



energy

Department:
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REPUBLIC OF SOUTH AFRICA

Development of post-2015 National Energy Efficiency Strategy, Targets, Measures and Implementation Plan

REPORT ON THE POTENTIAL ENERGY EFFICIENCY MEASURES

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INTRODUCTION

The Department of Energy is developing the post-2015 National Energy Efficiency Strategy (NEES) supported by the Danish Energy Agency. A fundamental stage in this process is to identify the barriers to improving energy efficiency and propose measures that would address those barriers.

The purpose of this document is to provide a succinct overview of possible measures that may be incorporated into the post-2015 NEES for South Africa. The measures described have been identified taking into consideration: i) the current measures being implemented and how they can be built on, ii) international best practice, and iii) preliminary consultations with local stakeholders. It is the intention of the Department of Energy, with the assistance of the International Energy Agency and the Danish Energy Agency, to discuss the proposed measures with key stakeholders in each of the economic sectors covered, and more broadly through public consultation.

To facilitate the process of consultation, the energy efficiency measures are generally grouped by economic sector, namely public, commercial, residential, industry and mining, agriculture, transport and power generation. Please note that cross-sectoral measures have been incorporated within the specific sectors. These include 12L, awareness raising, technology innovation, minimum performance standards for motors, equipment and appliances, energy performance certificates, buildings standards and data requirements that will inform system development.

Within each chapter of the report, the following sections frame the discussion with a view to ensuring that there is a strong link throughout the results chain for each sector, which will contribute to the achievement of economy-wide energy efficiency improvements:

- **Goal** – based on the priorities discussed in the following sections, the proposed goal defines the direction for the sector. This should not be confused with the targets that will be defined on the basis of further analysis. There can be more than one goal, as is the case for the public sector due to the varied nature of the activities performed in the sector.
- **Where are we now?** – a brief synopsis of the current status of energy consumption and efficiency for the sector, and policy measures that have been put in place to address energy efficiency already.
- **How will we get to our goal?** - a description of the barriers and package of measures that could potentially address those barriers. This section includes a *table of measures*. The measures are classed as short-, medium- and/ or long-term corresponding to 0-5, 5-10, 10+ years respectively.
- **Indicators of success** – the indicators define the point at which success has been attained.
- **How will we measure success?** – the data monitoring requirements are outlined to facilitate the establishment of systems to support data collection from the outset.

This document will form the foundation for consultations that will take place in February-March 2016, followed up by further discussion during the public consultation period.

PUBLIC

GOAL 1

Accelerate the current rate of improvement in the energy consumption per square metre in buildings occupied by the public sector at the national, provincial and municipal levels.

WHERE ARE WE NOW

The Government of South Africa has begun the process of institutionalising a principle of leading by example in terms of taking steps towards improving energy efficiency. The overall consumption of the public sector accounts for about 2-3% of total final energy consumption, primarily in the form of electricity. While the public sector includes many public services, this goal specifically relates to developing on the work initiated already to demonstrate leadership in energy efficiency by improving the performance of the new and existing public building stock, as well as identifying some new measures that could be implemented.

The South African National Standard on Energy efficiency in Buildings (SANS 204:2011) sets standards for energy efficient design by building type, while SANS 10400-XA provides the technical requirements that buildings must meet in order to comply with the energy-related parts of the National Building Regulations. Whilst SANS 10400-XA is a significant step towards improving building standards, the specifications defined were largely already being met by the construction industry. The buildings standards will be successively tightened according to trajectories that the Construction Industry Development Board (CIDB) and the Council for Scientific and Industrial Research (CSIR) are currently in the process of developing.

The introduction of labelling of household appliances is likely to have an effect on the public sector, specifically in office premises. The appliances included under SANS 941 are: air conditioners, TVs, dishwashers, electric lamps, electric ovens, refrigerators and freezers, tumble dryers, washer-dryers, and washing machines. Minimum standards for performance have been introduced for geysers manufactured in South Africa. Compulsory specifications for other appliances are being devised.

HARMONISATION WITHIN GOVERNMENT

At the national level, a draft of an Energy and Climate Change Strategy in the Public Building Sector describes a potential approach to introducing energy efficiency measures, including improvements to the building envelope, increasing awareness and encouraging behaviour change. The projections for energy savings potential are based on three levels of ambition: minor, medium and major refurbishments based on current building performance.

The Department of Public Works has been collaborating with the Department of Energy in developing Energy Performance Certificates (EPCs) that are initially to be introduced in public sector buildings under SANS 1544. An accredited body will produce the EPCs and the details of how this accreditation will be awarded is being finalised. The intention is to produce legislation that will make it mandatory to display an EPC in each government occupied premises.

The National Infrastructure Management Strategy (2012) incorporates the maintenance and refurbishment of public buildings. However, this has not been implemented to date. There is general recognition that efforts need to be made to improve buildings operations and maintenance, which the Energy and Climate Change Strategy for the Public Sector is beginning to address.

HOW WILL WE GET TO OUR GOAL?

To improve energy efficiency in public sector buildings, a mixture of proposed efficiency measures is proposed:

- Successively tightening building standards for new buildings,
- Stimulating more significant retrofits of existing public buildings,
- Introducing a culture of energy efficiency across the public sector, and
- Greening procurement policy.

The introduction of the building standards for new buildings is a positive step, due to the ease of implementation and the continued savings contribution. Although the standards are not considered to be significantly different to current practice, the intention is for these standards to become increasingly stringent for new buildings over time. The Department of Energy's priorities will therefore be to support this process, not just in terms of buildings materials but also in terms of stimulating energy efficient technology markets.

The most critical barrier to improving energy efficiency in the public sector is retrofitting the existing building stock. The emphasis of the measures proposed below is therefore on identifying measures through which public buildings can be refurbished with limited investment from the public sector using innovative financing models.

The culture of government to energy efficiency is changing, spurred on by the electricity supply constraints and a focus on mitigating climate change. However more can be done to incorporate energy efficiency in public procurement but also in encouraging behaviour change of its 2.161 million civil servants (2014). Therefore the post-2015 NEES for the public sector proposes that leading by example should be integrated more intensively in government operations.

The public sector can significantly contribute to the demand for energy efficient equipment, green buildings and higher standards of construction. Therefore, the measures proposed below are aimed to commit to build on current measures but making them increasingly challenging, encouraging improved practices and increasing awareness raising within government, and establishing a market mechanism to service the increased standards.

ID No	Measure	Key features	Implications	Anticipated impact/ Multiple benefits	Timeframe (S/M/L)
P1.1	The introduction of mandatory EPC certificates in all rented properties and publicly accessible buildings.	<ul style="list-style-type: none"> An extension of the current EPC standards The mandatory display of EPCs in public buildings Specify frequency / circumstances under which EPCs must be updated Incorporate the requirement that leased buildings meet minimum EPC ratings on signing of a new lease or the renewal of a lease. Introduce green leasing as a requirement for public properties on signing of new contracts 	<ul style="list-style-type: none"> The current standards will need to be expanded on to incorporate the different types of activities Online disclosure database EPCs of public premises public buildings Administration of EPCs and enforcement of standards in rented buildings Training of energy managers / auditors Revision of regulations. 	<ul style="list-style-type: none"> Improved property value Job creation (energy auditors, contractors, management and maintenance of EPC information) Reduce maintenance costs Improved health and safety of rented buildings 	Short – Medium
P1.2	Establish opportunities to develop and improve the procurement practices within government.	<ul style="list-style-type: none"> Consider developing a policy for green procurement. Undertake a cost-benefit analysis of implementing the green procurement policy. 	<ul style="list-style-type: none"> Significant re-drafting of public procurement regulations. Agreement with government as a whole. Administration and monitoring of application of policy. 	<ul style="list-style-type: none"> Improved systems to reflect government priorities. Increased demand and drive for high standards of energy efficiency. 	Medium
P1.3	Develop the public sector awareness raising campaign to facilitate the “leading by example” approach.	<ul style="list-style-type: none"> Develop a brand for “leading by example”. Develop an awareness raising strategy within government. Develop an energy awareness component schools curriculum. Identify energy efficiency champions within each government 	<ul style="list-style-type: none"> Collaboration between all tiers of government to implement campaigns. 	<ul style="list-style-type: none"> Cascade effect of government employee awareness of energy efficiency. Increased credibility for the leading by example initiative. 	Short

		department who will be responsible for seeing the implementation through.			
P1.4	Support the refurbishment of government owned buildings using innovative financing solutions.	<ul style="list-style-type: none"> Using lessons learned from DPW's Shared Energy Saving Contracts, undertake a feasibility study to assess the potential for implementing an "ESCO Incubator" model¹ in South Africa. Establish model for providing financial incentives to support the implementation for deeper refurbishments of public sector buildings. Encourage the development of international and national partnerships to deliver on energy performance contracts for the public sector. 	<ul style="list-style-type: none"> If feasibility is established (based on outcomes of study), develop the ESCO Incubator model and initiate setup. Develop and administer benchmarking tool for public sector Support to networking events between international and local companies to develop partnerships. 	<ul style="list-style-type: none"> Increased availability of financing on the market for energy efficiency measures in the South African market. Job creation. Improved health and safety in government buildings. 	Medium
P1.5	Support the professionalization of ESCOs for the public sector through recognised accreditation schemes	<ul style="list-style-type: none"> Expand accreditation more broadly to stimulate market competitiveness Include sub-sectoral accreditation to ensure expertise meet the needs of the sub-sector (e.g. schools, hospitals, prisons, office premises, etc.) 	<ul style="list-style-type: none"> Ensuring market monopolies are avoided by accrediting a broad array of institutions Developing partnerships with academic bodies to provide training Administration of accreditation scheme 	<ul style="list-style-type: none"> Job creation 	Medium

¹ The 'ESCO Incubator' is a public sector body, the main function of which is to implement large public-sector projects through energy performance contracting (EPC), using local private sector ESCOs as sub-contractors. Other key functions may include: providing loans or equity finance for smaller EPC projects, development of standardised EPC contracts, technical assistance for project development, training and accreditation of ESCOs, developing databases of approved equipment and materials. Core funding for an ESCO Incubator would be provided by government, with additional funds being leveraged from the private sector and from IFIs and international donors.

