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CLIMATE AND ENERGY | LOW CARBON FRAMEWORKS



UNDERSTANDING CARBON BUDGETS

A carbon budget can be defined as a tolerable quantity of greenhouse gas emissions that can be emitted in total over a specified time. The budget needs to be in line with what is scientifically required to keep global warming and thus climate change “tolerable.”

FAST FACTS:

GREENHOUSE GASES

With industrialisation from the mid-1700s on, human activity has released increasing amounts of greenhouse gases into the atmosphere. These are the gases that trap heat, leading to global warming, which is causing climate change. The gases accumulate in the air over time, and get more and more concentrated in the atmosphere, trapping more and more heat.

The most common greenhouse gas released by human activity is carbon dioxide (CO₂), which is emitted when we make cement, burn wood and use fossil fuels such as gas, coal or oil. Another major greenhouse gas is methane (CH₄) from livestock farts, rubbish landfills and rotting things. Different greenhouse gases have different global warming and hence climate change impacts.

To be able to compare the emissions of these gases, they are converted to a common basis called carbon dioxide equivalent (written CO₂e). Shorthand we talk of “carbon emissions”.



WHAT IS A CARBON BUDGET?

A carbon budget can be defined as a tolerable quantity of greenhouse gas emissions that can be emitted in total over a specified time. The budget needs to be in line with what is scientifically required to keep global warming and thus climate change “tolerable.” Carbon budgeting should not be confused with the use of targets, thresholds or caps to set emissions reduction goals.

Scientists have tracked how much of emissions leads to how much rise in temperature, and what impact higher temperatures have on the climate. If we want to avoid the worsening impacts of climate change, the temperature has to stay within limits, and so we cannot emit more than a certain amount of emissions. This is our global carbon budget. It is a global budget because emissions from anywhere on earth go into the atmosphere we all share.

A budget is a finite limit to the amount of emissions we can allow ourselves before we are locked into catastrophic climate change. But the way in which we use our carbon budget is up to us to decide. For example, we could use our emissions allowance to improve roads for private cars, or we could use it to create public transport infrastructure. Or focus on developing minerals beneficiation rather than accelerating mining. To stay within budget, a rise in emissions from one activity or country will require emissions to fall in another; and an “overspend” in one year will require greater cuts in emissions in future years. We can make choices about the timing and use of emissions, but not all choices are feasible, desirable or affordable.

We speak about “spending our carbon budget”, but note that a carbon budget is not an amount of money. It is an amount of greenhouse gases. It is an answer to the question: How much more of these gases can we afford to emit, before life on earth as we know it becomes impossible?

WHY DO WE NEED A CARBON BUDGET?

According to the scientific Intergovernmental Panel on Climate Change, for the planet to have a 50% chance of avoiding a dangerous global average temperature rise of 2 degrees Celsius (2 °C) or more above pre-industrial levels, greenhouse gas concentrations must stabilise at 450 ppm CO₂e. This will be very tough to achieve, but is still possible. As at April 2012, globally we are already at 396.18 ppm¹, so there is no time to lose. The average global temperature has already increased by 0.8 °C over the past century, most of that since the 1970s.²

¹From the website co2now.org, accessed on 5/6/2012

²USA National Academies' National Research Council 2011 publication *Advancing the Science of Climate Change*, cited in the *Living Planet Report 2012*, by the Zoological Society of London, Global Footprint Network, European Space Agency and WWF, released May 2012 (www.wwf.org.za/media_room/publications/lpr, accessed 31/7/2012)

³From government's November 2010 *National Climate Change Response Green Paper*

⁴For example *South Africa's Second National Communication under the UNFCCC 2011* (at www.sanbi.org/sites/default/files/documents/documents/sasnc201111.pdf), *South African Risk and Vulnerability Atlas* (at www.rvatlas.org)

50%
CHANCE
OF AVOIDING DANGEROUS
GLOBAL TEMPERATURE RISE

Africa is set to get much hotter than the global average. If globally we continue emitting as we are, studies project that “by mid-century the South African coast will warm by around 1–2 °C, and the interior by around 2–3 °C; after 2050, warming is projected to reach around 3–4 °C along the coast, and 6–7 °C in the interior”³. The consequences of such temperature increases in South Africa can be found in government and independent research⁴.

