nuclear industry association of south africa

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Feedback by the Nuclear Industry Association of South Africa (NIASA) to National Treasury on its Carbon Offsets Paper (April 2014), which was released for public comment.

NIASA's comments on National Treasury's Carbon Offsets paper (April 2014)

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Executive summary

During April 2014 the South African National Treasury released its *Carbon Offsets Paper* for public comment. The Nuclear Industry Association of South Africa (NIASA) submits the present document as its response to this call.

The South African Government decided to implement a carbon tax on emission of Greenhouse Gasses (GHG) in selected industries of R120 per ton CO_2-equivalent from 2016. Initially the bottom 60% of emissions will be exempted from this tax, but the full tax will be phased in over 5 years. Carbon tax will increase the cost of energy in South Africa, which will lower the international competitiveness of energy intensive South African industries, which may cause a flight of some of these industries towards more carbon-friendly countries, such as China. Such carbon leakage is at odds with Government policy. Therefore carbon offset credits are introduced as a means to reduce the cost of removing GHG from the atmosphere.

The Carbon Offsets paper allows industries to reduce their carbon tax by up to 10% of actual GHG emissions by offsetting their emissions by investing in activities in other industries that reduce carbon emissions or captures and stores carbon from the atmosphere, such as planting ‘spekboom’ forests in the Eastern Cape.

Investing in carbon offsets may provide a cheaper alternative than directly reducing carbon emissions by for instance displacing coal power. Therefore it may in principle slow the move away from coal power towards clean low carbon technologies. However, in practice this cost reduction will be too small to substantially affect power technology choices or reduce carbon leakage. Therefore the main effect of introducing carbon credits can be expected to be removal of significant amounts of GHG from the atmosphere at more affordable costs and at virtually no risk to any of the other sectors of the South African energy industry.

Therefore NIASA supports the concept of introducing carbon offset credits.

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1 Introduction

During April 2014 the South African National Treasury released its *Carbon Offsets Paper* for public comment. The Nuclear Industry Association of South Africa (NIASA) submits the present document as its response to this call.

2 The Carbon Offsets Paper in a nutshell

The South African Government decided to implement a carbon tax on Greenhouse Gas (GHG) emissions of R120 per ton CO_2-equivalent in selected industries from 2016. Initially the bottom 60% of emissions will be exempted from this tax, but the tax will be phased in over 5 years, after which time the full emissions will be taxed at this level of R120 per ton CO_2-equivalent, which will also be adjusted for inflation. The purpose of this carbon tax is to send a price signal to the market that will incentivise a move away from the carbon intense energy options, such as coal power, to low carbon options such as nuclear, solar, wind and hydro power. All energy options emits some GHG, but since Eskom's fleet of coal-fired power plants is South Africa's largest emitter of GHG and other pollutants, this report will focus on coal power from the perspective of what Eskom's best options might be. **This focus on Eskom as South Africa's largest GHG emitter should not be construed as a negative judgement of Eskom or its commitment to reducing GHG emissions:** It is well known that Eskom has a responsibility to keep the lights on to the best of its ability and thus ensure that the economy is not irretrievably damaged. Even if Eskom wanted to now shutdown coal-fired power stations, the National Energy Regulator (NERSA) and Government would probably not allow Eskom to do so. It should further be remembered that Eskom does not determine what technologies it shall use to generate electricity and who (Eskom or other public or private companies) should construct and operate power stations – this is done via the Integrated Resource Plan and the Electricity Regulation Act of 2006, i.e. Government.

Conclusions drawn for coal will also apply to lesser GHG emitters, but to a lesser extent.

2.1 Current R120/ton CO_2-equivalenty carbon tax too low to drive reductions in GHG emissions

The modelling results of the Integrated Energy Plan (IEP) and Integrated Resource Plan (IRP) Update suggest that the R120/ton CO_2-equivalenty carbon tax will be too low to affect technology choices in the South African electrical power industry and will thus not effectively lower SA's carbon emissions. Thus far external costs, such as nuclear accident costs, acid mine drainage water from coal mines and health costs caused by poisonous emissions such as mercury in the smoke of coal-fired power plants have not been taken into account in the

IEP and IRP Update. However it is standard Government policy that all such external costs should be internalised, i.e. all polluters should be made to pay for all external costs produced by their activities. The Externalities Sub-Committee of the South-African Department of Energy (DOE) is therefore currently working on methods to internalise external costs in the IEP. The combination of external costs and carbon tax will probably be high enough to drive a gradual move away from coal to the low carbon alternative power sources.

