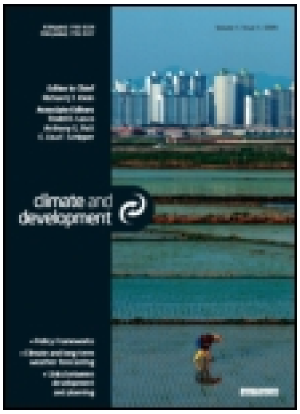

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Mitigating climate change through carbon pricing: An emerging policy debate in South Africa

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South Africa is considering how best to contribute its fair share to the global effort to mitigate climate change. The domestic policy debate is characterized by a vibrant engagement involving government, business, labour and civil society. The policy option with greatest potential for reducing emissions is carbon pricing through a carbon tax or emissions' trading scheme. The welfare and development impacts need to be carefully considered. The broader debate considers economic efficiency, environmental effectiveness, welfare impacts, competitiveness impacts, design implications given market concentration, and complexity and transaction costs. This article examines the challenges of pricing carbon given considerations of political economy, such as high unemployment, poverty and lack of access to basic services. The article shows a preference emerging for a carbon tax. A carbon tax does not create equivalent certainty with respect to environmental outcomes, but the tax level can be adjusted to achieve desired emissions reductions. Where the policy priority is price stability a tax is advantageous, providing long-term policy signals to investors, as well as price transparency, fiscal revenue stability, economy-wide coverage of emissions and administrative efficiency. However, three implementation issues need clarity: limiting welfare impacts on poor households; the feasibility of a hybrid model; and integrating carbon pricing with the broader transition to a low-carbon economy.

Keywords: carbon tax; climate change; developing country; economic instruments; emissions trading; environmental effectiveness; mitigation; policy debate; South Africa; welfare

1. Introduction

The scientific, economic and business case for mitigating climate change is clear. Science tells us that unmitigated climate change poses a danger to us all. Africa is particularly vulnerable, given the continent's unique climate conditions and low adaptive capacity. To avoid the worst impacts and keep unavoidable adaptation remotely affordable, the global community needs to limit temperature increases to below 2°C above pre-industrial levels. To have a 50:50 chance of staying below this temperature threshold, the concentration of greenhouse gases (GHGs) in the atmosphere must stabilize at 450 parts per million volume (ppmv) (IPCC, 2007). To achieve this, developed countries should reduce their absolute emissions compared to 1990 by 80–95 per cent by 2050, whereas developing countries need to make substantial deviations below business-as-usual (BAU) baselines – in other words, relative reductions. While the range of such deviation was not specified in the Intergovernmental Panel on Climate Change (IPCC), implied reductions in the range of 15–30 per cent below BAU have been indicated (Den Elzen and Höhne, 2008). The distinction between absolute and relative reductions remains fundamental, and implies a burden-sharing discount for developing countries.

Between 2009 and 2010, several developing countries announced goals expressed as

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reductions in carbon intensity of gross domestic product (GDP) or deviation below BAU emissions growth. Following the Copenhagen Accord (UNFCCC, 2009), these were formally submitted to the United Nations Framework Convention on Climate Change (UNFCCC), as nationally appropriate mitigation actions by developing countries. Although developed and developing countries have different historical responsibilities for the causes of the problem, they share responsibility for the way we deal with it in future (Zammit Cutajar, 2007). This balance of responsibilities informs the current international climate change negotiations, and will likely shape the architecture of a comprehensive global climate change regime after 2012. There is as yet no agreement on equitable burden sharing. For South Africa, as a leading developing country, it is therefore timely to consider the most environmentally effective and cost-efficient way to contribute its fair share to the global effort to mitigate climate change.

Inaction would not be environmentally, economically or politically sustainable. The world is moving towards a common price on carbon. If multilateral negotiations had to fail, tariffs on imports from countries with no emissions controls will likely become a reality. A more stringent and punitive global climate regime creates the risk of uncompetitive or even stranded assets in 20 or 40 years' time, and, in the shorter term, the country's exporters could face new tariff barriers as a result of the carbon embedded in their exports. Yet, responding to this challenge is a double-edged sword. On the one hand, energy markets that have not internalized the negative external costs of climate change have contributed to the problem. Subsidies for fossil fuels are an indication of this continued trend. On the other hand, a key imperative for developed and developing countries alike is to ensure that local firms are not placed at a disadvantage to their foreign competitors in the face of an increasing price on carbon.

South Africa could make various policy interventions to reduce its carbon footprint. A wide range of interventions were elaborated on in the long-term mitigation scenarios (LTMS) study (Department of Environmental Affairs and Tourism, 2007). This article considers the policy option with the greatest potential for reducing emissions, namely carbon pricing. The choice is essentially one between a carbon tax (a pure pricing instrument) and emissions trading (a domestic cap-and-trade system).[1] While various hybrid options are possible, this article focuses on the two distinct options.

Before describing and evaluating the two policy options, the history of the policy debate in South Africa, the country-specific socio-economic considerations and the range of available long-term mitigation options are described. Thereafter, the available economic instruments are evaluated against the most significant criteria cited in the current policy discourse. The concluding section reflects on the debate in the South African policy context and highlights the major policy choices required to turn the political commitment to price carbon into action.

2. History of the policy debate

The South African Government's 2007 LTMS study estimated that the country's emissions, under a BAU scenario, would quadruple by 2050 – from 446 megatons (Mt) of CO_2-eq in 2003, to 1,600 Mt per annum in 2050 (DEAT, 2007). If the rest of the world had to move along a similar trajectory, it would have disastrous consequences for South Africa and Africa.