Many argue that aiming for 450 ppm is too high. WWF and other organisations say that humanity cannot allow our emissions to increase the average global temperature by more than 1.5 °C. Cooler would be better, but by now is unlikely to be possible. Hotter than that and the climate tips over into conditions that we will find it very hard to survive in, particularly people with few resources. The longer we delay cutting emissions, or if our cuts are insignificant, the more dramatic our actions will need to be and the heavier the price we pay – not only in conventional economic terms, but in human suffering, and destruction of the ecosystems which support life.

WHAT IS THE GLOBAL CARBON BUDGET AS REQUIRED BY SCIENCE?

³Sharing the Effort Under a Global Carbon Budget, a 2009 study WWF International commissioned from Ecofys, written by Niklas Höhne and Sara Moltmann

⁴For a better chance than 66%, other researchers put the budget at 700 Gt CO₂e to have a 70% chance of staying within the 2 °C limit: "Decision support for international climate policy – the PRIMAP emission module", a 2011 paper by J.E.M.S. Nabel, J. Rogelj, C.M. Chen, K. Markmann, D.H. Gutzmann, M. Meinshausen, published in *Environmental Modelling and Software* Issue 26

⁷From The Emissions Gap Report of 2010, by the United Nations Environmental Programme (UNEP)

A study⁵ commissioned by WWF from Ecofys chose to set the desired concentration limit at 400 ppm CO₂e, so as to have a better chance (66% likelihood) of staying below 2 °C of global warming. The study translates this ppm limit into a global carbon budget for the period 1990–2100. (1990 was chosen as the start year because the Kyoto Protocol allows for emission reduction targets against 1990 emissions levels.)

The study concludes that collectively we can emit no more than about 1 600 Gt CO₂e over the period 1990–2100. We have already emitted a significant portion of this global carbon budget in the last 20 years, leaving us with about 870 Gt CO₂e from 2009–2100.⁶ After that we need to approach no net emissions.

If we divide this total budget up per year, globally we can emit on average 9.5 Gt CO₂e per year for the 91 years from 2009. This is about 20% of our current annual global emissions. If we continue our current global 47 Gt CO₂e emissions per year⁷, we will use up our remaining budget by about 2030.

FAST FACTS:

This cube shows how much space a tonne of CO₂ takes up at sea level pressure. (www.energyrace.com/commentary/what_does_a_ton_of_co2_look_like/, accessed 16/9/2011)

MEASURING EMISSIONS

An amount of greenhouse gases is measured in tonnes:

- 1 megatonne (Mt) = 1 000 000 tonnes
- 1 gigatonne (Gt) = 1 000 000 000 tonnes

The concentration of greenhouse gases in the atmosphere is measured in parts per million (ppm): of every million molecules in the air, how many are CO₂e molecules. The more tonnes of emissions we add, the higher the concentration becomes. This is like dissolving more and more spoonfuls of sugar in a cup of tea. Pre-industrial levels were 284 ppm, and we are now at the highest levels in 800 000 years (from "High Resolution Carbon Dioxide Concentration Record 650 000–800 000 years Before Present" an article by D. Luthi and others, published 2008 in *Nature* magazine 453).