2.2 Environmental taxes my cause carbon leakage

These taxes will, however, increase the cost of power in South Africa, which will lower the international competitiveness of power intensive South African industries, which may cause a flight of these industries towards more polluter-friendly countries, such as China. This process is called carbon leakage and is at odds with the declared policies of the SA government. Therefore measures need to be implemented to prevent carbon leakage.

2.3 Carbon offsets may reduce GHG in atmosphere cost effectively

Carbon offsets is designed to lower the cost for South African GHG emitters of reducing GHG concentrations in the atmosphere of the planet. These lower costs should then increase the incentive to reduce GHG in the atmosphere and reduce the incentive to flee SA in order to avoid Carbon tax.

The Carbon Offsets paper allows industries which are already subject to carbon tax, such as Eskom's power generation business, to reduce their carbon tax by up to 10% of their actual GHG emissions by offsetting these emissions by investing in other activities in other industries that either reduce carbon emissions by becoming more efficient or captures carbon from the atmosphere and store it. It is an accepted fact that the capture and storage from the smoke of coal plants by chemical or physical means (i.e. by building a CO_2 capture and storage plant) is too expensive to be economically viable. Furthermore this proposed technology has never been demonstrated successfully and thus is not a real option for Eskom. Therefore this kind of capture and storage is not discussed in this report.

The only two real options that South Africa has for lowering atmospheric GHG are:

1.) Release less GHG into the atmosphere by burning less coal or release less fugitive methane gas into the atmosphere by (in future) mining less shale-gas by means of fracking in the Karoo. As will be shown below, these will be costly options, both to Eskom and the South-African economy. It can also be expected to be politically unpopular. It is therefore unlikely that this route will significantly reduce GHG emissions in South Africa.

2.) Generate carbon offset credits by investing in capturing and storing CO_2 by natural means, such as planting spekboom forests, or by investing in reducing GHG emissions in other industries that are not subject to carbon tax. Investing in energy efficiency would be an example. Depending on the various cost factors, this option may be economically viable.

An excellent feature of the proposed carbon tax + carbon offset credits scheme is that it does not force any single solution onto Eskom, but leaves it free to choose the most beneficial from the following options:

- Keep on emitting GHG and just pay the carbon tax. NERSA will probably pass this tax on to consumers. Government can then use this carbon tax revenue to subsidise reductions of GHG in other industries.
- Reduce its carbon tax by reducing GHG emissions by investing in clean power technologies in Eskom's own power plant fleet.
- Obtain carbon offset credits by investing in GHG mitigation options in other industries, as explained above.

Giving Eskom this flexibility to choose the most viable strategy will result in the most cost-effective solution. If any of these three options would turn out to not be viable, that would not be a big problem as it would still leaves Eskom with two other viable alternatives.

Generating carbon offset credits by investing in planting 'spekboom' forests in the Eastern Cape may be a viable strategy. Spekboom trees capture CO_2 from the atmosphere into their leaves, which later fall to the ground in order to produce carbon-rich mulch, which effectively stores this carbon in the soil.

Reducing carbon emission by for instance closing down coal plants and their associated coal mines and replacing them with low carbon power sources will be expensive, which may result in resistance from vested interests. These measures can also be expected to cause job losses, which can be expected to be resisted by trade unions, which may make these measures politically difficult to implement.

In many cases the direct abatement cost of GHG emissions will be higher than the R120/ton CO_2-equivalent carbon tax and therefore it will probably be in the best financial interest of GHG emitters, such as Eskom, to simply keep polluting and pay the carbon tax. In most cases this tax will probably be passed on to consumers. The carbon tax will thus only increase SA power costs, which may lead to unacceptable carbon leakage, without significantly lowering GHG emissions. However, if planting spekboom forests may capture and store CO_2 at say R100/ton, Eskom may then choose to rather invest in the spekboom forests, than to cut the production of coal power. Every ton of CO_2 captured and stored in

this way will then cost Eskom only R100, while it will offset R120 carbon tax, which will leave Eskom with a R20 profit per ton of CO_2 captured, while the planet will then get the benefit of an actual reduction in CO_2 in the atmosphere. Carbon offset credits may thus result in a win-win situation.