P1.6	Introduce standards and labelling relevant for public sector appliances and equipment	<ul style="list-style-type: none"> Expand on the current standards and labelling scheme to include categories of equipment and appliances for the public sector Impose minimum standards for imported goods Support local production and technology innovation of energy efficient products that meet these standards 	<ul style="list-style-type: none"> Increased capacity for the administration and enforcement of standards and labelling 	<ul style="list-style-type: none"> Job creation Improved health and safety 	Short-Medium
P1.7	Announce a 15-year trajectory for the successive tightening of the energy performance component of building standards	<ul style="list-style-type: none"> Providing the construction industry with adequate warning of plans for future tightening allows time for them to respond positively Periodic reviews to ensure that the trajectory is neither too onerous to meet nor so lax that it has little impact 	<ul style="list-style-type: none"> Improvement in buildings standards of new buildings stock No significant negative implications apart from adjustment to standards 	<ul style="list-style-type: none"> Improved living conditions 	Short
P1.8	Establish a sectoral technology hub	<ul style="list-style-type: none"> Establish a technology hub that researches, tests and showcases technologies and best-practices that are energy efficient and address key, energy-intensive activities in the sector 	<ul style="list-style-type: none"> Expanding and building on existing resources and expertise (including current university-based hubs) to ensure that the needs of the sector are met 	<ul style="list-style-type: none"> Regional credibility as technology leader Provision of research relevant to local manufacturers 	Medium-long
P1.9	Roll-out of the provision of energy and activity data from the public sector	<ul style="list-style-type: none"> Build on the pilot voluntary provision of data undertaken during the development of the EETMS Integrate data collection and monitoring of bottom-up interventions with top-down 	<ul style="list-style-type: none"> Continued development of data submission mechanisms Investment in primary data collection Management of EETMS to be outsourced 	<ul style="list-style-type: none"> Data for evidence-based policy making 	Short

INDICATORS OF SUCCESS

A 50% reduction in the specific energy consumption (measured as GJ annual energy consumption per m² of occupied floor area) by 2030 relative to a 2015 baseline. Note that this target is composed of a sum of improvements brought about by the policy measures described above plus a continuation of current trends. It is estimated that current trends (including the effect of the current SANS 10400XA standards) will lead to a 15% reduction in specific energy consumption by 2030.

HOW WILL WE MEASURE SUCCESS?

Since EPCs are expected to be mandatory in all public buildings in the short-term, this will provide a robust body of data from which the energy performance of the public building stock may be determined into the future. However, the likely lead-time before a significant fraction of public buildings have had EPCs issued means that baseline data is not available. A suitable baseline may therefore need to be inferred by back casting to 2015 from a future set of data, using information from the DPW regarding any material changes that have been made to the buildings in question.

GOAL 2

Accelerate the reduction in the specific energy consumption per resident in delivering municipal services.

WHERE ARE WE NOW

The Energy Efficiency Demand-Side Management programme established by the Department of Energy has been delivering grants to 68 municipalities in South Africa since 2009. The cumulative energy saved as a result of the programme based on projected targets is approximately 1.8 PJ, mainly through street lighting retrofits.

The success of this programme has been in supporting non-priority expenditure in order to improve local government service delivery. However, the quality of interventions has varied significantly and municipalities have not necessarily been focusing efforts where they are most needed due to a lack of information as to the overall energy savings potentials across all operations.

HARMONISATION WITHIN GOVERNMENT

The Local Government Energy Efficiency and Renewable Energy Strategy developed in 2013 defines a framework under which local government develop their individual energy efficiency approaches. The strategy covers the governance framework, energy efficiency in the provision of services, improving household energy access, improving energy efficiency at end use level, and taking energy efficiency into consideration in spatial planning, amongst other things.

The measures that relate to improving the governance framework are as follows:

- Institutionalise a local level sustainable energy ‘mandate’ through provision of clear direction on IDP and related planning requirements.
- Build political and senior management leadership.
- Develop local level sustainable energy policy and plans.
- Support local sustainable energy plan implementation.

In terms of municipal services, the following “strategies” have been highlighted:

- Implement building and lighting efficiency.
- Implement water and sanitation service efficiency.
- Develop an efficient vehicle fleet.
- Support waste reduction, management and waste to energy development.

Individual municipalities have developed their own plans, including the cities of Johannesburg and Cape Town. Priorities include building, street and traffic light retrofits, greening the fleet, and implementing a green procurement policy. Financing of measures is highlighted as being challenging on the basis of public sector guidelines.

HOW WILL WE GET TO OUR GOAL?

The barriers to municipal energy efficiency improvements in terms of the provision of services are related to political priorities, capacity and resources. The municipalities have been identifying the low-hanging fruit and do not necessarily have a comprehensive overview of their energy consumption and opportunities for efficiency improvements.

The Department of Energy would like to take the progress made under the EEDSM programme and translate this into a sustainable and comprehensive programme whereby municipalities are able to develop their own strategies for energy efficiency and can attract investment in to support the achievement of their targets. The measures suggested below aim to support the development of the governance structure, the definition of priorities and investigating options within the current financial parameters to access capital investment.

Added to this, it is proposed that a benchmarking and rating mechanism be put in place to encourage transparency and accountability within municipalities for improving service delivery.

ID No	Measure	Key features	Implications	Anticipated impact/ Multiple benefits	Timeframe (S/M/L)
P2.1	Develop municipal energy efficiency strategies	<ul style="list-style-type: none"> • Develop energy management programme at municipal level led by an energy manager. • Support comprehensive baseline assessments (including vehicle fleets) of energy savings potentials and cost-benefit analysis of specific measures. • Support the development of energy efficient procurement policies based on full life-cycle costing across the municipal sector • Identify priority investments for which financing can be sought. • Support knowledge sharing across municipalities in order to scale up the good examples. 	<ul style="list-style-type: none"> • Municipal management of energy becomes holistic • Energy savings measures implemented are based on holistic overview of operations and greatest potentials, increasing impact. 	<ul style="list-style-type: none"> • Capacity building for municipal staff • Job creation • Improved public service delivery 	Short – Medium
P2.2	Support the implementation of energy savings measures	<ul style="list-style-type: none"> • Identify high priority measures with payback period of less than 10 years including undertaking refurbishments, reviewing operating procedures, and increasing community awareness. • Assist municipalities in developing financing proposals based on a variety of options (energy performance contracts, lease-purchase agreements, public bonds, state loans and rebates). 	<ul style="list-style-type: none"> • Establish the limitations of various financing measures within government (lease-purchase agreements, public bonds, state loans and rebates). 	<ul style="list-style-type: none"> • Long term and holistic implementation plan for improving energy efficiency with synergies to the GHG emission targets and the Integrated Resource Plan. 	Short-Medium

P2.3	Develop the energy rating scheme for municipal services	<ul style="list-style-type: none"> • Develop a rating scheme to assess municipal performance. • Introduce energy efficiency target obligations for municipalities performing poorly on the rating scheme. 	<ul style="list-style-type: none"> • Requires all municipalities to be rated. • Administrative system to manage, monitor and follow up on improvements. • Public disclosure database. 	<ul style="list-style-type: none"> • Improved public confidence in government commitment 	Medium
P2.4	Support the professionalization of ESCOs for municipal services through recognised accreditation schemes	<ul style="list-style-type: none"> • Expand accreditation more broadly to stimulate market competitiveness • Include sub-sectoral accreditation to ensure expertise meet the needs of the sub-sector (e.g. waste water treatment, public lighting, public vehicle fleet management, etc.) 	<ul style="list-style-type: none"> • Ensuring market monopolies are avoided by accrediting a broad array of institutions • Developing partnerships with academic bodies to provide training • Administration of accreditation scheme 	<ul style="list-style-type: none"> • Job creation 	Medium

INDICATORS OF SUCCESS

A 20% reduction in the energy intensity (measured as energy consumption per head of population served) of municipal service provision. The specific services included are street lighting, traffic lights, water supply and wastewater treatment. Note that this target will not fall equally on all municipalities, as some have already exploited a significant fraction of the potential savings through the EEDSM programme.

A 30% reduction in the fossil fuel intensity of municipality vehicle fleets (measured as total fossil fuel consumption by municipal vehicles per head of population served).

HOW WILL WE MEASURE SUCCESS?

For municipal services, a baseline will be estimated by extrapolating from the data collected under the DoE's EEDSM programme. While the EEDSM continues, the data it generates will enable progress towards the targets to be tracked in the short term. However, it is not currently known how long the programme will continue, so in the medium to long-term, this source of data may not be available. It will therefore be necessary for the DoE to create a mechanism whereby data on energy saving interventions in the municipal services sector is communicated back to the Department.

For municipal vehicle fleets, both a baseline and progress towards the target will be estimated by collecting consumption data directly from the largest municipalities and through a regular survey of a representative sample of smaller municipalities. The DoE will liaise as necessary with both CoGTA and SALGA in communicating with the municipalities.

RESIDENTIAL

GOAL 3

Transform the market for household appliances in favour of the most energy efficient models

Substantially reduce the average specific energy consumption of the stock of residential buildings

WHERE ARE WE NOW

According to Statistics South Africa's General Household Survey, there were about 15.6 million households in South Africa in 2014, representing a 37% increase over the previous decade. Because of a steady decrease in the average household size, the rate of increase in the number of households is likely to continue to outstrip population growth, such that the total number of households in 2030 will be in the region of 19-20 million.

As of 2012, the residential sector consumed about 192 PJ in the form of electricity and petroleum products, in addition to significant amounts of coal as well as biomass in the form of wood and crop residues. This represents an increase of approximately 32% over the previous ten years, indicating that the average energy consumption per household has declined slightly. This is despite a general increase in living standards over that period, which all else being equal would be expected to lead to higher energy consumption. The likely reason for the reduction in energy intensity is the steep increases in electricity price that households have experienced since 2008.

Increasing living standards in South Africa, which became particularly marked over the last decade, have been associated with higher rates of ownership of a wide range of household appliances. The fraction of households in the lowest three LSM bands, where appliance ownership is close to zero and cooking is performed predominantly using wood or paraffin, has fallen from almost 40% in 2001 to little over 10% in 2014. Over the same period, LSMs 6&7, which are associated with significant levels of ownership of most appliance types, have grown from less than 20% of households in 2001 to more than 35% in 2014.

This rapid rate of first-time acquisition of appliances provides a very strong opportunity for achieving energy efficiency gains through appliance standards and labelling. The decision was made to introduce mandatory labelling of appliances using a label based on the EU model, given the importance of trade in appliances with the EU. Alongside appliance labelling, minimum energy performance standards (MEPS) have been introduced or are proposed for most of the major categories of household appliance.

Historically low electricity prices combined with an imperative to deliver large volumes of affordable housing to previously disadvantaged populations means that relatively little attention has been paid in the past to the energy efficiency of residential buildings. Thermal inefficiency of dwellings not only contributes towards problematic peaks in demand for electricity, but also leads to local air pollution problems through the use of wood and

paraffin for space heating among the lower LSM groups. This situation is now being addressed for new buildings with the introduction of minimum energy performance requirements into the national building regulations (SANS 10400 XA). As well as specifying minimum insulation levels for each component of a building envelope, SANS 10400 XA also specifies that a minimum of 50% of the hot water requirements of a building must be met through means other than electric resistance heaters. Given the absence of piped natural gas supplies in most of South Africa, this in practice requires the use of either solar water heaters or heat pumps.

INTER-DEPARTMENTAL HARMONISATION

Measures to improve energy efficiency in the residential sector present many opportunities for reinforcing the aims expressed across government, and brought together in the National Development Plan (NDP), to improve living standards, combat energy poverty, reduce income inequality, provide adequate housing and create employment opportunities. Given the relatively higher fraction of household income that must be spent on energy in lower income households, improving energy efficiency is in strong alignment with NDP aim of shielding poorer households from the effects of energy price increases.