The government therefore recognized that South Africa cannot continue to grow without a carbon constraint (RSA, 2008a, 2008b). To remain competitive in a carbon-constrained world, the country would have to reduce its carbon footprint. This requires changes in the way it generates and consumes energy, inter alia, by pricing externalities, adjusting behaviour and more efficiently allocating resources.

Informed by the findings of the LTMS study, in July 2008, government committed to a so-called 'peak, plateau and decline trajectory for the country's GHG emissions', which means that emissions 'must stop growing at the latest by 2020–2025, stabilize for up to 10 years, and then decline in absolute terms' (RSA, 2008b). Subsequently, in multilateral negotiations, South Africa committed more concretely to 'undertake mitigation actions which will result in a deviation below the current emissions baseline of around 34 per cent by 2020 and by around 42 per cent by 2025' (Presidency, 2009), thus internationally committing to act in pursuit of the LTMS peak, plateau and decline trajectory. When this political pledge was submitted formally to the UNFCCC (RSA, 2010a), the conditions were re-stated that a global climate deal must be agreed upon and the pledge is conditional on an international regime that addresses the means of implementation: namely, financing technology transfer and capacity building. South Africa agreed that developing countries' mitigation actions and support would be measured, reported and verified (UNFCCC, 2009).

Government is committed to achieving this through, inter alia, regulatory and economic instruments aimed at improved household, industrial and commercial energy efficiency; pricing carbon; up-scaling investment in renewable energies and nuclear energy; passenger modal shifts; and stringent vehicle efficiency standards (RSA, 2008a, 2008b). These interventions are not the only ones modelled in the LTMS study, but are those with the greatest potential for reducing the country's carbon footprint at the lowest possible cost (DEAT, 2007).

In the LTMS study of mitigation potential, a carbon tax gradually increasing from R100 to R750 per ton of CO_2-eq over the next four decades was found to be the most effective mitigation option, reducing emissions by some 600 Mt of CO_2-eq by mid-century (Energy Research Centre (ERC), 2007a; Winkler, 2010). Emissions under BAU would have grown significantly by then. The pricing of carbon was implemented in the LTMS modelling in the form of a tax, which was 'designed to approximate a phase of slowing emissions growth, stabilising emissions and ultimately reducing absolute emissions' (DEAT, 2007).

The modelling approach did not prescribe a policy choice. In Cabinet's policy directions in July 2008 (RSA, 2008b), no final choice was made whether to put a price on carbon by means of a tax or through emissions trading. At the time of writing, the debate on the most appropriate economic instrument continues.

3. Socio-economic considerations

Climate change is an issue affecting the entire economy and that will have to be reflected in the changes to how South Africa does business. The reality is that we are entering a carbon-constrained world, and, to remain competitive, the country needs to make the transition from the historical bias in favour of the minerals–energy complex (Fine and Rustomjee, 1996) to a low-carbon economy. This debate can also not be divorced from the one on the nature of the monopolized market for electricity. Creating market forms that could facilitate a greater role for the private sector in lower carbon energy alternatives remain unfinished business.

There is broad consensus in South Africa on the urgency of mitigating climate change in the face of a more restrictive global regime. Few actors in the South African polity question the compatibility of economic growth and welfare imperatives with the objective of stabilizing the climate, and achieving this in a way that minimizes negative welfare impacts. There also seems to be general appreciation that the quality of development is as important as the quantity of development in a developmental state where broad-based development informs the policy framework. The environmental dimension of sustainable development is also recognized and mainstreamed in national planning. In terms of pricing carbon, there is high-level political will to move to implementation: from the ruling party (ANC, 2007), to Cabinet (RSA, 2008b) to Treasury (Manuel, 2009; Gordhan, 2011).

That said, the country is not yet at the point where the true costs of climate change are fully reflected in the relative prices of goods and services, or where future public and private investment strategies in the energy and industrial sectors assume an escalating price on carbon. However, despite the market concentration around major emitters, the sentiment is changing. There is a much stronger realization today than a few years ago that integrated energy planning, industrial policy frameworks and other policy domains must fully internalize the negative economic costs of externalities, and increasingly these frameworks demonstrate sensitivity in terms of these considerations.

Despite the broad commitment to the principle of making the low-carbon transition, the long-term integration with and alignment between different policy domains remains complex. This is, of course, not unique to South Africa and occupies the minds of policymakers across the world as they contemplate the challenge of deep structural transformation of economies over the next four decades.

Likewise, dealing with a complex political–economic environment is not an unusual phenomenon for a country grappling with the full implications of the transition to a low-carbon economy. It can be expected to be much tougher in a developing country that faces huge development and poverty challenges and where universal access to modern energy is still elusive.

In moving from scenarios to implementation, a national debate involving government (including various government line functions across the three spheres of government and a number of government agencies), business/industry (ranging from the major emitters to those investing in renewable energies), labour and civil society has been stimulated by the Treasury discussion paper on a carbon tax (RSA, 2010b).[2]

From the side of the South African government, the challenge is one of decoupling economic growth and emissions growth – and doing so with limited available resources to cover the incremental costs of greening energy infrastructure. The South African policy environment is still characterized by high unemployment, poverty and lack of access to basic services (including energy). Consistent with the ultimate objective articulated in Article 2 of the UNFCCC, the challenge from government's vantage point is therefore to stabilize emissions without preventing development from proceeding in a sustainable manner. Part of this challenge also involves difficult trade-offs between competing budget priorities.