2.4 Preventing double counting

However, carbon offsets also create the potential for double counting: if Eskom were to reduce its carbon emissions by displacing some coal power generation with nuclear or wind power generation, it would be rewarded directly by the reduction in its carbon tax. If, however, Eskom were to also claim carbon offset credits for this investment in low carbon power generation, it would then be rewarded twice for the same action, which would be unacceptable double counting. Therefore the *Carbon Offsets Paper* excludes activities that are already subject to carbon tax, such as large scale power generation, from claiming carbon offset credits for reducing their GHG emissions.

3 Implications of carbon offsets for the different power sources

3.1 Implications for the balance between coal and renewables

- As has been explained above, large scale power generation is excluded from the list of activities that can generate carbon offset credits. Therefore the direct impact of these offsets on these different power generation technologies will be zero.
- However, there will be indirect impacts. Since carbon offset credits may offer a cheaper way of reducing GHG concentrations in the atmosphere than displacing coal power production, the introduction of carbon offset credits may in principle cause Eskom to cut back less on burning coal by rather investing in other carbon offsetting activities. In theory this could make life more difficult for the low carbon power sources, such as nuclear, wind and solar.
- However, in practice the introduction of carbon offset credits will have a negligible impact on power generation technology mixes:
    - Firstly the simulation results from the IEP and IRP Update suggest that R120/ton CO_2-equivalent carbon tax is too low to induce a significant swing away from coal power: Since the production of 1 kWh of coal power causes the emission of about 0.9 kg of CO_2, the R120/ton CO_2-equivalent tax will translate into an increase in the cost of coal power of about R0.11/kWh. Depending on the assumptions used in the calculations, most clean sources of power, such as wind and solar, are more than R0.11 more expensive than

coal power, which explains why the addition of this carbon tax will, in itself, not cause a significant swing from coal power to say wind or solar power.

- According to the *Carbon Offsets Paper*, carbon offset credits can be used to offset a maximum of 10% of any business' actual carbon emissions. If these carbon credits were to be generated by an offset technique with a zero cost, which is virtually impossible, it would thus result in a reduction of R120 carbon tax on only 10% of the tons of CO_2–equivalent emitted by this business. This would then result in an only 10% reduction in the carbon tax on the average ton of CO2-equivalent emitted, i.e. only R12/ton CO_2-equivalent. However, if the introduction of a R120/ton CO_2-equivalent carbon tax was too low to cause a substantial switch away from coal, than obviously a R12/ton CO_2-equivalent reduction in this carbon tax will much more so be too small to cause a significant swing back to coal power.
- However, almost no carbon offset activities come for free. Therefore the average saving caused by investing in carbon offsetting activities will in reality be substantially smaller than R12/ton CO_2-equivalent. In view of the calculation in the previous paragraph, the actual reduction in the average carbon tax will thus be substantially less than R0.01/kWh. So, if the introduction of an R0.11/kWh carbon tax was not enough to cause a substantial swing away from coal power, then obviously reducing this tax by less than R0.01/kWh will not cause a noticeable swing back to coal power.

- Therefore the main effect of introducing only the R120/ton CO_2-equivalent carbon tax will be to increase the price of power in SA by about R0.11/kWh, without significantly reducing our GHG emissions. This can be expected to induce only limited amounts of carbon leakage, as power in most countries is more expensive than that in SA by more than R0.11/kWh.
- However, this may change if the carbon tax is combined with levies aimed at internalising the external cost of the different technologies, such as the health costs of poisons in the smoke from coal-fired power plants as well as the environmental costs of acid water drainage from coal mines etc. The combination of carbon tax and external cost levies, together with subsidies for renewables, may be enough to make coal power more expensive than these renewables, which may then induce a substantial swing away from coal towards renewables, as has happened in many countries, including Germany and the US. Obviously, if this swing from coal is driven by introducing substantial external cost levies, it will substantially increase the cost of power, which can be expected to induce more significant carbon leakage. If, on the other hand it is driven by the introduction of subsidies for clean power, this will put a

substantial tax burden on citizens, which may stifle economic growth, which may also cause industries to flee South Africa, which may result in substantial indirect carbon leakage.