The NDP also recognises the role of stricter energy efficiency standards for residential buildings in helping South Africa to meet its commitments to reduce greenhouse gas emissions. The Department of Human Settlements (DoHS) has recognised the risk of a possible conflict between the goals of delivering affordable housing in sufficiently large volumes to meet the needs of the poor, while ensuring that the housing provided is sufficiently energy efficient that it does not condemn the occupants to many years of high energy bills and low comfort. Even though the increased cost of delivering dwelling in compliance with SANS 10400 XA will impact on the number of units delivered, the DoHS has committed not to “...compromise on the quality of houses on the basis of chasing numbers”.

The NDP acknowledges that insufficient attention has been paid in the past to the importance of the rental and social housing. This is a key consideration in developing measures to address the energy performance of residential buildings, as neglect of the rental sector may risk stratifying the housing market into two tiers of dwelling – with high quality owner-occupied homes on one side and poor quality rented homes on the other.

Municipalities are likely to be key partners in delivering the elements of the package of policy measures that relate to buildings. The local authority’s building control office are the main point of contact for ensuring that planned housing developments meet current building standards. Furthermore, municipalities are well positioned to have a good understanding of the particular issues that are of concern to local populations, and may therefore be important partners in delivering awareness-raising messages through community initiatives.

Significantly, however, there is a risk of a conflict of interest facing municipalities in relation to energy saving initiatives, since the sale of electricity to residential consumers is an important source of municipal income. Measures will therefore need to be designed in such a way that successful implementation does not jeopardise the income stream of

municipalities and compromise their ability both to maintain the electricity distribution network and to deliver key services to their constituents.

HOW WILL WE GET TO OUR GOAL?

The core of the package of policy measures addressing the residential sector is the use of MEPS for domestic appliances and buildings to push the market in the direction of improved energy efficiency. Successive tightening of standards through time ensures that the market push is constant, and announcing in advance the trajectory that tightened standards will follow ensures that the respective industries (appliance manufacturers and suppliers, and the construction industry) have adequate time to respond positively to the new standards as they are introduced.

To complement the market push provided by buildings and appliance standards, a market pull will be provided by two measures:

- a strongly branded certification mark for energy efficient appliances. This will be modelled on the famous 'Energy Star' brand widely used in the USA and globally. It is intended to run alongside the existing appliance energy labels, and will provide appliance purchasers with a simple yes/no indication that a certified appliance is among the most energy efficient in its class.
- energy performance certificates (EPCs) for residential buildings. These will be introduced on a voluntary basis initially (with the possibility explored of incentivising through a small rebate on Transfer Duty to partially cover the cost of obtaining an EPC). Depending on how successfully they are seen to influence the market, consideration will be given in the medium-term to making them mandatory. Mandatory EPCs may in any case be necessary in the rental sector, where the issue of split incentives is likely to limit the extent to which energy efficiency interventions take place.

While appliance MEPS and labelling are expected to have a strong influence on the energy efficiency of new appliances, there is a danger their effect will be weakened if older, less efficient appliances are not removed from the stock of equipment in use. In particular, many lower-income households acquiring appliances for the first time may be tempted to purchase second-hand items. The feasibility of a scrappage scheme will therefore be investigated, whereby householders are incentivised to ensure that old appliances are disposed of (for example, by offering a trade-in against the purchase price of a new appliance). However, it is worth noting that experiences with appliance scrappage schemes in other countries have been mixed.

EPCs for residential buildings would, if widely adopted, be expected to influence the property market through a price premium on more energy efficient homes. This price signal would give householders an additional incentive (as well as the direct energy cost savings) to invest in energy efficiency measures with a longer payback period. However, experience from some countries suggests that this internalisation of energy performance into the property market is slow and uncertain. Additional financial incentives to undertake thermal improvements of existing residential building will therefore be considered in the medium to

long-term. These may take the form of direct grants for lower income groups, partial grants, low-interest loans, or rebates against Transfer Duty when the property is next sold.

In order for households to respond effectively to the market signals provided by the measures described, it is important that they are well-informed of the opportunities that exist for energy efficiency improvements and the potential benefits to be gained. In order to ensure maximum effectiveness, efforts by the Department of Energy to raise awareness of energy efficiency should build on successful schemes already in place:

- The DoE's recently initiated energy efficiency campaign for buildings.
- Eskom's 49M awareness-raising initiative, which has achieved very high levels of recognition.
- Energy education material developed by Eskom in partnership with the Department of Education in the context of CAPS (Curriculum and Assessment Policy Statement)
- Other education initiatives in energy and environment, such as the Department for Environmental Affairs 'MY2050' calculator and the Eskom / WESSA (Wildlife and Environment Society of South Africa) resources on sustainable energy for use in schools the community.

A possible future direction for awareness-raising efforts is to engage municipalities in developing and disseminating materials that are specifically targeted at local populations. An example of this in action was provided by the request from Umjindi municipality in Mpumalanga to the 49M campaign to influence the behaviour of local residents to alleviate excessive electricity demand within the municipal area.

Given the success of the EEDSM programme in mobilising municipalities to deliver energy savings in municipal services, opportunities will be explored for municipalities to play a direct role in achieving energy efficiency improvements in the residential sector. Areas where the involvement of municipalities may enhance the delivery of household energy efficiency programmes include:

- using their purchasing power when implementing retrofits on their own buildings to bulk-procure equipment and materials that is then made available for use in local residential sector projects
- facilitating the formation of residents' action groups as vehicles for the bundling of individual household energy efficiency project into packages that may be more attractive to local contractors

As described in the section 'Generation and distribution' below, consideration will also be given to placing an energy savings obligation on distributors of energy. Such obligations would require municipalities, in their role as suppliers of electricity, to implement measures to bring about energy savings among the customers they serve – in particular, household customers. The design of an obligation scheme would need to take account of the possible conflict of interest that arises from the reliance of many municipalities on electricity sales as an important source of revenue.

Although LSMs 1-3 now account for only 10% of households (a fraction that is likely to continue to fall in coming years), it is important that the Energy Efficiency Strategy does not overlook this group. This is because energy consumption patterns have a disproportionately strong influence on the quality of life of the lowest income households. Firstly, energy costs constitute a much larger fraction of total household expenditure in low-income groups; hence the inefficient use of energy represents a heavier financial burden. Secondly, the types of energy carrier that are prevalent in low income households lead to a wide range of adverse effects (e.g. indoor air pollution, fire risks). The types of equipment used for cooking, water heating and space heating using wood, coal and paraffin are not amenable to regulation or efficiency standards, so the emphasis of policy measures should therefore be on information and awareness-raising, as well as accelerating access to more modern energy technologies, such as energy efficient cook stoves, SWHs and LPG.

ID No	Measure	Key features	Implications	Anticipated impact	Timeframe (S/M/L)
R1	Announce a 15-year trajectory for the successive tightening of minimum energy performance standards for household appliances	<ul style="list-style-type: none"> Expected that a tightening by at least two energy label bands is feasible over the next 15 years Providing the appliance industry with adequate warning of plans for future tightening allows time for them to respond positively Periodic reviews to ensure that the trajectory is neither too onerous to meet nor so lax that it has little impact 	<ul style="list-style-type: none"> Implications are minimal on the basis that systems are in place but specifications would be tightened Appliance supply companies, would need to be sensitised in advance to be informed of future requirements 	<ul style="list-style-type: none"> Improved health and safety Growing market for energy efficient products 	Short
R2	Develop a strongly branded energy performance certification mark for household appliances (modelled on the 'Energy Star' brand in the USA), in addition to the planned EE labels.	<ul style="list-style-type: none"> Runs alongside existing energy labels to provide a purchasers with a simple means of identifying the best-performing models in each category of appliance 	<ul style="list-style-type: none"> Significant market research effort required in advance, and marketing effort following launch Select champions across the sector to lead the brand 	<ul style="list-style-type: none"> Consumer awareness Improved market demand 	Short-medium
R3	Announce a 15-year trajectory for the successive tightening of the energy performance component of building standards for residential buildings	<ul style="list-style-type: none"> Providing the construction industry with adequate warning of plans for future tightening allows time for them to respond positively Periodic reviews to ensure that the trajectory is neither too onerous to meet nor so lax that it has little impact 	<ul style="list-style-type: none"> Implications are minimal on the basis that systems are in place but specifications would be tightened Buildings supply companies, and the construction industry in general, would need to be sensitised in advance to know what future demand will be Enforcement of standards may be considered to ensure compliance 	<ul style="list-style-type: none"> Improved health and safety Increased property values Growing market for energy efficient products 	Short
R4	Energy performance certificates for	<ul style="list-style-type: none"> Incentivise the use of EPCs on a voluntary basis initially, through small 	<ul style="list-style-type: none"> Great care needed to ensure quality of assessment is 	<ul style="list-style-type: none"> Improved health and safety 	Medium-

	residential buildings	<p>tax incentives sufficient to cover the cost of obtaining a certificate</p> <ul style="list-style-type: none"> • Review progress and, if necessary, introduce a mandatory system in the longer term • Introduce a mandatory requirement for landlords to obtain EPCs for all rented residential properties 	<p>maintained if the EPCs are to carry credibility</p> <ul style="list-style-type: none"> • Capacity needs to be in place to issue EPCs • Administrative systems for enforcement of mandatory certificates • Widespread adoption of EPCs will provide a valuable source of data on the status of the housing stock 	<ul style="list-style-type: none"> • Increased property values • Market demand for energy efficient properties 	long
R5	Financial incentives for the thermal improvement of existing dwellings, particularly in the rented sector	<ul style="list-style-type: none"> • Incentives may take the form of partial or full grants, low interest loans or tax rebates against Transfer Duty 	<ul style="list-style-type: none"> • Cost-benefit analysis to identify most effective model • Administration of incentives scheme 	<ul style="list-style-type: none"> • Improved indoor climate • Health and safety 	Medium-long
R6	Explore the feasibility of a scrappage scheme for old, less efficient household appliances	<ul style="list-style-type: none"> • An incentive scheme for old appliances, less efficient appliances • Addresses the risk that older appliances remain in use, either in the second hand market or (particularly for refrigerators) as secondary appliances 	<ul style="list-style-type: none"> • A scheme needs to be established that is adequately robust not to be subject to fraud • Social impact of fewer second hand goods on the market 	<ul style="list-style-type: none"> • Growing market for energy efficient products 	Medium
R7	Build on the existing awareness-raising activities targeting households and the school curriculum	<ul style="list-style-type: none"> • Use existing vehicles of the DoEs newly launched energy efficiency campaign and Eskom’s 49M initiative • Mapping of current educational initiatives to guide development of curriculum content on energy efficiency that contributes to national examinations • Engage the support of municipalities in ensuring the content and style of awareness-raising material is relevant 	<ul style="list-style-type: none"> • Specific expertise required to develop campaigns that are effective • Capacity building of teachers in the area of energy efficiency through initiatives such as Fundisa for Change 	<ul style="list-style-type: none"> • Community awareness 	Short

