adjustment" significantly changes the energy mix presented in the IRP, which suggests that there is the potential for major shifts every two years as assumptions and government priorities change. Building a carbon price into the economy will, over time, mean that the desired clean energy mix becomes closer to the "cost effective" package, meaning less need for policy adjustment in the IRP process, and greater certainty for investors that policy settings will be stable. This could assist with long term investment certainty, potentially lowering costs.

Electricity pricing and dispatch

Rapidly-rising electricity prices in South Africa have implications for carbon tax design. These price rises reflect an adjustment in electricity tariffs that is needed to eventually recover the full cost of electricity supply. There is also significant new build underway and planned, to catch up on deferred investment in new electricity capacity, which itself resulted from years of low prices.

It could be argued that the consumer response to higher prices from a carbon tax should be minimal compared to that already seen in response to general tariff movements. As such, the carbon tax could be designed primarily to target Eskom's investment and operational decisions (through the IRP process, but also by shifting the economics of dispatch decisions where there is scope in the system to do so), with less emphasis on reducing final demand through price increases. Energy efficiency policies that assist consumers in lowering their energy demand will, of course, help them adjust both to the carbon tax and higher tariffs in general.

One key concern is that electricity price rises from the carbon tax could be a burden on economic growth and jobs. Clearly, the impact of a carbon tax would be minimal compared to the price-rises already underway to bring tariffs up to levels that fully reflect generating costs, and potential future rises as coal prices move toward market prices. Moreover as other countries' efforts to cut their emissions accelerate (for example China's emission trading pilot schemes), the risk of competitive disadvantage lessens. However this does not mean that concerns about electricity price rises should not be taken seriously: they can be a major issue determining the acceptability of introducing carbon pricing (Hood, 2010). Carbon tax design choices can alter the impact on electricity prices, if this is a priority.

Box 3 • Managing electricity price rises from a carbon tax

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

- Carbon tax revenue could be returned to the most needy in society, so the emissions reduction impact of the tax is undiminished but social costs are allocated to those most able to pay. The National Treasury has highlighted expansion of the Free Basic Electricity programme as one of the measures to reduce the impact of the carbon tax on lowest income citizens.
- Energy efficiency measures that are cheaper than building new generation should be maximised. Greater efficiency means a lower carbon tax is necessary for a particular goal. As a counterpart to the carbon tax policy, an Energy Efficiency Tax Incentive has been devised to utilise some carbon tax revenue to promote energy efficiency uptake.
- The tax-free threshold proposed for the electricity sector will reduce the impact of the carbon tax on final electricity prices. Due to the output-based nature of the tax-free threshold, Eskom will still see the full carbon price incentive at the margin for all decisions to increase or decrease emissions intensity of production, but a lower average price will be passed through to consumers than would have been the case without the tax-free threshold. This of course also reduces revenue from the tax.
- The existing electricity levy could be phased down gradually as the carbon tax rises to a level reflecting the full environmental externalities of carbon emissions.

Policies to support renewable energy

Policy that improves information and awareness can enhance the function of a carbon tax and be compatible and mutually reinforcing. Subsidy, be it through R&D to develop technology or tariffs to drive uptake of working technology, is more complicated, and may need alignment with the carbon tax.

The Energy Development Corporation (EDC) invests in alternative energy, targeting sectors with insufficient private sector activity. In bringing forward cleaner generation, the EDC should lower the cost for all consumers to reduce their emissions. In turn, the carbon tax will drive demand for cleaner generation and make it more competitive and affordable more quickly. This increases the incentive for private investors to enter the renewable energy market and lessens the need for public investment, which could crowd out private investment. Given the carbon tax and EDC are both technology neutral, Government should also consider each programme’s other parameters to ensure they support complementary technologies.

Similarly, a carbon tax would sharpen the need for the renewable energy technologies supported by the Renewable Energy Finance and Subsidy Office (REFSO). This should make it easier for renewable energy developers to make a return on their investment, lessening the need for REFSO support. However some worthwhile technologies may continue to be just beyond the risk threshold the private sector is willing to cross, so there is likely to be an ongoing role for REFSO, focusing more on less conventional or more niche possibilities.