3.2 Nuclear power

- One possible escape from this dilemma is nuclear power. If the capital costs of new nuclear power plants were to be low enough that nuclear power can be produced at similar costs than coal. A swing away from coal to nuclear, induced by the introduction of the carbon tax and environmental levies on external costs, will then not have to result in increasing power costs. Recent studies by NIASA showed that, provided that the real pre-tax Weighted Average Cost of Capital (WACC) can be limited to about 5%, nuclear power will indeed be cheaper than coal power, which will remove the threat of carbon leakage. However, if the WACC were to increase to be substantially above this number, nuclear power may become substantially more expensive than coal power, depending on the capital costs of the new power plants etc.

3.3 Effects on actual GHG reductions

- Whatever the case may be, the economic effect of reducing the carbon tax by substantially less than R0.01/kWh, through investing in carbon offsetting activities, will be negligible on power technology choices and power costs and therefore on carbon leakage.
- In contrast to its negligible economic risk, introducing carbon offset credits may actually remove many millions of tons of GHG from the atmosphere: If enough carbon offsetting activities were to be made available at lower costs than R120/ton CO_2-equivalent, utilities can be expected to invest substantially in these activities. These activities will then effectively remove many tons of CO_2-equivalent from the atmosphere, which may have a positive impact on global climate change.
- The following gives rough numbers on how this may work in practice:
  Eskom estimated its 2012/2013 CO2 emission to amount to 227.9 million tons, which we shall here round off to = 230 million tons of CO_2/year.

  Under the provision that only 10% of these emissions may be offset by carbon credits, the maximum carbon offset credits that can be generated is for 23 million tons of CO_2/year.
  One hectare of spekboom can captures and stores roughly 4 tons of CO_2/year. Eskom will thus have to invest in planting roughly 6 million hectares of spekboom to

capture and store this amount of CO_2 and generate the associated offset credits. These spekboom forests will thus have to cover about 6% of the roughly 100 million hectares of agricultural land (i.e. arable + grazing land) in South Africa.

It would probably be both impossible and nonsensical for Eskom to obtain and plant 6% of SA under Spekboom, so clearly South Africa should explore foreign options, such as investing in planting profitable wood plantations in the tropical areas higher up in Africa etc.

- SA emits only about 1% of the world's CO_2 and offsetting a maximum of 10% of that would thus reduce global CO_2 emissions by only 0.1%, which is tiny and can thus be expected to have only a very small positive impact on global climate change. One might thus ask whether this is worth the effort. However, if all countries that emit only about 1% of the world's CO_2 were to reason that their contribution to global warming is insignificant and were to therefore decide to do nothing about it, we will never be able to beat the problem. So a small positive result, at an affordable cost, should be viewed as a lot better than nothing.

3.4 South African versus foreign carbon offsetting activities

- The Carbon Offsets Paper limits the activities that may qualify for producing carbon offset credits to South African activities only. The obvious logic is to stimulate the South African economy and to protect South African jobs.
- This protectionist attitude is not limited to South Africa. In fact the main factor which so far hampered international collaboration to reduce GHG emissions was that most countries would support such measures only if it would not hurt their local economic interests.
- While the logic of protectionism appears sound at first, it should be remembered that the Great Depression was deepened and prolonged substantially by protectionism:

  Before the Great Depression, countries tended to buy goods from those countries that produced it the cheapest. If Germany could, for instance, produce steel cheaper and the US could produce wheat cheaper, Germany would then import its wheat from the US and in exchange export its steel to the US, and *vice versa*. This arrangement was mutually beneficial as Germans then got the benefit of cheap imported wheat, while simultaneously enjoying the profits from producing and exporting their steel, while Americans got the benefit of cheap imported steel and the profits from growing and exporting wheat. This mutually beneficial multilateral international trade was then and still is a great source of global wealth creation and economic growth.

  However, as soon as the Great Depression struck and people started to lose jobs in

all countries, the suffering citizens started to call for measures to protect their jobs from foreign competition. So in our example, the US would then have restricted steel imports from Germany by instating an import tax. Initially this would help workers in US steel mills, as their jobs were protected from German competition. However, the Germans then retaliated by imposing a similar import tax on wheat imported from the US. So the protectionist measures caused the collapse of bilateral trade between Germany and the US. So now Germans suffered doubly because they had to pay more for their locally produced wheat and because they lost the profits from producing and exporting their steel to the US. Similarly the Americans now suffered because they had to pay more for their locally produced steel, with money they no longer had because they no longer enjoyed the profits from growing and exporting wheat to Germany. So in the end, workers in both Germany and the US were worse off because of the introduction of the protectionist measures they clamoured for.