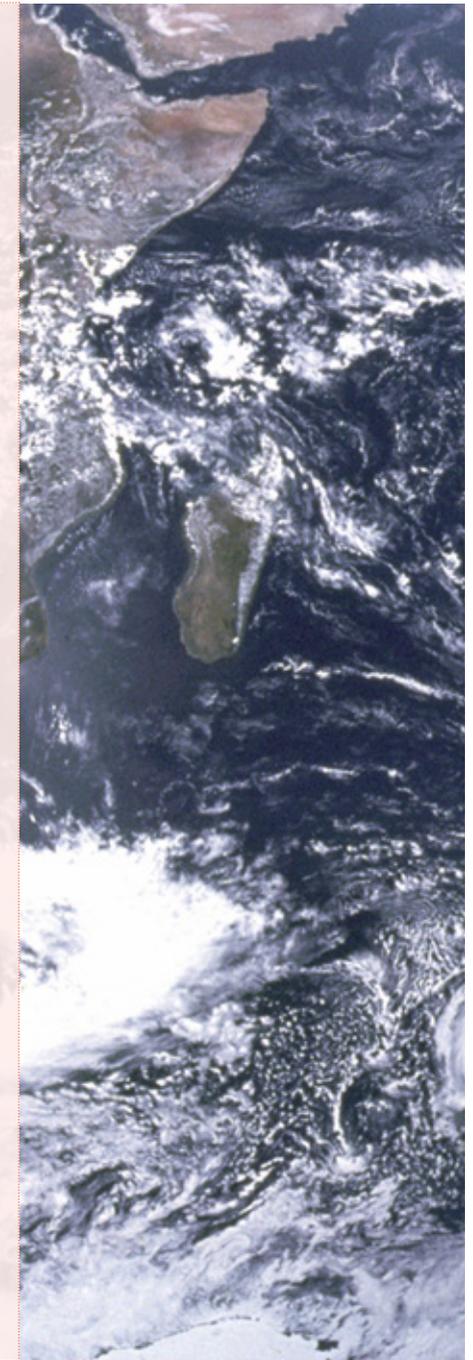


HOW CAN WE DIVIDE THE GLOBAL CARBON BUDGET FAIRLY BETWEEN COUNTRIES?

We have a carbon budget for the whole planet because there is one shared atmosphere. But economic activity causing emissions is located within countries, sectors, companies and other collectives, and that is where we can change our global emissions. There are many ways to divide the budget up among countries, but the cumulative budget cannot change substantially. If we relax on the emissions coming from one country, another country needs to reduce its emissions to compensate.

The remaining carbon budget is a scarce resource, that needs to be divided fairly between countries. Issues that come into the debate about how to do this include: • responsibility for historical emissions • state of economic development and the right to be able to develop to a certain level • size of population and per capita emissions • financial, technological and other capacity to reduce emissions. These issues are the subject of political negotiations between countries.

So-called "developed" countries that have been industrialised for longer have historically been emitting the greenhouse gases that have built up to today's concentrations in the atmosphere. Developing countries motivate that they should still be allowed to emit to continue their economic development, at least up to a certain threshold. There is also debate about whether there should be convergence in terms of a global per capita carbon allowance, where everyone ends up with the same per capita allowance; or whether there should be an ongoing disparity in per capita emissions that favours developing countries to compensate for historical emissions.

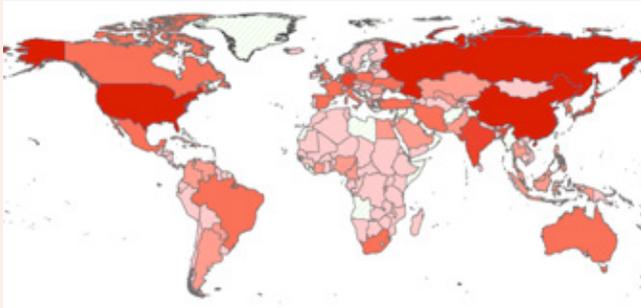


FAST FACTS: 🏃

EVALUATING A COUNTRY'S EMISSIONS

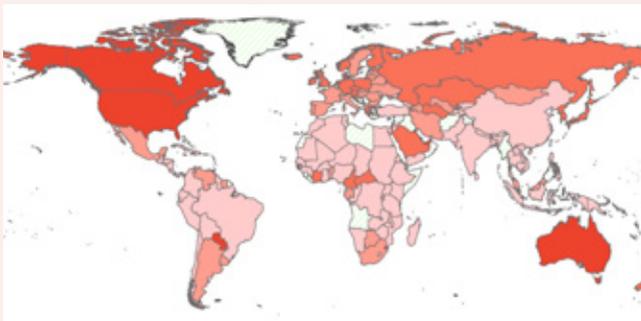
Different ways of considering a country's emissions:

- **Absolute** emissions: The total amount of Gt emitted by that country. This can be shown with or without land use emissions. For example, most of Brazil's emissions come from destruction of forests.