South Africa needs sustainable development in order to address poverty and unemployment, improve the quality of life of its citizens and create social safety nets for the vulnerable. Achieving this goal requires job-creating economic growth with accessible and affordable energy; accessible and affordable transport; more efficient housing; more efficient industry; and improved agricultural productivity. At the same time, climate change is happening and will undermine future development. Given these climate and development imperatives, the challenge is to stabilize GHG concentrations in a way that delinks growth and development from GHG emissions, while adapting to the changing climate patterns.

Pricing carbon in the context of rising energy prices and pervasive poverty will require skilful consensus-building involving industry and labour (the latter also representing poor households). Building such a consensus will certainly be aided by a convincing case demonstrating the positive welfare impacts of revenue recycling.

Labour movements have already resorted to mass mobilization in order to resist electricity price increases to fund Eskom's capital expansion programme and maintenance backlogs. After decades of no real electricity tariff increases, the nominal increases of between 27 and 31 per cent in 2008 and 2009, respectively, as well as the compound increases in real terms of 69 per cent on 2009 prices over the next 3 years will certainly drive up electricity tariffs irrespective of the implementation of carbon pricing (IOL, 2011). It therefore goes without saying that labour would be concerned about the impacts of carbon pricing on households and would need to understand the rate of pass-through of higher costs from producers (upstream) to consumers (downstream). In addition, depending on how prepared business is to shift towards low-carbon activities, as well as the extent of growth of green industries in the South African economy, employment impacts may emerge as a result of carbon pricing.

Similarly, in the implementation of carbon pricing mechanisms, businesses would need clarity on how they would be affected, both in the domestic and international economy contexts. This could contribute to them transitioning towards more low-carbon operations. Transparency and inclusivity in policy development and the design of a carbon pricing mechanism would therefore be critical for the sustainability, equity and effectiveness of carbon pricing.

In this context, the role of civil society tends to be that of an independent force that monitors the progress of climate change mitigation (and carbon pricing) on the agendas of all parties: government, business and labour. In turn, civil society helps to ensure that the motives embedded in sustainable development, whereby the welfare of current generations does not carry more weight than that of future generations, is maintained.

Clearly, in South Africa's political economy with its multitude of actors, a package deal would be required to balance pricing of carbon with reinvestment, increased government spending, household compensation schemes or tax relief elsewhere in economy, and transitional arrangements for some industrial sectors. Pushing the debate on carbon pricing into implementation in the absence of such a package deal could create distortions.

In moving towards consensus, much can be learnt from the inclusive and very successful LTMS process that informed government's long-term climate policy framework, as well as the recent consultations on the second iteration of the Integrated Electricity Resource Plan. In particular, a proper analytical base, sufficient time for mutual learning and the building of trust, and a high-level dialogue between the state, labour, business and civil society will be key.

The remainder of this article presents a more detailed description and evaluation of the two major economic instruments for pricing carbon – a tax and emissions trading – in light of South Africa's policy implementation and socio-economic decision-making context.

4. Evaluation of available economic instruments

4.1. Introduction

Goldblatt (2010a) describes the two available options as follows:

1. 'Carbon taxes are a "price instrument" which directly establishes a price on GHG emissions. Emitters therefore face the full price of their emissions and take this into account in investment and output decisions'.
2. 'Emissions trading is a "quantity instrument" which directly establishes an emissions quantity through a cap on emissions imposed on emitters. Emissions trading allows for emitters to trade their emission allowances and hence indirectly establishes a price on GHG emissions' (Goldblatt, 2010a).

Both options are intended to reduce emissions at the 'lowest possible cost to society' and to meet environmental goals cost-effectively (Robb et al., 2010).

The choice of instrument is a particular case of the theoretical issue of 'price versus quantity' (Weitzman, 1974). With a carbon tax, the price is certain, but the emissions outcome (reduction quantity) is not. Government has direct price control through the determination of tax levels. With emissions trading, on the other hand, we know the target quantity of emission reductions, but not the price. The absolute quantity of emissions (the cap) is determined upfront through rationing (i.e. the allocation of a carbon budget by government). The absolute cap will be below current or projected emissions levels, creating scarcity. The price level is then determined through market forces (i.e. price discovery), for example, through the trading of emissions permits. Both policy instruments raise revenue for government – a carbon tax by its nature, and emissions trading as long as emission allowances are auctioned (Stern, 2006; Makube, 2010; Robb et al., 2010; Winkler et al., 2010)

Assuming sufficient political will and the absence of any ideological bias for or against a tax instrument as opposed to a carbon market, a number of dimensions should be considered in evaluating these two options (the categories of criteria below draw on those in articles by Goldblatt, 2010a; Robb et al., 2010; Winkler et al., 2010), namely: (i) economic efficiency, flexibility and fiscal predictability; (ii) environmental effectiveness; (iii) the welfare and economy-wide impacts, including on poor households; (iv) the impacts on competitiveness for intensive energy-users and exporter sectors; (v) the concentration of major emitters in the South African economy; and (vi) the complexity of implementation. These dimensions are considered in turn below.

