



WWF

LCAP
REPORT 1

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Living Planet Unit

Approaching the 'Why, What and How' of Low-Carbon Planning in South Africa

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This document presents the high-level findings from a conceptual exploratory study that considered the design of a Low Carbon Action Plan (LCAP) for South Africa, setting out the thinking of how to go about low-carbon economy planning and implementation. While developed specifically for the South African context, the approach explores a methodology which could be adopted in whole or in part by low-carbon economy planners throughout the developing world. As well as outlining the core elements of the LCAP, this document highlights some of the challenges and opportunities this process presents.

The full report is available electronically from WWF South Africa. For more information please e-mail info@wwf.org.za.

WHY DO WE NEED TO REDUCE GREENHOUSE GAS EMISSIONS?

Climate change is occurring, and increases in atmospheric concentrations of greenhouse gases (GHGs) and changes in land cover as a result of human activity are causing it. Evidence of change includes increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.

South Africa is extremely vulnerable to the devastating impacts of climate change. Water, disease, food security and environmental migration have been identified as some of the main areas where climate change will amplify existing development challenges. The most vulnerable members of the populations are also those that are most at risk to the impacts of climate change.

The country is also vulnerable economically: the economy is powered by coal-generated electricity, and energy-intensive industry and mining contribute substantially towards GDP. Increasingly, global markets will penalise carbon intensive goods and services. The change in economic infrastructure required to reduce the emissions associated with the economy and move South Africa to one that is competitive in this new global economy is substantial.

To counter these climate change vulnerabilities, the country needs to take early action on contributing to reducing greenhouse gas emissions, and transitioning to a low-carbon future. Such a transition will have a number of benefits, including:

- **Avoiding the high future costs associated with Climate Change inaction:** Africa is particularly vulnerable to changes in climate. Early mitigation action globally and adaptation action locally can prevent catastrophic outcomes. As it is the most vulnerable populations who are most at risk, inaction leads to worsening poverty and ultimately instability and conflict.
- **Ensuring energy security:** reducing our reliance on fossil fuels in the energy supply and transport sector, maximising efficiency and diversifying energy sources will contribute to security of energy supply.
- **Avoiding unsustainable lock-in:** Decisions made now may lock us in to inappropriate capital stock and infrastructure that will commit us to a high carbon trajectory or become obsolete before the end of its useful life. Attention must be paid in particular to large power generation infrastructure, public transport and urban form.
- **Retaining international competitiveness:** In a carbon-constrained world, carbon prices will place a cost penalty on production in high-carbon economies. Products from such economies will become less competitive in global markets. This will lead to a decline in trade and investment, and a contraction in domestic economic activity.
- **Accessing new economic opportunities:** The new global markets for goods and services linked to climate change mitigation are likely to offer significant opportunities for export-led growth. Countries and firms that act upon these opportunities quickly will have a significant, and highly lucrative, first-mover advantage. These markets are expected to grow significantly as global commitments to reduce GHG emissions become more onerous and start to include developing countries (as happened with the Copenhagen Accord).

Government is currently contemplating economic transformation in order to address continuing high unemployment and levels of inequality in the country (in the New Growth Path and the National Planning Commission's Diagnostic Report). The time is ripe for a substantially new direction, one which is compatible with requirements to retain competitiveness in a low-carbon global economy.



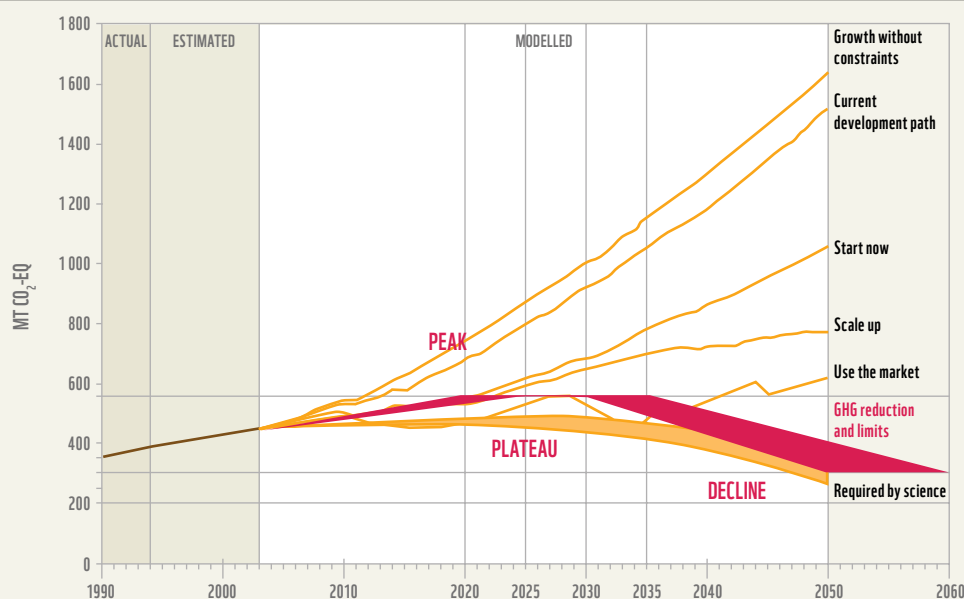
South Africa's economy is powered by coal-generated electricity, and energy-intensive industry and mining contribute substantially towards Gross Domestic Product (GDP).