		<p>to the local population</p> <ul style="list-style-type: none"> • Specific efforts to target low-income households currently dependent on non-electrical energy carriers 			
R8	Engage municipalities in the delivery of energy efficiency measures for the residential sector	<ul style="list-style-type: none"> • Builds on the success of EEDSM in engaging municipalities to deliver energy savings • Municipalities have a close relationship with the populations they serve and are thus well positioned to deliver initiatives targeting the residential sector 	<ul style="list-style-type: none"> • Financial arrangements structured to ensure that the ability of municipalities to deliver other essential services is not affected by the loss of revenues resulting from reduced electricity sales • Many (particularly smaller) municipalities would need significant capacity building to ensure they have the necessary skills to deliver energy saving projects in the residential sector • External auditing of energy savings would be required 	<ul style="list-style-type: none"> • Improved value of property • Enhanced image of municipalities as deliverers of key services to constituents 	Medium-long
R9	Establish a sectoral technology hub	<ul style="list-style-type: none"> • Establish a technology hub that researches, tests and showcases technologies that are energy efficient and address key, energy-intensive activities in the sector 	<ul style="list-style-type: none"> • Expanding on the concept of the EE hub, ensure that expertise is sectorally relevant to ensure that results meet the needs of the sector 	<ul style="list-style-type: none"> • Regional credibility as technology leader • Provision of research relevant to local manufacturers 	Medium
R10	Roll-out of the provision of energy and activity data from the residential sector	<ul style="list-style-type: none"> • Build on the pilot voluntary provision of data undertaken during the development of the EETMS • Integrate data collection and 	<ul style="list-style-type: none"> • Continued development of data submission mechanisms • Investment in primary data collection (household surveys) 	<ul style="list-style-type: none"> • Data for evidence-based policy making 	Short

		monitoring of bottom-up interventions with top-down	<ul style="list-style-type: none"> • Management of EETMS to be outsourced 		
R11	Support technology innovation and dissemination of energy efficient cookstove technologies	<ul style="list-style-type: none"> • Identify appropriate, high performing and socially acceptable technologies • Introduce a subsidised roll out programme for LSM houses 	<ul style="list-style-type: none"> • EE Technology Hub to identify suitable technologies in collaboration with sector stakeholders and beneficiaries • Monitoring and management of roll out programme • Financing of stove distribution 	<ul style="list-style-type: none"> • Health benefits • Environmental benefits • Technology innovation for export across the region 	Short-Medium

INDICATORS OF SUCCESS

A 33% reduction in the average specific energy consumption of new household appliances purchased in South Africa by 2030 relative to a 2015 baseline. The percentage reduction is expected to be different for different types of appliance, but the target figure represents the weighted mean reduction calculated according to sales numbers.

A 20% improvement in the average energy performance of the residential building stock by 2030 relative to a 2015 baseline, as measured by the energy consumption (excluding plug loads) per square meter of habitable space.

HOW WILL WE MEASURE SUCCESS?

The continued development and maintenance of the existing Department of Energy database of household appliance sales will provide the necessary data for monitoring the appliances target.

For the buildings target, the main challenge is assessing the baseline – it is likely that a survey of a representative sample of dwellings would be necessary for this. Using this data along with data on housing completions from municipalities (currently collected by StatsSA), a model of the housing stock can be created, with regular calibration from subsequent surveys. In the long-term, if EPCs are widely adopted, this will provide a robust body of data against which progress towards the targets may be assessed.

COMMERCIAL

GOAL 5

Accelerate the current rate of improvement in the energy consumption per square metre of lettable/ inhabited floor space in the commercial sector.

WHERE ARE WE NOW

The commercial sector in South Africa includes a very broad range of activities, including wholesale and retail trade, the motor trade, the hospitality industry, and a range of business services. The commercial sector accounts about 4-5% of total final energy consumption, primarily in the form of electricity. Due to the varied nature and scale of the activities, measures for the commercial sectors have generally focused on improving the energy efficiency of the building envelope.

SANS 204:2011 sets maximum energy efficiency standards by building type. The standard includes requirements for building design, including orientation and maximum energy demand (excluding plug loads). SANS 10400-XA was promulgated in 2011 and the technical specifications to reduce energy consumption in new buildings defined in 2014. Whilst this is a significant step towards improving building standards, the specifications defined were largely already being met by the construction industry. The buildings standards will be successively tightened according to trajectories that the CIDB and the CSIR are currently in the process of developing.

The Green Buildings Council of South Africa (GBC-SA) has developed a benchmarking tool for commercial property owners to rate their buildings. This Green Star rating tool uses nine different criteria, one of which is energy consumption, to rate retail, office and academic buildings. Data is available for more than 60% of the South African Investment Property Database in terms of annual electricity consumption (gas is not included). However, the buildings covered are predominantly office space. An average of 219 kWh/ m² is consumed per year within the GBC-SA sample. The Green Star SA – Existing Building Performance Tools focuses on management and operations of the building and takes into consideration the use of green leases.

The South African Property Owners Association confirmed that green leasing is becoming a more significant feature, specifically for their larger members. Although property owners report that prospective tenants are increasingly asking for green buildings, the lower operating costs represented by higher energy efficiency are not yet fully reflected in the market value of properties. However, there are signs that energy efficiency is becoming an increasingly important criterion for tenants as the price of electricity increases.

The National Business Initiative supported by the Department for International Development have funded up to 8 months of energy consultancy support, energy audits and help-desk services to large, medium and small enterprises respectively to incentivise business to undertake energy efficiency measures.

The introduction of labelling of household appliances is likely to have an effect on the commercial sector, specifically in the office and hospitality sub-sectors. The appliances included under SANS 941 are: air conditioners, TVs, dishwashers, electric lamps, electric ovens, refrigerators and freezers, tumble dryers, washer-dryers, and washing machines. Minimum standards for performance have been introduced for geysers manufactured in South Africa. Compulsory specifications for other EE appliances are being devised.

HARMONISATION WITHIN GOVERNMENT

The initiatives that are on-going in the business sector to address energy efficiency have primarily focused on introducing change to be applied to public buildings, with a view to expanding this out to the commercial sector.

Through the consultations with the sector, it has become apparent that the 12L does not provide a significant incentive to many of the major property owners in South Africa. The dominant model for letting commercial buildings is through real estate investment trusts (REITs), through which the net rental income earned is paid to REIT shareholders in the form of dividends. Because the REIT itself does not make a profit, it is not liable for corporate income tax and therefore cannot benefit from the 12L incentive.

The National Development Plan aims to progressively strengthen the energy efficiency criteria set out in the South African National Standard 204 to achieve a zero carbon building standard by 2030. Although this target is unlikely to be achieved by 2030, as described above, the buildings standards are intended to become increasingly stringent. Under the National Building Regulations and Building Standards Act no. 103, revised in November 2011, 50% of the hot water supply to all new buildings needs to be provided for by energy sources other than electric resistance heaters or fossil fuels. The Department of Public Works has been collaborating with the Department of Energy in developing Energy Performance Certificates (EPCs) that are initially to be introduced in public sector buildings under SANS 1544. An accredited body will produce the EPCs and the details of how this accreditation will be awarded is being finalised. The intention is to produce legislation that will make it mandatory to display an EPC in each government occupied premises and that this scheme will then be broadened to cover the commercial sector.

HOW WILL WE GET TO OUR GOAL?

The introduction of the building standards for new buildings is a positive step. Although the standards are not considered to be significantly different to practice in the construction industry, the intention is for these standards to become increasingly stringent for new buildings over time. The Department of Energy's priorities will therefore be to support this process in terms of buildings materials, stimulating energy efficient technology markets, and ensuring the capacity to implement and continuously improve the standards in close collaboration with public and private key stakeholders. The most significant barrier to improving energy efficiency in the commercial sector is the financial and practical challenges of retrofitting the existing building stock. The emphasis of the measures proposed below is therefore on establishing a financing mechanism that will improve the business case for more extensive retrofits to be performed and on enabling the development of the ESCO market that will provide the technical and financial capacity to sustain the market.

ID No	Measure	Key features	Implications	Anticipated impact/ Multiple benefits	Timeframe (S/M/L)
C1	The introduction of mandatory EPC certificates in all rented properties and publicly accessible buildings.	<ul style="list-style-type: none"> • An extension of the current EPC standards • The mandatory display of EPCs in commercial buildings • Incorporate the requirement that leased buildings meet minimum EPC ratings on signing of a new lease or the renewal of a lease for properties rented to the public sector • Work with the green buildings organisations and academia to develop a rating system that can be applied to all commercial buildings • Introduce green leasing as a requirement for commercial properties 	<ul style="list-style-type: none"> • The current standards will need to be expanded on to incorporate the different types of activities • Online disclosure database EPCs of commercial premises commercial buildings • Administration of EPCs and enforcement of standards in rented buildings 	<ul style="list-style-type: none"> • Improved property value • Job creation (energy auditors, contractors, management and maintenance of EPC information) • Reduce maintenance costs • Improved health and safety of rented buildings 	Short - Medium
C2	Revision of 12L to ensure it provides an incentive to commercial property owners	<ul style="list-style-type: none"> • In consultation with the commercial sector, review the structure of the 12L to make it relevant to the sector 	<ul style="list-style-type: none"> • Additional resources to be invested in revising the regulation • Greater relevance of the mechanism 	<ul style="list-style-type: none"> • Jobs creation • Reduce maintenance costs • Improved health and safety of rented buildings 	Short
C4	A tax incentive for 'deeper' energy efficiency retrofits provided on an escalating scale	<ul style="list-style-type: none"> • Provide a tax rebate to encourage retrofits that go beyond simply exploiting the 'low hanging fruit' • Incentivise ESCOs to achieve higher levels of saving 	<ul style="list-style-type: none"> • Establish minimum savings contracts • Establish capacity for the vetting and approval of deep retrofit proposals 	<ul style="list-style-type: none"> • Improved property value • Job creation (energy auditors, contractors, management and maintenance of EPC information) 	Medium

				<ul style="list-style-type: none"> • Reduce maintenance costs • Improved health and safety of rented buildings 	
C5	Support the professionalization of ESCOs for the commercial sector through recognised accreditation schemes	<ul style="list-style-type: none"> • Expand accreditation more broadly to stimulate market competitiveness • Include sub-sectoral accreditation to ensure expertise meet the needs of the sub-sector (e.g. hospitality, automotive, financial services, retail, etc.) 	<ul style="list-style-type: none"> • Ensuring market monopolies are avoided by accrediting a broad array of institutions • Developing partnerships with academic bodies to provide training • Administration of accreditation scheme 	<ul style="list-style-type: none"> • Job creation 	Medium
C6	Introduce standards and labelling relevant for commercial sector appliances and equipment	<ul style="list-style-type: none"> • Expand on the current standards and labelling scheme to include categories of equipment and appliances for the commercial sector • Impose minimum standards for imported goods • Support local production of energy efficient products that meet these standards • Develop the capacity of staff in the retail trade to provide customer advice. 	<ul style="list-style-type: none"> • Increased capacity for the administration and enforcement of standards and labelling 	<ul style="list-style-type: none"> • Job creation • Improved health and safety 	Short-Medium
C8	Establish a sectoral technology hub	<ul style="list-style-type: none"> • Establish a technology hub that researches, tests and showcases technologies that are energy efficient and address key, energy-intensive activities in the sector 	<ul style="list-style-type: none"> • Expanding on the concept of the EE hub, ensure that expertise is sectorally relevant to ensure that results meet the needs of the sector 	<ul style="list-style-type: none"> • Regional credibility as technology leader • Provision of research relevant to local manufacturers 	Medium

C9	Roll-out of the provision of energy and activity data from the commercial sector	<ul style="list-style-type: none"> • Build on the pilot voluntary provision of data undertaken during the development of the EETMS • Integrate data collection and monitoring of bottom-up interventions with top-down 	<ul style="list-style-type: none"> • Continued development of data submission mechanisms • Investment in primary data collection (end user surveys) • Management of EETMS to be outsourced 	<ul style="list-style-type: none"> • Data for evidence-based policy making 	Short
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INDICATORS OF SUCCESS

A 37% reduction in the specific energy consumption (measured as GJ annual energy consumption per m² of lettable / habitable floor area) by 2030 relative to a 2015 baseline. Note that this target is composed of a sum of improvements brought about by the policy measures described above plus a continuation of current trends. It is estimated that current trends (including the effect of the current SANS 10400XA standards) will lead to an 11% reduction in specific energy consumption by 2030.