4.2. Economic efficiency, flexibility and fiscal predictability

Goldblatt (2010a), Robb et al. (2010) and Yamba (2010) argue that, given perfectly competing markets, perfect information and certainty, carbon taxes and emissions trading schemes lead to ‘equivalent’ marginal abatement costs when emissions reduction outcomes are the same. A tax instrument will ‘reduce emissions up to the point where marginal GHG abatement is less costly than the tax’, thereby rendering the ‘marginal cost of emissions . . . equivalent through the economy and equal to the emissions tax rate’, while a carbon market will reduce emissions as long as the costs ‘are lower than the prevailing market price for emissions’, thereby also equalizing the marginal cost of abatement throughout the economy (Goldblatt, 2010a).

However, under conditions of uncertainty, imperfect knowledge and differentiated transaction costs, marginal abatement costs will vary. What is also clear from the literature is that there is no analytical base as yet to calculate these cost differentials. It is therefore assumed that the required ‘common price signal could – in principle – be delivered through taxation or tradable permits’ (Stern, 2006). In that situation, what matters in choice of instrument is the purpose that is being prioritized.

In terms of flexibility, Goldblatt (2010a) argues that a carbon tax allows slightly more room for industry to time their emissions reductions ‘under changing economic circumstances’, and that, by definition, it also produces greater price stability that serves as a predictable market signal to long-term investors. Stated differently, following the business cycle it is possible to vary abatement over time. The level of abatement will depend on the opportunity cost of abatement (i.e. price of emissions-intensive goods) as determined by demand and supply in the market.

Robb et al. (2010) point to a different advantage of emissions trading, namely ‘sophisticated risk management mechanisms (available) to firms to smooth their integration of carbon pricing over time’. Such risk management mechanisms could include ‘inter-temporal banking and borrowing of permits’ (Robb et al., 2010), and so-called ‘grandfathering’, whereby emissions rights are allocated free of charge for transitional periods on the basis of historical emissions levels (Robb et al., 2010; Winkler et al., 2010) – something not generally favoured by environmentalists preoccupied with environmental effectiveness. However, this will be discussed more thoroughly later.

There is fairly broad agreement (Robb et al., 2010; Goldblatt, 2010a) on the advantages of price stability, and the predictability of fiscal revenues under a tax regime. A carbon tax by its nature generates more predictable revenues, whereas ‘price volatility under an emissions trading scheme’ renders public revenue streams uncertain (Goldblatt, 2010a).

When revenues from either a tax or auctioned allowances are recycled as tax relief for the poor, or other household compensation schemes to offset higher-energy prices, or are reinvested as incentives for research and development (R&D), renewable energies, energy efficiency, or low-carbon diversification, price stability and predictable revenues become even more important. Fixed prices also lead to more predictable extra costs for carbon-intensive producers, and more accurate estimates of the impact of carbon pricing on poor households.

One challenge of a tax is the difficulty in determining the appropriate level of taxation. In a Pigovian tax, the level of taxation should reflect the cost of the environmental externality to be addressed. In the case of climate change, where the estimation of the costs of inaction is not a precise science, determining the point where the marginal cost of emissions equals the marginal societal benefit of reducing emissions is no easy task (Devarajan et al., 2009; Makube, 2010). Governments may have to adjust tax levels to achieve the desired environmental outcome – a particular level of GHG emission reductions.

4.3. Environmental effectiveness

Both these instruments give 'a monetary value to 'clean' energy processes' (ERC, 2007b; Winkler, 2010), and make 'carbon a factor of production that needs to be paid for in the same way as labour or raw materials' (Cloete and Robb, 2010). The pricing of externalities through these instruments makes 'the use of fossil fuels much less attractive, and induces an indirect effect of greater investment in low-carbon technologies' (DEAT, 2007). In other words, the instruments encourage substitution, and an adjustment in the behaviour of consumers and producers. Yet, it is argued that the two options differ in their environmental effectiveness.

Goldblatt (2010a) underscores the greater environmental effectiveness of a cap-and-trade regime. By its nature, it has 'an inflexible cap' based on 'defined emissions targets'. It does, however, pose the risk of 'an incorrectly calibrated emissions cap', which, if set too high, will reduce environmental effectiveness (Goldblatt, 2010a). Should a country decide to adopt an absolute emissions target (as opposed to the current commitment to a relative deviation from baseline), a cap-and-trade regime brings greater certainty with a view to compliance with international obligations (Robb et al., 2010).

Taxes, on the other hand, are easier to apply on an economy-wide basis. Emissions trading schemes typically cover only part of the economy. A tax could ensure wider coverage of all economic sectors in the country – especially when the tax is levied upstream in the energy production value chain. Tax regimes limit the risk of evasion; are less susceptible to political lobbying for exemptions, in particular when grandfathering or other political compromises to energy-intensive, trade-sensitive sectors come into play, and limit the room for administrative discretion or corruption (Robb et al., 2010; Winkler et al., 2010; Goldblatt, 2010a). Although, in a tax regime, there is no certainty on the quantity of emissions reductions upfront, tax rates can be increased to achieve more ambitious emissions reductions, which of course depend on price responsiveness and substitutability.

4.4. Welfare and economy-wide impacts

Based on the current modelling in South Africa (Kearney, 2010), the two instruments can be regarded as equivalent in terms of impacts on welfare and the economy, and 'neither instrument is a priori better or worse in its effect on economic growth, assuming each is appropriately designed' (Robb et al., 2010). It goes without saying that the actual effect depends more on the tax level, the size of the emissions target and the manner in which revenues are recycled, than on the choice of an instrument as such.