SOUTH AFRICA'S POSITION ON GREENHOUSE GAS MITIGATION

The foundation for considering climate mitigation in South Africa is the 2008 Long Term Mitigation Scenario (LTMS) Process. The LTMS comprised a stakeholder engagement, research, and modelling process for the building of future GHG-related scenarios and options for South Africa. The LTMS demonstrated the extent

of the rise of emissions up to 2050 in an economy where no mitigation action is taken, and contrasted it against a trajectory where South Africa does its fair share of what is required globally to stabilise GHG concentrations (Figure 1). Four further options were modelled considering different packages of the major mitigation 'wedges'. The mitigation wedges represent the actions that are required to achieve the different trajectories.

Figure 1:
Diagram showing the LTMS Scenarios and the Peak, Plateau and Decline trajectory (Cabinet, 2008)



Cabinet responded to the LTMS outcome by defining a Peak, Plateau and Decline (PPD) emissions trajectory for the country, whereby the emissions will peak between 2020 and 2025, plateau until 2035, and then decline to align with an acceptable level of ongoing GHG emissions identified in the 'Required by Science' scenario by 2050. In December 2009, just prior to the United Nations climate negotiations in Copenhagen, the Presidency pledged that South Africa would undertake mitigation actions, which will result in carbon emission reductions below a business-as-usual trajectory of 34% by 2020 and by 42% by 2025. The pledge is conditional on financial, technological and capacity-building support from developed countries, and a fair, effective and binding multilateral agreement to enable delivery of this support.

The South African pledge was included in the Copenhagen Accord where 138 developed and developing countries, accounting for 87% of global emissions, have listed GHG emissions reduction pledges within a single document, demonstrating that there is a broad commitment within the international community to fight climate change. The commitment was more recently acknowledged under the Cancun Agreements and is included along with the PPD trajectory in the National Climate Change Response Green Paper.

FROM COMMITMENTS TO A PLAN

South Africa has demonstrated a clear commitment to mitigation. The challenge now is how to achieve this.

A Low Carbon Action Plan or LCAP offers an approach to unpack the what, when and how of low-carbon economy planning and implementation. In particular, an LCAP can be designed to tell us the following:

- What is the best deployment of the limited emissions space left to achieve South Africa's development needs?
- How and when could and should individual interventions be brought in to move towards a low-carbon economy?
- What planning needs to be done on an annual basis to ensure that we are remaining within our emissions trajectory?
- What policies need to be put in place, and when?
- What contribution do the changes have to development, and how can these be maximised?
- What institutional/technological/financial/resource/skill constraints need to be addressed in order to implement successful policies?
- What institutional capacity needs to be built? What skills are required?
- What monitoring needs to be put into place in order to ensure that we are on a suitable emissions trajectory?
- What are the priority areas of opportunity for both carbon mitigation and development, which can be implemented immediately?
- How do we ensure that adaptation to climate change takes place concurrently with mitigation?

CO₂

The LCAP approach is centred on the concept of allocating a national 'carbon budget', with an emphasis on leveraging South Africa's remaining carbon space to develop the low-carbon infrastructure the country will require to maintain a low-carbon economy in the future.

This document outlines an approach for the development of a Low Carbon Action Plan (LCAP) for South Africa, which includes conceptual, quantitative modelling and stakeholder engagement components.