HOW WILL WE MEASURE SUCCESS?

As the number of buildings having an EPC increases, this will provide a substantial body of data from which the energy performance of the commercial building stock may be determined. The biggest challenge to tracking progress towards the target is therefore that of establishing a reliable baseline. Early efforts should therefore be devoted to drawing together all sources of data on the current energy performance of commercial buildings, supplemented if necessary by targeted surveys.

INDUSTRY AND MINING

GOAL 4

Create an enabling environment for the full exploitation of cost-effective energy efficiency opportunities across the manufacturing and mining sectors.

WHERE ARE WE NOW

Manufacturing

South Africa's manufacturing industries accounted for about 14% of GDP in 2014, employing around 1.7 million people. As of 2012, the manufacturing sub-sector consumed 750 PJ annually, accounting for 28% of the country's total final energy consumption. By far the largest energy consumer in manufacturing is the iron & steel industry, which accounts for almost one-quarter of the total. Other significant consumers of energy are non-ferrous metals, non-metallic minerals and chemicals, which account for about 33% of manufacturing industry energy consumption between them.

The overall energy intensity of manufacturing in South Africa stood at about 12 MJ/\$ value-added in 2012, which was over twice the average level in the European Union. However, international comparisons of this kind must be approached with caution because of the widely varying range of manufacturing activities undertaken in different countries. For example, very energy-intensive activities such as iron & steel production and primary aluminium smelting play a much more significant role in the manufacturing sub-sector of South Africa than in the EU.

In fact, a study by the International Energy Agency suggests that the scope for energy savings in the whole industrial sector (including mining) is a relatively modest 10% beyond the savings that are expected to occur under a business as usual scenario. Most of this potential is found in the 'Other industry' category, rather than in the energy intensive industries (iron & steel, aluminium, cement, chemicals, paper), where it can be assumed that the potential for energy savings has already been extensively exploited.

A number of initiatives have provided significant support to the implementation of energy efficiency projects in the manufacturing sector. The National Cleaner Production Centre's Industrial Energy Efficiency (IEE) programme, the Private Sector Energy Efficiency (PSEE) scheme operated by the National Business Initiative, Eskom's Integrated Demand Management (IDM) programme, the Manufacturing Competitiveness Enhancement Programme (MCEP) and the Green Energy Efficiency Fund (GEEF) both operated by the Industrial Development Corporation, and the 12L tax incentive scheme operated by SANEDI and the National Treasury are the most prominent initiatives.

At present, IEE and PSEE have both ended, although a follow-on to IEE is expected to commence soon and run for a further four years. The rebate schemes under Eskom IDM have been on hold since the end of 2013 due to funding constraints, while MCEP is currently suspended for new applications, as the current allocation of funds has been fully committed. Since its inception in late 2011, GEEF has made loans of R562 million, leading to estimated

annual savings of about 3.3 PJ. Projects already registered under the 12L tax incentive scheme will, if implemented successfully, yield annual energy savings of 13.5PJ – a figure that is expected to increase significantly following the recent approval of an increase in the incentive to more than twice its original level. Some industry sector stakeholders feel that the M&V costs of 12L projects have been too high for the scheme to be attractive, but this is being addressed both through the increase in incentive levels and the development of simpler, more streamlined M&V procedures.

Mining

As of 2013, the mining industry accounted for over a quarter of South Africa's exports and employed half a million people. Although its contribution to GDP has been falling for a number of years, it remains a key component of the country's economy, generating 9% of total GDP in 2014. The mining and quarrying sub-sector consumed approximately 170 PJ in 2012, accounting for over 18% of the total industrial sector consumption. About two-thirds of this consumption was in the form of electricity.

The combination of rising electricity prices and steep falls in the price of most of the commodities mined in South Africa has presented the industry with very challenging conditions. In response to these circumstances, particularly the larger firms have already implemented many significant energy saving initiatives. Examples include:

- comprehensive adoption of LED lighting in several mines, resulting not only in direct energy savings but also in a reduction in the demand for cooling
- many mining companies specify IE3 class motors and variable speed drives as standard
- optimisation of ventilation and compressed air systems is widespread
- several companies have adopted management approaches such as real-time monitoring of energy consumption, setting of annual rolling targets for reductions in specific energy consumption or implementing internal carbon pricing schemes

Many of the energy saving projects undertaken within the mining industry in recent years have been supported successfully under the Eskom Integrated Demand Management programme. In contrast, some mining industry stakeholders report that the 12L tax incentive programme has been less attractive as a vehicle for supporting energy efficiency projects because the incentives take the form of an allowance against profit taxes, which is of no value for those years in which an operating loss is recorded.

The impact of the proposed carbon tax on the mining industry is likely to be particularly strong, because of the industry's heavy dependence on electricity (because electricity generation is very carbon-intensive, the effect of the tax on electricity tariffs is likely to be proportionally very high). However, the phase out of the current electricity levy combined with a number of allowances and exemptions against direct CO₂ emissions will provide a period of up to five years before the full impact of the carbon tax begins to be felt. Given the challenging circumstances that the mining industry currently faces, it is essential that this window of opportunity is exploited effectively so that the negative impacts of the carbon tax may be pre-empted.

INTER-DEPARTMENTAL HARMONISATION

The Department of Environmental Affairs, National Treasury, Department of Trade and Industry and Department of Energy have been collaborating very closely on the Carbon Tax, introduction of Energy Management Plans, 12L, and the development of the South African Air Quality Information System (SAAQIS). Where possible, alignment has occurred. The Department of Environmental Affairs will be introducing carbon budget for individual companies within the energy-intensive sub-sectors and therefore it will be necessary to ensure that there is alignment between the departments when it comes to developing Energy Management Plans.

The Green House Gas Mitigation Potential analysis developed by the Department of Environmental Affairs analyses detailed measures for each sub-sector and their potential for GHG abatement. In general, these measures include co-generation, improved process, energy monitoring and management systems, as well as industry specific measures to improve energy efficiency.

HOW WILL WE GET TO OUR GOAL?

The focus of policy measures to facilitate improvements in energy efficiency in the industry sector is to build on the significant progress already being made by the front runners, while ensuring the conditions are created to enable all players within the sector to achieve similar gains. Shorter-term actions are particularly important to ensure that the whole sector is equipped to respond effectively to the challenges presented by increasing electricity prices and the impending carbon tax.

The NCPC IEE programme has demonstrated the energy savings that may be stimulated through the adoption of energy management systems (EnMS) and energy system optimisation (ESO) within the industrial sector. The planned continuation of the IEE programme into a second phase will ensure that these benefits continue to accrue for the next four years. However, it is unrealistic to expect programmes such as IEE to have comprehensive reach within South Africa, so complementary measures to incentivise the wider adoption of EnMS and ESO will be considered. Possible approaches include:

- the use of targeted tax rebates, which has been very successful in helping Germany to reach the very high levels of ISO 50001 certification seen there.
- allowing enterprises with ISO50001 certification to self-verify 12L projects, subject to random spot-checks to ensure compliance.

It is worth noting that the achievement of significant energy savings is not the result of ISO50001 certification per se, but rather of the introduction of an EnMS that is of a standard equivalent to ISO 50001. To date, the rate at which South African firms have certified has been slow, with only 10 firms achieving certification as of 2014. Stakeholders report that, unlike ISO 9001 and 14001, certification to ISO 50001 is not something that their customers demand. Once a strong EnMS is in place, the advantages of achieving ISO certification are marginal relative to the additional costs. It is important that any incentive schemes to promote the introduction of EnMS recognise this fact.

The Private Sector Energy Efficiency (PSEE) programme run by the National Business Initiative (NBI) provided an extensive set of resources from which firms could receive targeted advice and assistance in improving their energy efficiency. Three tiers of support were provided: small enterprises could access free technical advice by telephone, a range of tools, publications and information via the internet and access to free workshops on specific energy-related subjects; medium-sized firms could also receive fully-funded energy surveys and follow-up services; large firms could receive in-depth energy reduction consultancies at only 40% of the full cost. The PSEE programme, supported by UK DFID, ended in 2015, but similar models have proven successful in other countries. The development of a permanent successor scheme to PSEE should therefore be investigated, including the identification of suitable sources of funding and an appropriate hosting body.

While the provision of advice and audits and the wider adoption of EnMS are important in increasing awareness of the opportunities for improved energy efficiency, significant energy savings will result only if these initiative are coupled with programmes and measures to enhance the flow of investment into energy efficiency. The DoE will therefore continue to collaborate with the National Treasury, the Department of Trade and Industry and other government departments, with international financial institutions and donor organisations, with the local banking sector and with industry sector stakeholders to ensure that appropriate and effective financing schemes for energy efficiency continue to be developed.

The 12L tax incentive scheme provides a potentially strong mechanism for stimulating investment in energy efficiency among many firms in the industry sector, although many industry stakeholders have reported that the M&V costs are too high to make the scheme attractive. A further issue with 12L that is particularly relevant during the current challenging economic climate is that, because it provides an allowance against profit taxes, it is of no value to firms during years in which they make a loss. The effectiveness of 12L is likely to improve following the recent increase in incentive levels and the extension of eligibility to include cogeneration projects. Furthermore, efforts are currently in progress to streamline and simplify the M&V procedures and to address some of the other constraints of the scheme. Moving forward, it is essential that the detailed design of the scheme is continually reviewed and improved, and that opportunities are identified to facilitate the development of a dynamic and competitive M&V industry, which will ensure that the M&V costs associated with 12L are kept low.