A range of studies have been completed in a static computable general equilibrium (CGE) framework. The potential for a triple dividend was explored by Van Heerden et al. (2006) in a CGE framework with the intension of determining how to simultaneously reduce emissions, expand economic development and alleviate poverty. The authors found that when the revenues of any one of the four environmental taxes analysed (i.e. a tax on greenhouse gas emissions, a fuel tax, a tax on electricity use and an energy tax) is recycled through a decrease in the price of food, a triple dividend is found.

Pauw (2007) conducted a static CGE modelling exercise for the LTMS and found a variety of efficiency, investment, employment and welfare impacts for the various scenarios assessed.[3] One of the most significant results was that, under the *Use the Market* scenario where a CO_2 tax is implemented, the welfare implications tend to be negative for all households with the exception of poor households as these impacts are mitigated through a food subsidy. Devarajan et al. (2009) find that direct carbon taxes would impose the least distortionary impact on the South African economy when compared to the alternative of a tax on energy or energy-intensive sectors of the economy.

Kearney (2008, 2010) analysed the impacts of the gradual increase in the carbon price as proposed in the LTMS study, using a dynamic CGE model. The dynamic CGE model factors in the circular flow of carbon pricing revenues in the form of either tax relief or reinvestment, as well as the resulting expansion of capital stock over time. The author finds that the economic impact of a carbon tax is 'mildly positive if this is combined with either tax relief or reinvestment' (Kearney, 2010), and, even though the demand for fossil fuel energy may decline as energy prices increase, the demand for energy will in the long run increase along with investment. Under static modelling (only considering the economy's once-off reaction to the policy shock), the impact on GDP was previously found to be −2 per cent, which is not surprising, given that 'economic models see taxes as a distortion away from equilibrium' (Winkler, 2010). In the dynamic model, the GDP impact was a positive 0.7 per cent, and increases in energy prices are overshadowed by higher investments. All households are better off, inter alia due to the expansion of productive capacity of the economy (Kearney, 2008).

Kearney (2010) voiced an important caveat, though, namely the expected distorting impact of carbon pricing. The issue here is the distributional impact on different income groups, i.e. how a price on carbon might impact on the distribution of income – and the fairness of such distribution.[4] Winkler et al. (2010) also stress the vulnerability of the poor in the face of rising energy costs. Makube (2010) takes a similar stance, and emphasizes poor households' vulnerability, given the anticipated behaviour of the state-owned natural monopoly in the electricity-generation sector, Eskom, in South Africa. The author emphasizes that, in the absence of a competitive market, a price on carbon will not 'yield an optimal outcome... where the social marginal benefit of the tax is equal to the social marginal damage'.

In economics, an inefficient allocation is called a 'deadweight loss', in that it would be possible to find a better allocation where no-one is worse off and at least some are better off. Makube (2010) therefore makes a strong case for a tight regulatory environment, combined with a tax regime that prevents the passing through of costs to consumers. Goldblatt (2010a) agrees, and points out that '[c]arbon pricing through any mechanism will affect the level and distribution of the real income of households', but, like Kearney (2010) and Winkler et al. (2010), stresses that the impact can be tempered if revenue is used to 'offset' negative effects and to address distributional issues. In particular, Kearney (2010) finds that under the *Use the Market* scenario, all household income groups are better off when a carbon tax is levied and combined with tax relief or the reinvestment of carbon revenues.

Goldblatt (2010b) recognizes that placing a price on carbon will have disproportionately negative impacts on poor households simply based on the nature of their household expenditure. In particular, Figure 1 (Goldblatt, 2010b) clearly illustrates that lower-income groups spend a relatively larger share of their income on energy, as compared to higher-income groups.

Taking this one step further, Goldblatt (2010b) then models the household impact of a R100 per tonne of CO_2 equivalent carbon price and finds that, as compared to the highest income decile increasing its spending by 0.36 per cent, the

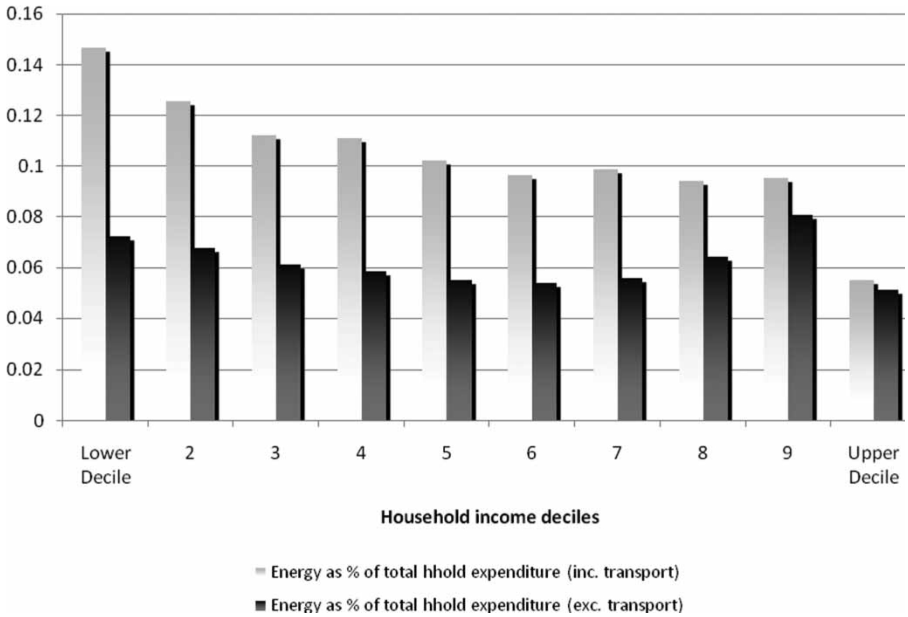

FIGURE 1 Energy as a proportion of total household expenditure
Source: Goldblatt (2010b).

poorest 10 per cent of households will spend an additional 1.27 per cent due to the implementation of a carbon tax of this form. In effect, a carbon tax would be regressive in nature and lead to counter-productive impacts in terms of the inequality reduction aims of government tax policies.