Feed in tariffs and procurement of renewable generation are a more direct overlap. A carbon tax will reinforce demand for cleaner energy and abatement. The rise in electricity prices as a result of the carbon tax will reduce the incremental cost to consumers of supporting renewable technologies: tenders for renewable generation will be closer to general electricity prices, so the subsidy required in additional to baseline electricity prices is smaller (even if the absolute cost is the same). This could help with the acceptability of continued promotion of renewable generation.

Given the current constrained nature of the South African power supply, additional clean capacity potentially has a much greater carbon impact beyond its own capacity. By creating a greater reserve margin, it also enables the rest of the grid to dispatch on the basis of cleanliness in response to the carbon tax, rather than just dispatching all plants to meet demand.

If the carbon tax level is to be reset in subsequent periods to deliver a particular emissions goal, then the balance of effort between the tax and energy policies needs consideration. Additional investment in renewables and other energy policies that reduce emissions can mean that a lower carbon price is needed to achieve a particular emissions goal. However if energy policies deliver all the reductions required, then the carbon price could be too low to provide any real incentive for low-carbon investment, which could undermine longer-term action. Ideally, the solution would be to move to a more ambitious emissions target, rather than allowing carbon prices to remain inefficiently low.

Energy efficiency & demand-side management policies

Modifications to some existing demand-side policies may be appropriate with the introduction of a carbon tax. For example the rising electricity price would make more energy efficiency opportunities cost-effective, potentially justifying a greater level of intervention to overcome market failures and unlock any blocked energy efficiency potential. Conversely, the publicity surrounding the introduction of the carbon tax could raise awareness among consumers of these cost-saving energy efficiency opportunities.

There is also the question of what benchmark to use when assessing the appropriate level of support for energy efficiency policies. If carbon prices start low, should energy efficiency interventions be up to the level of the current carbon price, or should they be assessed against a higher, more optimal, shadow carbon price? Similarly, if electricity prices are artificially low because costs are not being fully recovered or because of implicit coal subsidies, should intervention decisions to fund energy efficiency programmes be benchmarked against this lower electricity price, or a higher shadow price?

If in future the carbon tax level is to be reset to deliver a particular emissions reduction goal, then abatement delivered by energy efficiency will reduce the carbon tax level needed to achieve that climate goal. In this case an integrated package of energy efficiency and renewable support policies would be needed, balanced with the carbon tax, to allow all policies to work effectively.

Specific design issues can also cause policy interactions. In South Africa's carbon tax proposal (National Treasury, 2012), trade-exposed industries are exempted for up to 90% of emissions per unit of production, based on industry-specific reference levels. The setting of these carbon tax reference levels needs to be considered carefully to ensure they do not undermine incentives for energy efficiency. For example, a cement company operating at 15% better efficiency than the sectoral reference level would receive the full 90% tax-free threshold, so would have less incentive to improve operations further. In some industries there will be a significant range of energy intensities among facilities, so the current formula may not provide enough flexibility for some industries.

On should consider whether companies covered by the carbon tax should have access to targeted energy efficiency subsidy programmes, or whether reductions in their tax obligations (through the threshold adjustment formula) should be only as a result of their own investments. If some companies have already benefited from government-funded improvements to their processes in the past, cutting this funding with the introduction of the carbon tax could cause equity concerns.

Major energy infrastructure changes

Any significant shifts in infrastructure or primary energy supply could significantly affect the role of a carbon tax in South Africa's energy-climate policy mix: either 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 alternatives enter the South African 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 emissions targets. It may be necessary to strike a balance: for example signaling a price "band" for the carbon tax, while allowing some flexibility to adjust it for changing circumstances.

Policy design to keep the package aligned over time

The design of both the carbon tax and energy policies needs to take into account maintaining alignment over time. Building in review mechanisms allows policies to be updated for significantly changed circumstances, whether this is the introduction of new overlapping policies, or "game-changing" events.

Balancing flexibility and certainty

Reviews to maintain coherence of a complex policy package are critical, but if policies are adjusted too often there is the risk of creating uncertainty and distrust among investors. A key objective of clean energy policies is to drive investment in cleaner technologies, so changing settings too often would undermine the transition to low-carbon energy systems. In general, this risk can be mitigated by adjusting carbon pricing and energy policy settings only at scheduled reviews, with criteria well-understood by all involved.