- It should further be noted that global climate change is by definition a global problem that can only be solved if the nations of the world were to cooperate globally, rather than try and sabotage each other's economies.
- Applied to local versus international opportunities for carbon offsetting activities, this means:
    - If Eskom were to invest in capturing and storing CO_2 at say R100/ton CO_2 by planting spekboom forests in the semi-desert areas of the eastern Cape, where these plants traditionally grow, that would create a win-win solution for Eskom, workers in the Eastern Cape and for the global climate.
    - However, if Eskom were to invest the same amount of money into planting hardwood or other valuable wood plantations in the tropical areas in Central African countries, these trees would grow much faster, due to the warmer climate and much higher rainfall, and would thus capture and store CO_2 much faster and cheaper than the spekboom forests in the Eastern Cape. If this investment could capture and store CO_2 at say R60/ton CO_2, Eskom would then triple its profit on this investment from R20 to R60/ton CO_2. If this could also inspire Eskom to double its investment in forest planting, this would also greatly increase the benefit to the global climate. What's more, the precious hardwoods produced in this manner could later be sold for a profit.
- Therefore it is recommended that the South-African Government should remove this restriction to local carbon offsetting opportunities. The fact that this may lead to funds flowing out of South Africa may be countered by using this as an opportunity to

negotiate mutually beneficial trade agreements with the countries in which these investments will be made.

4 Conclusions

- **The effect of introducing Treasury's proposed carbon offset credits will be negligible on energy technology choices and energy costs and thus on carbon leakage in South Africa. Therefore it will produce virtually no risks for any of the energy industries.**
- **However, it may prove a cost-effective method for removing substantial amounts of GHG from the atmosphere.**
- **Therefore NIASA supports the concept of carbon offset credits.**

5 Sources

DOE 2011: Integrated Resource Plan for Electricity 2010-2030 (IRP 2010-2030). Revision 2, Final report, 25 March 2011. Department of Energy of the Republic of South Africa.

DOE 2013a: Draft 2012 Integrated Energy Planning Report. (IEP). Department of Energy of the Republic of South Africa. http://www.energy.gov.za/files/iep-publications.html (Assessed: Dec. 2013).

DOE 2013b: Annexure A – Technical Report on Model Output (Part 2 - Optimisation Model Output) of the *Draft 2012 Integrated Energy Planning Report.* (IEP A.2). Department of Energy of the Republic of South Africa. http://www.energy.gov.za/files/iep-publications.html (Assessed: Dec. 2013).

DOE 2013c: Annexure B – Model Input and Assumptions (Optimisation Model) of the *Draft 2012 Integrated Energy Planning Report*. Department of Energy of the Republic of South Africa, September 2013. http://www.energy.gov.za/files/iep-publications.html (Assessed: Dec. 2013).

DOE. 2013d. Integrated Resource Plan For Electricity (IRP) 2010-2030: Update Report 2013. Department of Energy of the Republic of South Africa, 21 November 2013. www.doe-irp.co.za/content/IRP2010_updatea.pdf (Accessed: Jan. 2014).

European Commission,2003. External Costs - Research results on socio-environmental damages due to electricity and transport. Directorate-General for Research, Directorate J-Energy, Brussels.

NEA. 2012. Nuclear Energy and Renewables: System Effects in Low-carbon Electricity Systems. Nuclear Energy Agency, Organisation for Economic Co-Operation and Development. http://www.oecd-nea.org/ndd/pubs/2012/7056-system-effects.pdf (assessed: 16 Jan. 2014)

NERSA. 2013. Revenue Application - Multi Year Price Determination 2013/14 to 2017/18 (MYPD3). National Energy Regulator of South Africa. 28 Feb. 2013.

NIASA. 2013. Review of: Draft 2012 Integrated Energy Planning Report (IEP), released by the South African Department of Energy. December 2013. Available from the Nuclear Industry Association of South Africa (NIASA) or from its website: http://www.niasa.co.za/main.html (Accessed: March 2014.)

NIASA. 2014. Review of: INTEGRATED RESOURCE PLAN FOR ELECTRICITY (IRP) 2010-2030 UPDATE REPORT 2013, released by the South African Department of Energy. December Feb. 2014. Available from the website of the Nuclear Industry Association of South Africa (NIASA): http://www.niasa.co.za/main.html (Accessed: March 2014.)