The important point here is the recycling of revenue – be that revenue raised through a tax, or through the auctioning of emissions allowances under a cap-and-trade regime. Goldblatt (2010b) recommends that the regressive nature of a carbon tax be addressed such that it is instead progressive. In other words, the revenue generated through a tax or trading scheme should not simply be regarded as income, but it should be recycled to alleviate the impact of increased energy costs on poor households. It can take the form of targeted tax relief elsewhere in the economy and government expenditure. For example, lump-sum transfers to households, increased social grants, food and school fee subsidies or pro-poor electricity tariffs could act as the means to mitigate the impacts of carbon pricing on poor households (Goldblatt, 2010b). Winkler et al. (2010) also underline that recycling could further support mitigation, thereby yielding a double dividend. A triple dividend could be achieved if this increased investment leads to job creation as well.

4.5. Competitiveness impacts

Both instruments favour lower-carbon industries over energy-intensive, high-emitting sectors, and are likely to trigger structural changes in the South African economy. This is bound to have sectoral welfare impacts. In the absence of a global price on carbon, both instruments could trigger carbon leakage, i.e. the migration of high-emitting industries to countries with less stringent carbon constraints (Cloete and Robb, 2010). In the trade-exposed sectors, it raises significant issues of international competitiveness (Winkler et al., 2010). In short, competitiveness impacts may be domestic (between sectors) or international.

This is of particular significance to South Africa, given the high-energy consumption (largely from fossil fuels) per unit of GDP. To deal with this, transitional arrangements for high-emitting, trade-exposed sectors could be considered as part of the design of both economic instruments. This would be slightly easier to achieve with emissions trading, where initial allowances to affected industries are not auctioned, but allocated administratively free of charge (Winkler et al., 2010). Under a tax regime, rebates for sensitive sectors can also be considered (Robb et al., 2010).

In Table 1, Jooste et al. (2009) identify those energy-intensive, trade-intensive, and energy-*and* trade-intensive (EITI) sectors in South Africa that could be targeted for such transitional arrangements.

However, a note of caution should be raised. Even though the development imperatives (i.e. job opportunities, economic growth, poverty, etc.) underlying such exemptions are well understood, the risk of abatement inefficiency due to differentiated treatment across sectors should be carefully considered. Structured approaches to EITI sectors still need to ensure that these sectors contribute to mitigation. Exemptions or free allocations will dilute the carbon cap through its exclusion of major emitting sectors. Stern (2006) made this very clear: '[A]batement costs are minimised when the carbon price is equal across sectors', while 'free allocations can significantly distort incentives . . . for emissions reductions'.

When one introduces exemptions, the risk arises that the sectors covered by a carbon price are narrowed rather than broadened, thereby diluting scarcity. In such a case it will distort the incentive scheme. Once exemptions are allowed, the taxation or allocation process may even be exposed to political lobbying and potential abuse. This suggests that any exemptions should be introduced transparently, for transitional periods only, and only if the welfare and emissions reduction trade-offs are well understood.

TABLE 1 Energy-intensive, trade-intensive and EITI sectors

Energy-intensive sectors	Trade-intensive sectors	EITI sectors
Iron and steel	Basic iron and steel	Iron and steel
Non-ferrous metals	Basic non-ferrous metals	Non-ferrous metals
Non-metallic minerals		
Chemical and petrochemical products		
Mining and quarrying	Gold and uranium ore mining	Gold and uranium ore mining
	Coal mining	Coal mining
	Other mining	Other mining
	Machinery and equipment	

Source: Jooste et al. (2009).

4.6. Appropriateness in light of market concentration

Emissions' trading requires a competitive market with a relatively large number of market players. High market concentration would distort economic efficiency, and is likely to lead to price manipulation. A small number of market players can create 'monopoly power in any subsequent trading' (Goldblatt, 2010a). This is a real risk, given the market concentration in South Africa. Of the total local emissions, 79 per cent come from energy production and use (DEAT, 2009), with a high concentration among a few potential market players: Sasol, for example, accounts for 12 per cent of emissions, and Eskom for 44 per cent (DEAT, 2009). Stated differently, the 'concentrated market structure of the South African energy sector raises . . . concerns about the ability to construct a competitive and efficient emissions trading market' (Goldblatt, 2010a).

This reality could favour a hybrid model in South Africa, with some sectors being regulated through a cap-and-trade regime, and others, notably the major emitters, taxed on emissions at source. In practice, a tax regime might be applied for major emitters like Sasol and Eskom, with emissions trading markets covering high-emitting sectors with a larger number of market players. What should be noted, however, is that if Eskom and Sasol are removed from the trading scheme, only a small percentage of emissions would in effect be covered by the trading scheme. The administrative cost for covering such a small proportion of economy-wide emissions may be difficult to justify.