However, it is also possible that a sudden change in economic conditions or a misalignment within the core set of energy efficiency, technology and carbon price policies, could be so severe that the benefits of re-establishing policy balance outweigh the damage to investment certainty caused by intervening before the next scheduled review – as with the EU ETS now. In South Africa's context, there is significant scope for game-changing shifts in the energy sector, so maintaining investor confidence in the climate-energy package could require either reviews every few years, or establishing pre-agreed criteria for when mid-term interventions would be contemplated. That is, investors should understand in advance whether the carbon tax and other policy settings will be fixed until the end of the period, come what may, or if not under what circumstances it would be revised.

Balancing flexibility and certainty is difficult. In the EU ETS, Phase III was extended to eight years in response to stakeholder requests for 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 will set annual caps on a rolling basis – but to lock these in five years in advance to provide certainty. A similar approach could work with a carbon tax: setting the rate a number of years in advance on a rolling basis.

Institutional issues of policy integration

In South Africa, as in other countries, co-ordination between government agencies in policy development can be a challenge. The establishment of the Intergovernmental Committee on Climate Change (IGCCC) is a positive development, providing a forum for discussion on progress towards meeting national climate objectives. Consideration could be given to expanding the mandate of this group to include a decision-making function for development of the climate-energy policy package, and in steering departmental policies towards better integration.

To achieve a fully integrated climate-energy policy package, government agencies may need to adjust their own proposals to accommodate others', for example in timing of new clean energy policies or energy tax adjustments to fit with carbon budget cycles or carbon tax reviews (and vice-versa). This could represent some intrusion into traditional responsibilities, which will be more acceptable to the agencies involved if they are part of a co-ordinated decision-making process. This process will work best if each Department recognises that good policy integration may mean some limitations in their individual policy-making authority, but gives a better result overall for South Africa.

Good engagement with stakeholder groups and wider society is also critical. This can help build support for both the process and outcomes of climate policy development, so every effort should be made to develop policy in conjunction with stakeholders. Wider engagement on carbon tax design, for example with the National Committee on Climate Change (NCCC), will improve outcomes.

Conclusions

A carbon tax could be a powerful tool for South Africa to deliver its emissions reduction goals, but other policies will still be needed. South Africa has already clearly identified that a package of policies is necessary to address the wide range of barriers to emissions reductions in the energy sector. Key considerations for policymakers in managing interactions among policies within this package include:

- The "core" policy set includes carbon pricing (a carbon tax in South Africa's case), supported by cost-effective energy efficiency and technology policies. Policies can be complementary to the carbon tax when they have different objectives (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). Policies to avoid infrastructure lock-in and overcome financing challenges may also be needed.
- Without the energy policies, a higher carbon tax level would be needed to achieve a given emissions reduction goal.
- When a carbon tax is introduced, it would be appropriate to review existing energy policies for consistency amongst themselves and with the carbon tax. Energy efficiency and technology support policies and the carbon tax will overlap and interact, so their design should take this into account. The goal would be for climate-energy policies to be aligned as a coherent package.
- Complexity in the policy package is an issue in itself: Even adding further targeted energy policies is theoretically justified, the additional complexity created in aligning policies and managing interactions could outweigh the potential benefits.
- How the carbon tax will interface with specific emissions goals. If the tax level will be adjusted over time to deliver particular emissions targets, then it will need to be set as part of a package considering the relative contributions of energy efficiency policies, renewable and other clean energy support policies, and the tax.
- The interface between the Integrated Resource Plan (IRP) process and the carbon tax. Because the carbon tax does not directly drive investment decisions (these are decided through the IRP), the rationale for how the carbon tax will improve the clean energy transition over time needs to be clearly explained.
- Reviews to maintain coherence of a complex policy package are critical, but if policies are adjusted too often there is the risk of creating investment uncertainty. In general, this risk can be mitigated by adjusting carbon pricing and energy policy settings only at scheduled reviews, and subject to criteria well-understood by all involved. In the event of a major unforeseen change in the energy sector, there is a balance to be struck between the benefits of restoring policy alignment by intervening, and the damage to investment certainty. In South Africa's context, maintaining policy integration could require either reviews every few years, or establishing pre-agreed criteria for when mid-term interventions would be contemplated. That is, investors should understand in advance whether the carbon tax and other policy settings will be fixed until the end of the period, come what may, or if not under what circumstances it would be revised.
- Good co-ordination within government, building on the Intergovernmental Committee on Climate Change (IGCCC), and with external stakeholders and the public will be critical for making policy integration work.

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