This LCAP approach has a number of defining features. At its heart is the concept of allocating a national 'carbon budget', with an emphasis on leveraging South Africa's remaining carbon space to develop the low-carbon infrastructure the country will require to maintain a low-carbon economy in the future. The allocation of the budget between activities and sectors would require a collaborative process, involving all stakeholders. Consequently, it will involve trade-offs between different activities, which may have far-reaching implications.

South Africa's developmental context provides the second defining feature. The way the carbon budget is allocated is determined by the country's development priorities and climate change adaptation goals.

In this approach it is acknowledged that current carbon and economic growth accounting approaches are limited, and it may well not be possible to achieve the mitigation that is required by science within these. As a third defining feature, this LCAP seeks on an ongoing basis to explore and incorporate alternative approaches.

ACHIEVING EMISSION REDUCTIONS: MITIGATION ACTIONS

At the heart of the LCAP outlined here are the technological, behavioural and societal interventions that are required to reduce the emissions intensity of our country.

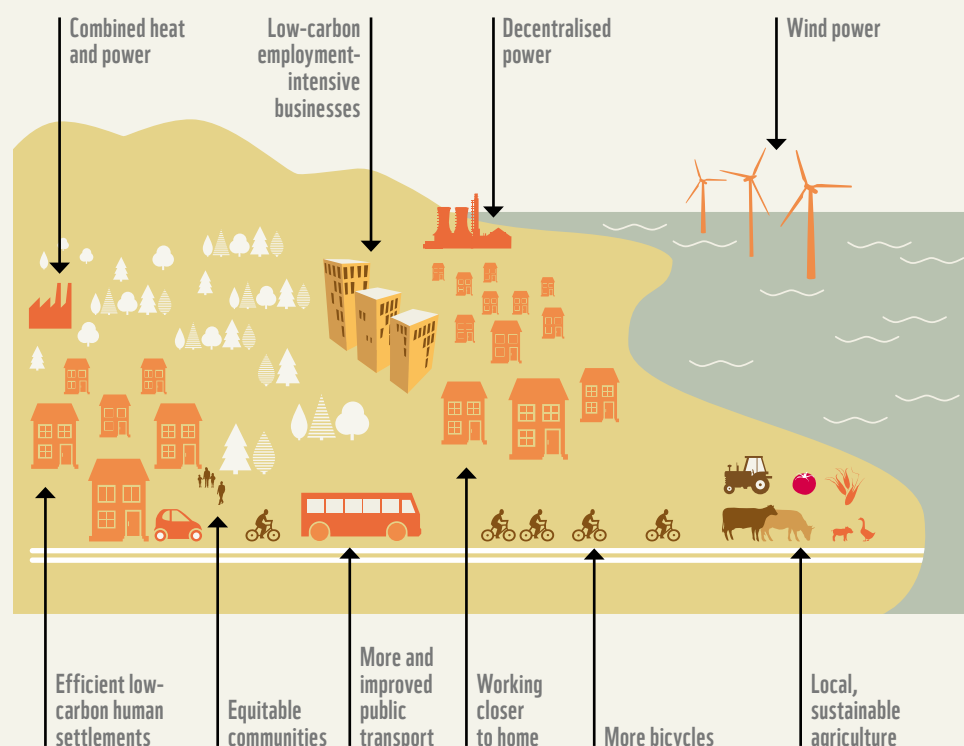
A lack of data, and a lack of 'sufficient' mitigation options does not provide an excuse for not embarking on immediate action.

As part of this study, over 90 such interventions were identified and assessed. Some of these are readily achievable now with minimal capital investment, while others are more likely to be realised only in the future.

In assessing these options three critical observations are highlighted. Firstly, the available information required to assess their potential for implementation, cost and/or contribution to development and adaptation is limited, and is likely to be insufficient for the requirements of LCAP development. Secondly, the majority of them focus on emissions from production within the economy, with a limited number arising from a broader understanding of the role of consumers in driving emissions reduction. Finally, the majority of these were included in the LTMS analysis, where it was demonstrated that even if all of them were implemented, we would still be unlikely to be able to live within a carbon budget as constrained by the peak, plateau and decline trajectory.

A lack of data, and a lack of 'sufficient' mitigation options does not provide an excuse for not embarking on immediate action. The proposed LCAP is therefore an iterative process – whereby new mitigation actions, and new information on existing actions, can be introduced at any time.