Robb et al. (2010) point out that the only other way to avoid the market concentration dilemma is to design the emissions trading system by moving down the value chain, focusing on end users rather than emitters. The researchers add that this will be administratively complex, and could create gaps in the coverage of emissions.

Market concentration also has implications for a tax regime. It would seem far simpler to levy the tax upstream at the point of emission (i.e. a direct tax on emissions), than downstream through proxies on emissions, for example, a sales tax on energy inputs, or taxes on the carbon embedded in final goods and services (National Treasury, 2006).

4.7. Complexity of implementation

At an operational level, both instruments require extensive monitoring, reporting and compliance. However, there is broad consensus that the complexity and transaction costs involved in designing and administering an emissions trading regime exceed those of a tax regime.

Trading attracts intermediaries and may spawn secondary markets with their own risks. Robb et al. (2010) believe that emissions trading may just be too sophisticated for a developing country with an existing skills deficit and major gaps in available emissions data from industry.

It also seems as if at least some in industry favour 'a strategy that would be administered by South Africa's most effective government department, the South African Revenue Service' (Tyrer, 2009), rather than having to create expensive new institutions to deal with accounting, reporting, verification and trading mechanisms. Goldblatt (2010a) also supports a simpler carbon tax 'based on existing tax instruments and mechanisms of tax collection', and adds that it should ideally be 'applied at an upstream level in the fossil fuel use chain', which does 'not require the monitoring of emissions' as in a cap-and-trade regime.

5. Conclusion and policy recommendations

In the discourse on the two policy instruments, namely emissions trading versus a carbon tax, the debate focuses on trade-offs between the economic efficiency, flexibility and predictability; the environmental effectiveness; the welfare and economy-wide impacts; ways to soften competitiveness impacts; the design implications given the market concentration in South Africa, and the complexity and transaction costs of the implementation of the respective instruments. In terms of the welfare implications of carbon pricing in particular, Goldblatt (2010b) illustrates the potential for carbon pricing to generate a regressive tax system whereby poor households incur a disproportionately higher burden of higher energy costs, than higher-income households. As such, it is proposed that the regressive nature of a potential carbon tax be converted to be progressive through the recycling of carbon revenues in the form of incentives for cleaner-energy investment and/or to alleviate the impact of increased energy costs on poor households.

In this article, a preference has emerged for a carbon tax, without closing the door on emissions trading or a hybrid model. By design, a carbon tax does not create the same certainty with respect to environmental outcomes, but the level of a tax can be adjusted to achieve the desired emissions reductions. Provision would need to be made for adjusting tax levels, however, and if that adjusting is upwards, this may prove politically difficult in the context of increasing energy prices. A tax has clear advantages if the policy priority is price stability, providing long-term policy signals to investors; transparency of pricing; stability of fiscal revenues and an economy-wide coverage of emissions. Given the existing administrative tax collection efficiency, a carbon tax entails lower transaction costs as well. The complexity of implementation, and the risk of evasion, will be reduced if emissions are taxed directly, upstream in the fossil fuel value chain, rather than trying to find downstream proxies for emissions.

At the most fundamental level, if price stability is given high priority among policy goals, this favours a tax; if certainty of environmental outcome is paramount, emission trading is preferable. It is also possible for both instruments to be used in one country, for example, with coverage of different sectors and/or facilities.

In implementing a carbon tax, three issues need to be clarified; firstly, the political feasibility of the recycling of revenues. To limit the welfare impacts, revenues must be recycled, probably through a combination of tax relief to poor households affected by higher energy costs and targeted government spending, which may be achieved through on-budget or soft earmarking. Refinement of existing research is needed to verify analysis of the impacts of such revenues on the well-being of poor households and in relation to existing social grants and current labour market dynamics (particularly in relation to the high level of unemployment in the country). In addition, in support of the broader transition to a low-carbon economy, subsidies and other incentives to leverage renewable-energy and energy-efficiency investments by the private sector, as well as focused R&D spending, could benefit from increased government spending. The concerns by treasuries to keep a carbon tax within the principles of sound public finance policy can be addressed in this manner.

Secondly, the compatibility of tax regimes and emissions trading regimes requires further investigation. Emissions' trading provides greater certainty of environmental outcome – the core objective in climate mitigation policy must be reducing emissions. The cap in 'cap-and-trade' is a central element, and one that should inform the national burden-sharing discussion that needs to take place in South Africa. At the same time, it should be considered that an overall emissions target and the 'cap' in a cap and trade scheme is unlikely to be the same. A cap and trade scheme would leave gaps that need to be addressed through additional policy instruments. The biggest challenge to emissions trading is the duopolistic nature of the energy economy, and the implication that there might not be liquidity in a purely domestic carbon market. However, the potential for linking markets (and the spectre of border trade measures in their absence) means that the option of cap-and-trade should not be definitively rejected.

Should the international climate change negotiations evolve to such an extent that domestic emissions trading regimes are linked, South Africa may well wish to consider ways in which a domestic carbon tax regime can either be linked to such an international regime, or be regarded as a first step in a staggered approach. A hybrid model, with different sectors covered by tax and trade, could evolve over time. This would also allow time for South Africa to develop more sophisticated methodologies and local capacities, more complete information about GHG emissions at firm level, and a market structure more amenable to carbon trading. Our conclusion, however, is that the more practical starting point for implementation is a carbon tax. Turning discussion into action is very urgent indeed.