While significant progress in improving energy efficiency continues to be made by the front-running companies, there is likely to be considerable scope for building the capacity of those companies that have been less active to date in exploiting energy saving opportunities. This may be achieved by facilitating learning and experience sharing across the industrial sector, through the development of a centralised gateway that brings together both existing and new resources dedicated to advice, training, information, assistance and the dissemination of best practice relating to energy efficiency.

The introduction of minimum energy performance standards (MEPS) for electric motors in the 0.75-375kW range has been adopted in many part of the world to ensure that the least efficient devices are no longer available for purchase. The testing facilities and procedures

for electric motors are already in place in South Africa, so this policy measure could be introduced relatively easily and quickly. However, the impact of MEPS for motors may be constrained if they are introduced in isolation:

- simply substituting a premium efficiency motor into an otherwise un-optimised system without the use of a variable speed drive often results in minimal savings and, under some circumstances, may result in increased consumption
- if MEPS result in an increased price for new motors, this may lead to increased demand for motor rewinding, the market for which is as yet unregulated

MEPS should therefore be introduced only as part of a wider coordinated approach to transforming the market for electric motors, which may also include: awareness-raising and support relating to the importance of overall system optimisation; tighter regulation of the motor rewinding industry; the use of differential import duties to reduce / eliminate the price differential between standard and premium efficiency motors.

In line with the recommendations of the IEA and the recently tightened EU standard, when MEPS for electric motors are introduced, the minimum performance level should be set at IE3 class motors, with IE2 being permitted if an integral VSD is included. In the medium term, MEPS may be extended to include packaged motor-driven systems (pumps, compressors, fans etc.), for which testing facilities will need to be set up and appropriate testing procedures defined.

For industrial boilers, the use of MEPS is impractical and likely to be ineffective, because of the wide range of different operating conditions under which boilers are used. Instead, a more effective means of ensuring satisfactory levels of performance are achieved is to specify mandatory minimum design standards. These would generally require the inclusion of design features such as combustion controls, an economiser and a variable speed drive on the combustion air blower. Analysis conducted in connection with the EU Ecodesign Directive indicated life-cycle cost savings of 6-8% through minimum design standards in industrial boilers. The potential will therefore be explored for the introduction in the medium-term of similar mandatory standards in South Africa.

Although many of the larger pumping and ventilation systems in the industry sector (particularly within mines) are custom-designed and built, the industrial sector as a whole has a significant demand for smaller, off-the-shelf packaged systems. While MEPS will ensure that the worst performing devices are removed from the market, there is a need for a simple, well-recognised endorsement label for high energy performance to run alongside MEPS, to assist in energy efficient procurement. The most well known example of this is the Energy Star brand in the US, which provides an independent and trustworthy indication that the device in question is among the best-performing in its class. The development of a clearly branded endorsement label specific to South Africa, along with the criteria for its award, may begin in the short-term, although the experience from the US suggests that it will take several years for the development of a critical mass of endorsed items that is necessary for high brand recognition to be achieved.

ID No	Measure	Key features	Implications	Anticipated impact	Timeframe (S/M/L)
11	Adjustment of the 12L tax incentive scheme	<ul style="list-style-type: none"> • Simplified and streamlined M&V procedures • Changes to ensure scheme is attractive even when an operating loss is recorded (e.g. allowing 'banking' of tax allowances to future years) • Institute regular review of design and effectiveness 	<ul style="list-style-type: none"> • Revise business case to establish financial impact of changes to existing scheme • Agreement with Treasury • Addendum to 12L regulations 	<ul style="list-style-type: none"> • Greater uptake of 12L scheme • Jobs created (M&V) & skills development 	Short
12	Minimum energy performance standards for motors and motor-driven systems	<ul style="list-style-type: none"> • In the short-term, conduct an assessment to determine whether MEPS for motors would lead to a net benefit • IE3 class of motors to become standard unless an integral VSD is present • In the medium-term, MEPS to be introduced for packaged motor-driven systems 	<ul style="list-style-type: none"> • Revision to MEPS for motors • Integration of new standards by SABS 	<ul style="list-style-type: none"> • Reduced maintenance costs • Reduced cost of efficient products 	Short-Medium
13	Creation and promotion of a strongly branded certification for the most energy efficient products (modelled on the 'Energy Star' brand in the USA)	<ul style="list-style-type: none"> • Certification of 'off the shelf' items of equipment greatly simplifies the process of implementing energy efficient procurement 	<ul style="list-style-type: none"> • Although the scheme itself may be introduced relatively quickly, the process of certifying a critical mass of items and achieving high brand recognition is expected to take significantly longer • Administration and monitoring of certification process 	<ul style="list-style-type: none"> • Reduced cost of energy efficient products • Demand driven market 	Medium-long
14	Provision of targeted support and advice on energy efficiency to enterprises (similar to the NBI's PSEE programme)	<ul style="list-style-type: none"> • Provide three tiers of support and advice will be provided to small, medium and large enterprises. 	<ul style="list-style-type: none"> • Administration of PSEE • Management arrangement for the implement programme through partnership with NBI 	<ul style="list-style-type: none"> • Skills development • Job creation 	Short
15	Incentivise enterprises to introduce EnMS and achieve ISO50001	<ul style="list-style-type: none"> • Incentives provided either through tax rebate or allowing ISO 50001 certified firms to self-verify 12L projects (subject to 	<ul style="list-style-type: none"> • Commitment from National Treasury to support tax incentive • Support improvement of skills and 	<ul style="list-style-type: none"> • Skills development 	Short-medium

	certification	random spot-checks for compliance)	diversification of ISO certification companies to support the market.	• Job creation	
16	Roll-out of the provision of energy and production data from the manufacturing sub-sector	<ul style="list-style-type: none"> • Build on the pilot voluntary provision of data undertaken during the development of the EETMS • Targeting the largest energy users in the short-term gives the potential for at least 60% coverage in terms of total energy consumption • Integrate data collection and monitoring of bottom-up interventions with top-down 	<ul style="list-style-type: none"> • Continued development of data submission mechanisms • Investment in primary data collection, such as a household energy survey • Management of EETMS to be outsourced 	• Data for evidence-based policy making	Short
17	Develop standardised tools for voluntary reporting of energy savings from specific initiatives in the mining sector	<ul style="list-style-type: none"> • Some mining companies have already developed tools such as Anglo American's ECO₂MAN, which could serve as models for the development of industry-wide tools. 	<ul style="list-style-type: none"> • Extensive consultations with the sub-sector • Administration of energy savings being reported and use of data 	• Evidence-based policy reviews	Short-medium
18	Creation of technology/ learning hubs for energy efficiency	<ul style="list-style-type: none"> • Hubs should be specific to sub-sector and technologies, ensuring that information is relevant to South African industry. • Potential models include the Chamber of Mines 'MOSH' health and safety learning hub, whereby leading firms document and share their experiences across the industry through 'Communities of Practice for Adoption'. 	<ul style="list-style-type: none"> • Learning hubs in the manufacturing sub-sector are likely to be especially effective in the more diverse industries such as food processing, textiles etc. Therefore, hubs should be sub-sector specific. 	<ul style="list-style-type: none"> • Skills development • Regional pioneers 	Short-medium

INDICATORS OF SUCCESS

Manufacturing

A 16% reduction in weighted mean specific energy consumption by 2030 relative to a 2015 baseline.

Mining

A cumulative total annual energy saving of 40 PJ arising from specific energy saving interventions undertaken by mining companies. Note that energy savings additional to this are also expected to arise from a combination of non-specific good housekeeping and behavioural change, as well as so-called 'autonomous change'.

HOW WILL WE MEASURE SUCCESS?

Manufacturing

The target for the manufacturing sub-sector is expressed in terms of a weighted mean specific energy consumption. This will be calculated in a manner similar to the Odex indices used in the European Union, and will require the collection of data on energy consumption and output from the major energy-consuming manufacturing enterprises. This data collection process was initiated in voluntary pilot form during the development of the Energy Efficiency Target Monitoring System (EETMS) during 2012-14. Data collected under EETMS development accounted for about 40% of the total final energy consumption of the manufacturing sub-sector. It is expected that a coverage rate of in excess of 60% of sub-sector energy consumption may be achieved through a concerted rollout of the data collection process.

Mining

The mining sub-sector is unusual in that the indicators commonly used for assessing energy efficiency have significant shortcomings. An indicator based on the economic value of outputs (i.e. the conventional MJ per Rand of GDP) results in figures that are strongly influenced by the global prices of the commodities being mined, which may be highly volatile. Indicators based on specific energy consumption (i.e. MJ per physical unit of final product) do not capture the complex relationship between energy consumption and output, where issues of depth, accessibility and quality of ore bodies may radically alter the specific energy consumption independently of any changes in energy efficiency.

For this reason, the preferred indicator is one based on the total absolute quantity of energy savings achieved through specific energy saving interventions. The data for tracking total savings will be obtained from two sources: (i) any energy saving projects implemented with support from 12L, Eskom DSM programmes, or any future similar mechanisms, will by necessity be audited to verify the savings achieved; (ii) the DoE will work with the mining industry to develop voluntary agreements for the self-reporting of the results of energy saving projects that have been implemented without any external financial support.

Many mining companies already self-report the results of energy saving projects through their annual sustainability report, and several firms have developed formal methodologies for this reporting (e.g. Anglo American's ECO₂MAN approach). Smaller companies, particularly those that are not ISO50001 certified, may not have methodologies in place for quantifying the results of energy saving interventions. The DoE will therefore aim to work

with industry stakeholders (in particular the Chamber of Mines and the EIUG) to develop simplified tools to facilitate this voluntary reporting of energy savings.

AGRICULTURE

GOAL 6

Contribute to the modernisation of the sector and the rebuilding of an inclusive rural economy by addressing the inefficient use of energy in agriculture.

WHERE ARE WE NOW

The agricultural sector (including forestry and fishing) consumes approximately 60 PJ of energy annually, of which about two-thirds is in the form of petroleum products. The sector accounts for about 2% of South Africa's total final energy consumption, and is responsible for a similar fraction of total GDP. Because of its minor role in energy consumption and relatively modest contribution to GDP, the agricultural sector is often overlooked when focussing on promoting energy efficiency. However, StatsSA estimate that as many as 20% of all South African households are directly connected with agriculture, so it is a key sector from a social perspective.

Relatively little research has been conducted in opportunities for energy savings in the agricultural sector, with most focussing on the savings potential in motor-driven systems (irrigation pumps, fans, dryers etc.). Given the large fraction of energy consumption that is accounted for by petroleum products, it is likely that significant energy savings are possible in agricultural vehicles.

A study by Eskom identified possible savings of 824 GJ in a sample of 12,000 centre-pivot irrigation systems. Scaling this figure up to the total area irrigated by similar systems across South Africa suggests that the total savings possible in this technology alone are 675 TJ, or over 1% of the total sector energy consumption, or well over 3% of agricultural electricity consumption.