Figure 2:
We need to re-imagine our society
 (adapted from *The UK Low Carbon Transition Plan: National strategy for climate and energy*, July 2009)



MITIGATION WITHIN A CARBON BUDGET

The LCAP approach outlined here aims to provide a framework for the allocation of carbon constraints to emitting activities in the country.

In this way, the LCAP aims to enable the country to understand what mitigation really means in terms of constraints on emissions for the country as a whole, for sectors and for individual stakeholders. The use of a ‘carbon budget’ as a framing concept is particularly useful in this allocation discussion, and is proposed as the driver for carbon mitigation in the LCAP.

A national carbon budget is defined as the overall quantity of carbon emissions that a country can emit between now and 2050 to develop its low-carbon infrastructure, and transition to an infinitely smaller ongoing annual carbon budget post 2050. A limit needs to be placed on this overall quantity to transform an economy and society from one of high emissions intensity to one that is largely decoupled from carbon.

By definition a carbon budget is cumulative; it is the total carbon space available between now and 2050, expressed as one figure, in gigatonnes of carbon dioxide equivalent. While the budget is a finite quantum, the trajectory which makes up this quantity may vary.

The carbon budget approach is an alternative to using historical arguments, where emission reductions are evaluated against those in a single year (for example, against emissions in 1990), and those where hypothetical future business-as-usual trajectories are used for emissions allocation to particular sectors. Here, as with all budgets, the only way of staying within the carbon budget constraint is to carefully plan the use of our limited carbon resource, and then track actual use relative to estimated use in order to take corrective action if and when required. This implies rigorous and regularly updated carbon monitoring procedures.

There are a number of further advantages to understanding a mitigation challenge as a budget. By framing the limited remaining emissions space as a budget or a finite resource, the trade-offs between alternative uses of carbon become explicit. A tonne of CO₂ emitted by one sector at any point in time implies one less tonne of CO₂ available to be emitted by that or any other sector now and in the future. It is therefore not simply a case of looking where emissions reductions can be achieved most cheaply in the economy, but at which activities produce the most value per unit of emissions space occupied. This mindset is critically important for ensuring sustainable economic growth in a global economy that will increasingly be incorporating carbon efficiency as a component of competitive advantage. The allocation process therefore needs to be collaborative, involving all stakeholders.

In the case of South Africa, if the country finds itself in a situation where it falls behind in the efficiency with which it uses its ‘scarce’ carbon resource, this will exacerbate existing vulnerabilities that already serve to slow down its economic development such as low labour productivity, or the lack of capital resulting from a low savings rate. Just like labour and capital, carbon will become a factor of production in a carbon-constrained world. In the medium to long term the failure to become more carbon efficient will harm South Africa’s growth prospects.

While the magnitude of national carbon budgets is the subject of ongoing international political debate, an indicative budget could theoretically be calculated from South Africa’s emission reduction commitments to provide an immediate starting point for mitigation planning and securing stakeholder buy-in to begin to engage with low-carbon planning.

In the medium to long term the failure to become more carbon efficient will harm South Africa’s growth prospects.

INCORPORATING DEVELOPMENT AND CLIMATE CHANGE ADAPTATION PRIORITIES

In South Africa, the way the carbon budget is allocated must be informed by the country's development and adaptation priorities.

A suitable set of indicators is required in the LCAP for two reasons. Firstly, they are to be used to screen and evaluate the performance of various alternatives available to form part of the LCAP during the modelling process. In particular they provide a forward-looking indication of the expected impact of the LCAP on:

- the overall amount of emissions generated per year and the sources of these emissions; and
- the wider impact on the economy and the other LCAP goals and non-carbon policy priorities.

These indicators will assist policymakers and stakeholders in choosing between different combinations of mitigation actions and weighing up any potential trade-offs.

Secondly, indicators will support a forward and backward-looking monitoring process that will compare the actual impact of the LCAP with the impacts that were envisaged in the LCAP's development. This will allow both the re-calibration of the LCAP models in a way that estimates more closely resemble actual outputs, and the LCAP to be adjusted to increase its effectiveness in attaining the common LCAP goals and policy priorities. The monitoring process will focus on:

- whether the economy is tracking within the long-term carbon budget;
- the extent to which the actual emissions differed from the expected emissions in a specific year;
- the extent to which performance as measured by the indicators (and thus goals and policy priorities) deviated from their expected values; and
- whether the LCAP is likely to lead to a flourishing South Africa.