Finally, carbon pricing is important, but not sufficient. It is an indirect measure that sends a powerful signal for emissions to be reduced in the real economy. In isolation, it would not achieve the country's climate change mitigation objectives. Carbon pricing needs to form part of a broader government strategy to facilitate the transition to a low-carbon economy; to create green jobs; to incentivize behavioural change through awareness and regulation; and to work towards a more ambitious climate-resilient and low-carbon technology R&D strategy.

Together, government, labour, industry and civil society can achieve much more in a carbon-constrained world. An interactive and inclusive national policy process should continue to build a middle ground on the complex issue of pricing carbon. This kind of transparency and accountability in the policy development process avoids any miscommunication between parties or any vested interests superseding those of others. Ultimately, while the design of a carbon pricing mechanism is important, it is the manner in which it is administered to and communicated with those affected by it, that determines its effectiveness and sustainability.

Historically, the major players in South Africa's political economy have demonstrated that they have a very unique ability to find common ground and act in the national interest – even in the face of seemingly competing agendas – and when the time is right, to rise to major challenges with a united voice. The challenge of and imperatives for decarbonization should not be underestimated. What is clear is that despite the remaining uncertainties, the main actors are in the process of uniting in their resolve to tackle the climate change challenge head-on, without compromising socio-economic development. It is now over to finalizing the implementation details, aligning policies and developing a deeper understanding of how to adapt business strategies to the new drivers of competitive advantage in a carbon-constrained future.

Notes

1. The concepts of emissions trading, a cap-and-trade regime and a carbon market are used interchangeably in this article. Reference to carbon markets is used in the narrow sense referring only to a regulatory cap and trade regime and not voluntary off-set markets.
2. An important recent development is the emergence of the low-carbon economy theme on the agenda of the National Planning Commission.
3. The modelling results are illustrated in Table A.1 of the Appendix.
4. The distributional impact of a tax across income groups/households is assessed here in terms of the effect which a carbon tax has on the spending ability (i.e. expenditure) of an income group. As such, a carbon tax can result in certain income groups having less, more or the same disposable income after the tax was imposed, as compared to prior to its imposition. The welfare effects of a carbon tax could thus be differentially felt across income groups depending on the initial spending patterns of income groups. In particular, a negative distributional impact of a carbon tax for a household would thus be felt if the ability of a household to spend decreases after the tax is applied. A positive distributional effect would imply the converse implication.

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APPENDIX 1

TABLE A.1 Condensed summary of results of economy-wide modelling

	Structural shift	Efficiency	Investment	Impact on GDP	Employment/job impact	Poverty/welfare
	Description of inputs to economic model			Results		
Start now/ combined initial wedges	Moderate shift towards renewables, e.g. electricity supply from coal declines to 46%, with nuclear and renewables each contributing around 27% in 2050 (9% renewables and 5% nuclear by 2015) Also: changes in transport to more efficient vehicles and shifting to public transport	Net-negative cost wedges, esp energy efficiency, implemented esp in industry	Relatively little additional investment required, few positive cost mitigation options added	Small / negligible (+0.2% GDP in 2015)	Small and ambivalent – positive for unskilled (1%), skilled (1.2%) and highly skilled (1.7%) in 2015, but negative for semi-skilled (−2% in 2015, −2.5% in 2010) – which is of concern. Only short-term costs of mitigation are considered and not the longer-term productivity gains	Household welfare increases relative to reference case for all household groups High-income HH benefit as high-skilled labour gains and low-skilled labour losses. Savings reduce investment requirements also avoid negative consumption effects of higher savings
Scale up/ combined extended wedges	Transition to zero-carbon electricity by mid-century. Significant shift towards renewables and nuclear, e.g. output share of coal-fired electricity plants declining to 2%. Add carbon capture and storage, extend biofuels as far as possible, introduce electric vehicles	Mitigation extended, adding more efficiency and further positive cost wedges	Significant investment required, between 5 and 10% above the reference case	Initially higher (+1% in 2015)	Increase: +1% in 2015 Semi-skilled jobs peak at 3% in 2015	Generally negative with positive impacts for low-skilled labour if biofuels is pushed hard High-income HH loss (opposite of above)

Continued

TABLE A.1 Continued

	Structural shift	Efficiency	Investment	Impact on GDP	Employment/job impact	Poverty/welfare
	Description of inputs to economic model			Results		
Use the market/ CO_2 tax	Uses economic instruments. Key driver is a CO_2 tax, starting at current carbon prices and escalating. Tax quickly reduces coal in electricity and synfuel sectors and shifts in fuel and towards efficiency [Incentives included in energy modelling for SWH, biofuels and renewable electricity not assessed in CGE modelling]	Driven by tax, but efficiency allows (limited) response on energy demand side. Plus fuel switching to gas	High investment required initially, 20% above reference case	Negative (-2% in 2015) as taxes result in energy price increases unless countered by fiscal policies. Recycling revenue can off-set economic impact at lower tax levels	Jobs *increase* for lower-skilled ($+3\%$ semi-skilled, 0% for unskilled in 2015) *Decrease* for higher-skilled workers (-2% for skilled and -4% for highly skilled)	Negative for all households, except poorer households who gain initially from food subsidy; impact depends on fiscal options, low income households can be targeted directly

Source: Department of Environment Affairs and Tourism (2007).