The magnitude of the potential savings in irrigation systems is borne out by a case study from ABB, which describes 40% electricity savings from optimising a system on a farm in North West Province by installing VSDs. The payback period for this investment was only seven months. Other studies suggest significant savings may be achieved by switching from high-pressure to low-pressure irrigation systems, and another case study at a grape farm in the Northern Cape illustrates the feasibility of using solar PV to power irrigation pumps.

Despite the clear opportunities for energy savings in agriculture, there have been no energy efficiency programmes specifically targeting the sector to date. Eskom have produced a promotional leaflet aimed at the agricultural sector under their IDM programme, aiming to solicit applications from farmers to the Standard Offer and ESCOs programmes. However, it is clear that more exploratory consultation is required with stakeholders from the agricultural sector to gain a better understanding of energy use patterns and the opportunities for energy savings, particularly among the smaller farms and smallholders.

INTER-DEPARTMENTAL HARMONISATION

The Department of Agriculture, Forestry and Fisheries (DAFF) strategy does not specifically address energy consumption, although one of its broader strategic goals is the sustainable use of natural resources. Another key element of the DAFF strategy is to improve the production efficiency of small farmers and smallholders. The National Development Plan points to the importance of reversing the decline in rural employment and creating a modern efficient agricultural sector as part of the process of building an inclusive rural economy.

HOW WILL WE GET TO OUR GOAL?

Given the relatively large percentage energy savings that may be achieved through the optimisation of motor-driven systems, the provision of high-quality targeted awareness-raising material may be expected to yield significant impacts. Potential partnerships with various sector associations (e.g. AFASA, AgriSA) will be explored for the development and dissemination of such materials. In particular, the possibility will be explored for including modules on energy efficiency in the training courses run by SABI (the South African Irrigation Institute).

Since two-thirds of the energy consumed in agriculture is in the form of petroleum products, this suggests a significant savings potential in vehicles. More research is required to derive a full understanding of the patterns of fuel use, but the feasibility will be explored for targeted awareness-raising campaigns around vehicle use in the agricultural sector.

Avenues for mobilising funding for energy efficiency improvements will be assessed and developed. For larger projects, this might involve working with SANEDI and the National Treasury to ensure that the 12L tax incentive scheme meets the needs of the sector. For small farmers, it is likely that the most effective way of mobilising funding would be through direct grants. Efforts will therefore be made in partnership with DAFF to secure a National Treasury budget allocation for this purpose. The agricultural sector is also likely to prove an attractive source of carbon-offset projects, since the sector will fall outside of the scope of the proposed carbon tax.

A further potential source of finance is through energy performance contracts with ESCOs, financed through normal bank financing, or through Eskom's ESCO programme. The scope will be explored for providing targeted training to ESCOs wishing to enter the agricultural sector.

ID No	Measure	Key features	Implications	Anticipated impact	Timeframe (S/M/L)
A1	Explore the potential for savings in agricultural vehicle use, and develop appropriate awareness-raising material	<ul style="list-style-type: none"> Produce research on energy savings potentials within the agriculture sector Work with sectoral associations to research the feasibility of technology innovations 	<ul style="list-style-type: none"> Commission SANEDI in partnership with the Agricultural Research Council (ARC) to undertake sector-specific research that can be applied to the sector 	<ul style="list-style-type: none"> Nationally relevant measures 	Medium
A2	Development of targeted awareness-raising and training material on potential savings in motor-driven systems	<ul style="list-style-type: none"> Developed in partnership with key sector associations and the ARC Establish demonstration sites to showcase potentials Aim to include energy efficiency modules in the training courses provided by the South African Irrigation Institute (SABI) and the ARC 	<ul style="list-style-type: none"> Develop partnerships with sector associations Identify pilot sites and subsidise implementation of energy savings measures Jointly devise module content for training courses 	<ul style="list-style-type: none"> Awareness raising Increased demand 	Short
A3	Provide direct grants to small farmers / smallholders for all or part of the cost of interventions	<ul style="list-style-type: none"> Use for simple off-the-shelf energy efficiency solutions such as variable speed drives and premium efficiency motors May also be appropriate for more complex system optimisation projects 	<ul style="list-style-type: none"> Identify financing stream for grant mechanism 	<ul style="list-style-type: none"> Inclusive growth Improved livelihoods Job creation 	Short-medium
A4	Establish the most effective means for providing financial incentives / mobilising funding	<ul style="list-style-type: none"> Possibilities include adapting 12L, developing alternative agriculture-specific tax incentive schemes, promoting the entry of ESCOs into the sector 	<ul style="list-style-type: none"> Commission SANEDI in partnership with the ARC to research possible financing mechanisms for the sector Identify if the opportunities exist for ESCOs to enter the market 	<ul style="list-style-type: none"> Job creation 	Medium

INDICATORS OF SUCCESS

A total electricity saving of 1 PJ through officially supported projects by 2030.

HOW WILL WE MEASURE SUCCESS?

For officially supported larger projects (e.g. those supported through schemes such as 12L, carbon offsets or Eskom IDM programmes), robust M&V data will be available to enable energy savings to be tracked. For smaller interventions (e.g. the provision of grants to small farmers), a 'deemed savings' approach is more appropriate, where savings are assumed based on the type of technology installed and the level of usage.

TRANSPORT

GOAL 7

To bring about significant improvements to the average fuel efficiency of the fleet of road transport vehicles in South Africa.

WHERE ARE WE NOW

The transport sector in South Africa accounts for 27% of total final energy consumption (Energy Balance Tables, 2012), 90% of which is attributable to road transport. Between 2004 and 2012, the energy intensity of the transport sector has been relatively consistent as compared to other sectors, although there are structural changes (such as modal shifts) that have occurred during this period that cannot be identified due to the current lack of data (EETMS, 2015).

Few policy measures have been implemented to improve energy efficiency in the transport sector. Second hand vehicles cannot be imported to South Africa without special permission being granted, thereby simplifying the policy measures that would need to be applied to imported new vehicles. There are currently no fuel efficiency or technology standards in place for vehicles. The fuel levy is calculated by National Treasury and is allocated to specific road programmes, such as the Road Accident Fund. Fuel levies were raised by 80.5 cents per litre in 2015, with 30.5 cents of that attributable to the general fuel levy, and 50 cents per litre going towards the Road Accident Fund (RAF) levy. The current level is 255 cents per litre on petrol and 240 cents per litre for diesel (February, 2016). The decrease in oil prices was therefore countered by the increase in the fuel levy.

The introduction of labelling for vehicles in 2008 requires that the average fuel consumption and CO₂ emissions of each model of vehicle are specified on the vehicle labels, but no impact analysis of this measure has been conducted. Vehicle licences are renewed annually (bi-annually for buses), but a routine roadworthy inspection is not performed at this point. Roadworthiness is assessed only when a vehicle is bought or sold.

HARMONISATION WITHIN GOVERNMENT

The Department of Transport has produced a fuel reduction strategy, and reflects the role of the Department of Energy in supporting the achievement of its goals. The measures defined in this strategy include:

- Road
 - Modal shifts
 - Passenger shift from private to public transport
 - Freight shift from road to rail
 - Improving land use and town planning to increase densification
 - Increasing the capacity of public transport vehicles
 - Improving fuel efficiency in vehicles
 - Encouraging the use of alternative lower carbon fuels and biofuels

- Rail
 - Introduce more energy efficient rolling stock/ locomotives
 - Encourage the use of alternative lower carbon fuels
 - Introduce a voltage upgrade

The Department of Transport's draft GHG Emissions Reduction Strategy (2015) highlights the following measures:

- Road
 - Improved Efficiency – Petrol/ Diesel Internal Combustion Engine
 - Alternative Fuels – Fuel Cell Electric Vehicle/ Electric Vehicle
 - Alternative Fuels – Biofuels
 - Modal Shift – Passenger Car to Public Transport
 - Modal Shift – Road to Rail Freight
- Rail
 - Improved Efficiency - Electric Multiple Unit/ Diesel
 - Alternative Fuels - Hybrid Diesel / CNG
 - Alternative Fuels – Biofuels
 - Metrorail Voltage Upgrade
 - Aviation
 - Improved Efficiency – Retrofit
 - Early Retirement/ scrappage scheme
 - Alternative Fuels – Biofuels

HOW WILL WE GET TO OUR GOAL?

The challenge for the DoE strategy for energy efficiency for the transport sector is that providing adequate public infrastructure, improving town planning, and incentivising modal shifts are complex measures that are primarily the mandate of other government departments to implement. Many of the measures that can be taken are outside of the remit of the Department of Energy. Therefore, it is suggested that the DoE focuses its energy efficiency strategy for the transport sector in the short term on measures that it can implement directly, while providing support where possible to the more extensive, cross-departmental, measures defined by the Department of Transport.

The barriers to energy efficiency in the transport sector that can be addressed by the DoE include misaligned pricing signals for energy efficient vehicles, availability of fuel-efficient vehicles, poor levels of awareness of the effect of driving behaviour on fuel consumption, and the lack of specific technical expertise to recommend improvements to vehicle fleet management.

The proposed package of measures described below combines regulatory improvements, addressing behavioural change, developing the enabling framework, and committing to inter-departmental collaboration.

ID No	Measure	Key features	Implications	Anticipated impact/ Multiple benefits	Timeframe (S/M/L)
T1	Develop fuel efficiency standards for light and heavy vehicles to improve the overall efficiency of the vehicle stock	<ul style="list-style-type: none"> Consider standards for both new and used vehicles Consider a scrappage scheme for vehicles that are considered to be below Consider tax rebate on purchase of vehicles of high fuel efficiency 	<ul style="list-style-type: none"> Awareness raising Enforcement of standards through SABS Database of vehicle sales and efficiencies 	<ul style="list-style-type: none"> Gradual improvement of the fuel efficiency of the vehicle stock over time Relative reduction of market price of energy efficient vehicles on introducing standards 	Short
T2	Improve systems for ensuring road worthiness	<ul style="list-style-type: none"> Undertake an in-depth cost-benefit analysis of establishing a regular road worthiness inspection system Incorporate energy efficiency in the routine road worthiness tests (including tyre and fuel efficiency) Enforcement check through national testing centres Collaborate with the Department of Transport for the road worthiness test to become a routine, annual check to assess environmental fitness 	<ul style="list-style-type: none"> Inter-departmental assessment of cost-effectiveness of the system Development of organisational setup for testing and management 	<ul style="list-style-type: none"> Improved condition/ performance of vehicle stock Reflection of road worthiness in used car market Increased public awareness Improved road safety 	Short Long
T3	Encourage domestic car manufacturers to build more efficient vehicles	<ul style="list-style-type: none"> Develop voluntary agreements with the automotive industry to improve fuel efficiency of their vehicles Encourage innovation and knowledge sharing 	<ul style="list-style-type: none"> Define incentive for manufacturers (import duties rebate for parts?) 	<ul style="list-style-type: none"> Gradual improvement of the fuel efficiency of the vehicle stock over time 	Medium-Long
T4	Introduce voluntary agreements with private passenger transport companies to improve vehicle performance	<ul style="list-style-type: none"> Develop voluntary agreements with the private passenger transport to identify performance measures 	<ul style="list-style-type: none"> Provide financial incentives Research the potential to establish an ESCO model for vehicle 	<ul style="list-style-type: none"> Gradual improvement of the fuel efficiency of the vehicle stock over time Requires financial incentive from government (fuel levy rebate?) 	Medium-Long