Selection of a suitable set of indicators that achieves the above is not trivial and a critical element of the development of the LCAP is to identify a suitable indicator set. This indicator set will need to be identified through stakeholder participation, and is likely to change as our understanding of both mitigation and development evolves. Besides being relevant, the following considerations are important in developing the LCAP indicator set to ensure that it is manageable:

- a small set of indicators should be used;
- indicators should explicitly be linked to policy targets; and
- environmental and social indicators that are compatible with existing macro-economic indicators and standard growth accounting are preferred in the short term.

QUANTITATIVE MODELLING IN THE LCAP

The LCAP is necessarily underpinned by sound and defensible quantitative modelling, using agreed upon assumptions where data is not yet available. After extensive review of a host of modelling platforms that have been applied in the energy and climate change space, a proposal was developed for a modelling framework

to support design and implementation of the LCAP. This framework has at its heart a system dynamics model developed through a process known as ‘mediated modelling’.

Mediated modelling is a modelling approach that aims to achieve a high degree of consensus and understanding among stakeholders by involving them collaboratively in the model building. Mediated modelling is used in tandem with a computer-based modelling paradigm – traditionally that of system dynamics. System dynamics (SD) is a type of simulation modelling which allows for the exploration of the evolution of a complex system over time, by taking on board the feedback loops and dynamic behaviour of the system. SD models are initially established through drawing up causal loop diagrams, which demonstrate which variables impact on each other and how. Causal loop diagrams are then translated into models that are populated with equations that describe the interrelationship between variables, and how these evolve with time.

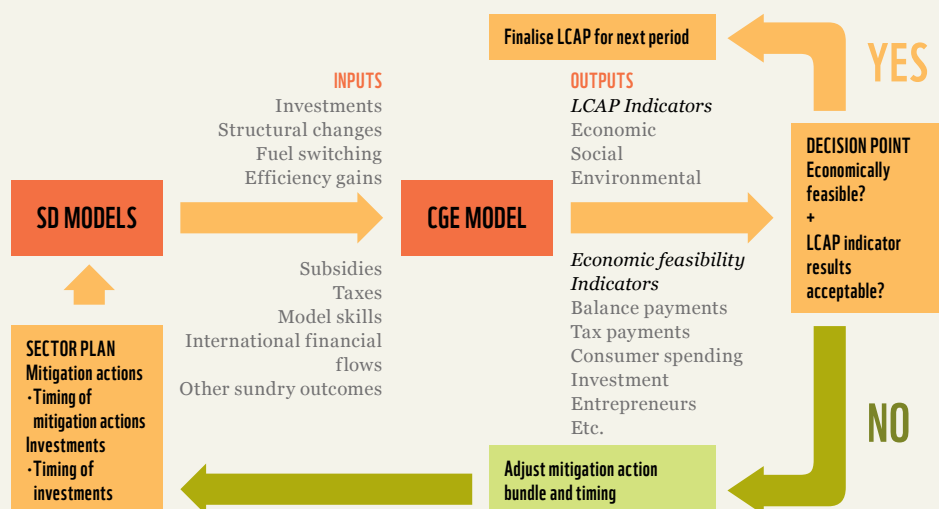
In general, this approach is used to overcome some of the problems inherent in linear thinking and compartmentalised, non-participatory decision making. Unlike in expert modelling, the aim of mediated modelling is not necessarily to predict a precise outcome. The objective is rather to increase the understanding of a wide group of stakeholders on a complex problem and develop a set of consensus-based conclusions.

In the proposed LCAP framework it is envisaged that the outputs of the system dynamics model, in terms of the preliminary choice of mitigation actions and the timing of their implementation, are fed into an economy-wide modelling platform (e.g. a computational general equilibrium or CGE model) to assess the implications of low-carbon activities for the wider economy as well as development and adaptation considerations. Based on the outputs from the economy-wide model one of two actions can be taken:

- If the likely impact of the combination of mitigation actions is acceptable (as measured by the screening and evaluation indicators), the combination of mitigation actions will be included in the LCAP. No iteration of the SD and CGE models is required.
- If the outcome in terms of screening and evaluation indicators is not desirable, or the combination of mitigation actions is not economically feasible, the combination of mitigation actions and their timing would need to be adjusted and the new choice and timing of mitigation actions fed into the CGE model, a process that is repeated until a combination of mitigation actions is found that is both economically feasible and delivers an outcome deemed to be acceptable.

The integration between the modelling approaches is shown in the Figure below.

Figure 3:
Interaction between SD and economy wide models



ADDRESSING THE EXTENT OF THE CHALLENGE: HOW DO WE MAKE OUR EMISSIONS DECLINE?

While we are likely to be able to meet the ‘Peak’ and ‘Plateau’ parts of our emissions trajectory through maximising energy efficiency, introducing low-carbon technologies and building low-carbon infrastructure, the ‘Decline’ part represents a significant challenge which remains largely unaddressed in the current mitigation discourse in South Africa.

It will require fundamental transformation of how our society operates (our behaviour and expectations) and how we do business (moving away from high emissions intensive activities). While daunting, this presents South Africa with an opportunity to imagine a different future and society. And also to assess what South Africa does well – where could we excel as a nation, and thus reap the rewards from being a first mover in the global low-carbon economy?

In providing this understanding, it is likely that we will need to evolve from the current production-based view of mitigation (where emissions are allocated according to traditional economic sectors) to a broader, more inclusive, and perhaps very different way of understanding our economy and society. This evolution will require among other things changing the approach to carbon accounting and allocation by exploring consumption- and service-based approaches, and the transformation of financial tools. Although these aspects will take time to fully include in the LCAP, there is urgency to making progress on them in the short term, to avoid spending our valuable resources investing in infrastructure which will no longer be relevant in the low-carbon South Africa. Framing emissions in terms of demand for goods and energy services is suggested to contribute to fostering an environment that stimulates more creative ways of using our emissions space, rather than just focusing on incremental improvements in the way we do things at present. This will contribute to identifying inefficiencies in our systems, and can help identify both large and small interventions that can help reduce emissions even further – which become particularly important in the ‘Decline’ phase of the PPD trajectory.

A further motivation for an alternative framing is that of ‘carbon leakage’. Some developed countries have seen a decline in their national carbon emissions owing to a shift from primary, energy-intensive sectors to service-based sectors. However, while a low energy and carbon intensity of economic output is achieved, the carbon emissions associated with ever-increasing imports of goods to meet domestic consumption demands typically remain unchanged.

Accounting for the emissions embodied in the goods that we consume will provide a more accurate representation of the footprint associated with our economies and societies, as opposed to only what we emit within our borders. Once again, the systems required to collect this data are substantial, and it will take time for this accounting element to be realised.

Finance is a crucial element of the LCAP implementation, and the existing financing models and disbursement mechanisms may become increasingly inappropriate as our economy and society evolves. Currently, financial models penalise risk and favour large, known, well-resourced implementing agents. While the LCAP will still require the capitalisation of large infrastructure investments, there may be a shift towards decentralised, smaller technologies, reliant on local understanding of risks, and a reward of risk taking. A mix of national and international, private and public, debt and equity, and innovative new funding sources will all be involved in providing finance in a low-carbon economy.



Accounting for the emissions embodied in the goods that we consume will provide a more accurate representation of the footprint associated with our economies and societies, as opposed to only what we emit within our borders.

CLOSURE

This document has set out an approach to planning for a low-carbon economy in South Africa.

It has emphasised the value of a carbon budget conceptual framework, the need for contextualising and driving mitigation within other pressing developmental priorities, and the importance of indicators to select and evaluate interventions, measure progress and chart a course. It has also provided an understanding of how quantitative modelling and data must underpin all planning, of why a stakeholder-rich approach is fundamental to the planning process, and that constant transformation of our economy, society, and our ways of thinking about our economy and society, will be required to go the distance.

At a high level this LCAP framework offers a methodology for adoption in whole or in part. It emphasises the challenges of low-carbon economy planning in a development context, but also the opportunities which this future will bring.

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WWF South Africa's mission is to inspire people to live in harmony with nature, for the benefit of our country and the wellbeing of all.

Towards a low-carbon future

100%
RECYCLED



CLIMATE CHANGE

Evidence of change includes increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level

SA PLEDGE

In December 2009, the Presidency pledged that South Africa would undertake mitigation actions, which will result in carbon emission reductions below a business-as-usual trajectory of 34% by 2020 and by 42% by 2025



CARBON BUDGET

A national carbon budget refers to the overall quantity of carbon emissions that a country can emit between now and 2050 to develop its low-carbon infrastructure, and transition to an infinitely smaller ongoing annual carbon budget post 2050

LCAP

A Low Carbon Action Plan offers an approach to unpacking the what, when and how of low-carbon economy planning and implementation



Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

www.wwf.org.za

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