			fleets.	<ul style="list-style-type: none"> Requires technical expertise specifically for the transport sector 	
T5	Implement a national eco-drive strategy	<ul style="list-style-type: none"> Incorporate standards for ecodriving in curriculum of driving schools Raise awareness in freight and passenger transport companies of potential savings from eco-driving 	<ul style="list-style-type: none"> Training driving schools in ecodriving Awareness raising 	<ul style="list-style-type: none"> Driver behaviour will improve – estimated to be within 10-20% energy savings potential 	Medium
T6	Develop accreditation scheme for energy auditors for the transport sector	<ul style="list-style-type: none"> Develop accreditation for transport sector energy auditors improve professionalization of the sector 	<ul style="list-style-type: none"> Define performance assessment framework for accreditation 	<ul style="list-style-type: none"> Availability of technical expertise to support the commercial and public transport sub-sectors to realise savings 	Medium
T7	Roll-out of the provision of energy and activity data from the transport sector	<ul style="list-style-type: none"> Build on the pilot voluntary provision of data undertaken during the development of the EETMS Integrate data collection and monitoring of bottom-up interventions with top-down 	<ul style="list-style-type: none"> Continued development of data submission mechanisms Investment in primary data collection (end user surveys) Management of EETMS to be outsourced 	<ul style="list-style-type: none"> Data for evidence-based policy making 	Short

INDICATORS OF SUCCESS

A 20% reduction in the average vehicle energy intensity (measured in MJ/km) of the South African road vehicle fleet relative to a 2015 baseline. This is approximately equivalent to the rate of progress envisaged in the Global Fuel Efficiency Initiative target of a 50% improvement in the fuel economy of all cars and light commercial vehicles by 2050 relative to a 2005 baseline.

HOW WILL WE MEASURE SUCCESS?

Monitoring progress towards the target will require the composition of the vehicle fleet to be tracked. This may be performed in one of two ways: (i) if the requirement for annual roadworthiness tests is introduced, this will yield detailed data on the make, model and age of the vehicle fleet; (ii) existing data sources on new vehicles entering the vehicle fleet may be combined with data in existing vehicles obtained from regular surveys.

Either of these approaches will provide a comprehensive picture of the composition of the vehicle fleet, which may be combined with standard data sources on vehicle fuel efficiency to allow the average fuel efficiency of the fleet to be tracked.

PRODUCTION AND DISTRIBUTION

GOAL 8

Accelerate the improvement of energy efficiency in the generation, transmission and distribution of energy.

WHERE ARE WE NOW

The Department of Energy Integrated Energy Plan (2012) and Integrated Resource Plan (2010-30) jointly define the anticipated energy mix with a view to informing policy to address future energy service needs efficiently and in the most socially beneficial manner. The generation of electricity is largely provided for by coal power (92.6%), with the state-owned Eskom currently producing 97% of the power consumed. While the strong role of coal-fired power is expected to continue through to 2030, solar PV, wind and other renewable energy sources are anticipated to increase in importance in the energy mix. The main mechanism for the promotion of renewable generation is the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), which was launched in 2011 after earlier moves to introduce a feed-in tariff were unsuccessful.

The National Energy Efficiency Strategy (2005) and associated National Energy Efficiency Action Plan (NEEAP) (2012) included measures to improve the efficiency of the power sector. Specifically, the NEEAP suggests a reduction in the energy use in the boiler, turbine and auxiliary power consumption at each of the 13 Coal Fired Power Stations (excluding the ash and dust plants). In addition, the NEES (revised in 2008) aimed to reduce Eskom's internal (non-essential) energy consumption by 15% by 2015. Eskom's own analysis indicates that this target has been comfortably exceeded, with savings of 26% being achieved. The emphasis in this respect was on technology improvements, including lighting, air-conditioning, water heating, control and automation (sensors etc.), and renewable energy. The NEEAP (2012) also suggests working with all power generators to improve efficiency by developing minimum efficiency thresholds for new generation, setting a timescale for efficiency upgrades to existing generation capacity and developing a reporting and tracking mechanism.

While electricity prices are amongst the cheapest in the world, the recent price increases (12.59% in 2015/16) and lack of generation capacity have highlighted the necessity to improve energy efficiency at all points in the supply chain from generation through to end use. The National Development Plan specifically refers to energy generation and distribution as a pressing constraint on growth, investment and job creation.

Approximately 180 municipalities distribute 41% of electricity sales to 60% of the customer base. Based on an analysis of revenue from sales and expenditure on operations and maintenance performed by the National Treasury (2012), the profits are a significant component of municipal income. Over 50 municipalities derive more than 30% of their total income from electricity sales. Some municipalities therefore have little incentive at present to work towards reducing consumption among their domestic, as the resulting lost revenue would compromise their ability to deliver other key services.

Very few South African cities live up to international standards for distribution losses. It is estimated that 18% of electricity that is bought from Eskom by municipalities is lost. Based on data provided by Eskom, over 22 TWh were lost in 2013 in distribution and transmission, equivalent to about one-quarter of all electricity sold to municipalities.

The City of Johannesburg has distribution losses of 22%, while some municipalities report distribution losses of between 30-40%. These comprise both technical and non-technical losses (i.e. illegal connections, inaccurate billing, defective meters, etc). Eskom has initiated the Energy Losses Management Programme (ELP) with activities being undertaken to reduce theft and tampering and feeder losses. Based on these efforts, distribution feeder losses decreased by an average of 13% between 2013 and 2014.

HOW WILL WE GET TO OUR GOAL?

The Department of Energy has anticipated the generation landscape in the IEP and IRP. The post-2015 NEES needs to therefore be aligned with the plans. It is likely that coal will continue to be a significant factor, but the IEP does build in improvements in coal technologies. The overall thermal efficiencies of the power plant can be improved from the current average of 33% to roughly 38% by the year 2030 with the inclusion of super critical boiler higher efficiency coal power plants and IGCC type power plants. Retirement of older, inefficient power plants (particularly return-to-service plants) has to be implemented once the two new coal-fired power plants (Medupi and Kusile) are completed.

The key barriers to improving energy efficiency in generation are the significant capital investment required to improve infrastructure and the split incentives for producers. The emphasis has generally been placed on demand-side management rather than looking at energy supply. Requests for bids for IPPs using cogeneration launched by Eskom in the mid-2000s were unsuccessful, with only about 400 MW of industrial capacity being brought in through short-term power purchase contracts. The invitation for bids launched in 2015 was similarly poorly responded to. Co-generation is not currently incentivised, and the proposed carbon tax will not take into consideration electricity fed back into the grid. The measures proposed will identify the barriers to the current enabling framework to make cogeneration and trigeneration to understand why uptake is currently so low and to take steps to address this.

An effective approach to stimulate significant end-use efficiency savings that has been used internationally has been to place energy efficiency obligations on distributors / suppliers of electricity and other energy carriers. The obligations require quantified savings to be achieved by utility companies larger than a certain size threshold, while allowing them some freedom to choose how best to achieve those savings. Schemes are generally designed in such a way that obligations must be at least partly met by achieving energy savings in certain specific target groups (e.g. low income households). The costs of achieving the obligated savings are passed through to end-users through the tariff, but where competition between suppliers exists, there is a strong incentive to minimise cost pass-through by leveraging other sources of funding.

The introduction of a similar scheme in South Africa would place an obligation on Eskom as well as on those municipalities that are involved in the supply of electricity. In common with

the approach taken in some EU countries, the initial size threshold could be set at a sufficiently high level that only the largest municipalities would be obligated at the outset. Depending on the detailed design of a future scheme, obligated municipalities would not necessarily be restricted to achieving energy savings among their own customers. The potential may therefore exist for obligated municipalities to achieve savings by forming partnerships with smaller non-obligated municipalities.

It is worth noting that, on average, South Africa's municipalities derive almost 30% of their income from electricity sales, rising to nearly half for some smaller municipalities. For some municipalities, there may therefore be a potential conflict between achieving electricity savings among their customers and ensuring that adequate funds are available to deliver other services. The design of any scheme that places an energy saving obligation on municipalities would therefore need to ensure that their ability to deliver other key services is not compromised.

ID No	Measure	Key features	Implications	Anticipated impact/ Multiple benefits	Timeframe (S/M/L)
G1	Developing the enabling framework for cogeneration and trigeneration	<ul style="list-style-type: none"> Identify the barriers to uptake of cogeneration and trigeneration opportunities and address these. Continue to issue tenders for the procurement of power from high-efficiency cogeneration (either by extending the scope of the current REIPPPP or by launching a parallel CogIPPPP) Establish appropriate power efficiency thresholds for plants to qualify Provide carbon tax credits for any power provided, to reflect the average carbon intensity of the grid power displaced 	<ul style="list-style-type: none"> Regulatory change Monitoring of thresholds by NERSA 	<ul style="list-style-type: none"> Reduce carbon tax liability of industries supplying power from cogeneration plant 	Short
G2	Introducing energy efficiency obligations on distributors of electricity	<ul style="list-style-type: none"> Establish mandatory agreements with distribution systems operators Set long-term targets and penalties for non-compliance, but review the agreement every 3-5 years. Investigate and evaluate mechanisms for passing through costs of obligations to end users 	<ul style="list-style-type: none"> Legislative and regulatory change Subsidies to be made available to utilities Administering and verification of savings 	<ul style="list-style-type: none"> Autonomy for power producers and distributors to identify best business case for savings Job creation (ESCOs) 	Medium
G3	Expansion of internal efficiency programmes for producers	<ul style="list-style-type: none"> Consider making energy management plans a condition of IPP licencing Mandatory internal efficiency programmes for state-owned producers developing the brand 	<ul style="list-style-type: none"> Based on energy audit of operations and a cost-benefit analysis, select the interventions with greatest savings potential As producers of electricity, 	<ul style="list-style-type: none"> Recognition of public responsibility in contributing to improved efficiency Institutionalised energy efficient culture on the 	Short

		<p>“leading by example”.</p> <ul style="list-style-type: none">• Agreement of targets to be set for state-owned producers• Incorporation of a condition for licencing for IPPs to produce annual energy management plans to be submitted to NERSA and the DOE.	<p>an obligation will be placed on all IPPs to manage the efficiency of their operations.</p>	<p>supply side</p>	
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INDICATORS OF SUCCESS

A total of 10 PJ of electricity derived from grid-connected cogeneration plant by 2030

Average total electricity distribution losses below 8% by 2030, and average non-technical losses below 0.5%.

HOW WILL WE MEASURE SUCCESS?

All data necessary for tracking progress towards the targets will be readily available from official sources (Eskom and municipalities).