(map from unstats.un.org/unsd/environment/air_greenhouse_emissions.htm, last updated July 2010, accessed 2/11/11)

- **Per capita**: The average emissions per person in the country: the total Gt emitted by that country divided by the population. In the year 2000, developed countries emitted 14.1 t CO₂e per person, while in developing countries it was 3.3 t CO₂e. The worldwide average was 5.6 t CO₂e per capita. (from pdf.wri.org/navigating_numbers_chapter4.pdf, accessed 21/6/12)



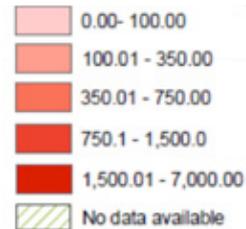
(map from unstats.un.org/unsd/environment/envpdf/GHG_emissions_per capita.pdf, last updated July 2010, accessed 2/11/11)

Looking at the two maps, you can see China has very high absolute emissions, but because it has a huge population its per capita emissions are in a medium range – 4.6 t CO₂e in 2009 (from www.guardian.co.uk/environment/datablog/2009/sep/02/carbon-emissions-per-person-capita).

- **Emissions intensity**: The emissions per \$1 of gross domestic product (GDP): the total Gt emitted divided by that country's GDP.

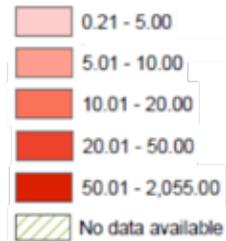
UNITS: MILLION TONNES OF CO₂ EQUIVALENT

* Note that data correspond to the latest year available



UNITS: TONNES OF CO₂ EQUIVALENT

* Note that data correspond to the latest year available



⁸Global climate negotiations between countries are conducted under the United Nations Framework Convention on Climate Change.

⁹If a country is going to emit more than its emissions budget, it may opt to support another country to make emissions cuts, so that the cuts offset or balance out the excess. This can only be counted as a true offset if the total emissions of both countries still remain below their combined carbon budgets. There is no offset for Planet Earth as a whole.



In 1992, the UNFCCC⁸ adopted a principle of common but differentiated responsibilities and respective capabilities. But there is still no agreed method to quantify a country's "responsibility and capability" or to allocate the global carbon budget between countries. The WWF/Ecofys report examines three methods, with the following outcomes over the period 2010–2050, given in Gt CO₂e:

	CONTRACTION AND CONVERGENCE (C&C)	COMMON BUT DIFFERENTIATED CONVERGENCE (CDC)	GREENHOUSE DEVELOPMENT RIGHTS (GDRs)
DESCRIPTION OF THE METHOD OF DIVIDING THE GLOBAL CARBON BUDGET	Emissions are reduced to get every country to end up with the same per capita emissions by 2050	As for C&C, except • Annex 1 countries begin reductions immediately; and • non-Annex 1 countries begin only once they reach a threshold	All countries reduce emissions based on • their responsibility (cumulative emissions); and • their ability above a development (GDP) threshold
CARBON BUDGET FOR ANNEX 1 COUNTRIES	319	294	-7
CARBON BUDGET FOR NON-ANNEX-1 COUNTRIES	579	605	895
CARBON BUDGET FOR SOUTH AFRICA	10	9	15

Annex 1 countries are those that have targets under the Kyoto Protocol. They are developed countries. The budget for Annex 1 and for non-Annex-1 countries then needs to be divided up among all the countries in each category.

Remember that however the budget is divided up, globally it can't exceed about 900 Gt CO₂e from 2009–2100. The different methods are more or less generous in terms of the carbon budgets that developing countries end up with, and more or less difficult for industrialised countries to achieve.

Using C&C or CDC methods, industrialised countries get a bigger share of the budget, and then developing countries get far smaller carbon budgets for their development. Under the GDRs method, developing countries may be allowed to increase their emissions in the short term for development purposes. Industrialised countries thus have to make deep and rapid changes so that by 2050 they have absorbed 7 Gt more CO₂e than they emit after any offsets⁹.

RESOURCE SHARING AND EFFORT SHARING¹⁰

Whether using the resource-sharing (carbon budget) or effort-sharing (reduction targets) approaches explained below, the allocation method should ensure fair shares.

SHARING OUT THE CARBON BUDGET

The carbon budget approach stays within a limit to cumulative global emissions, scientifically consistent with limiting global temperature increases and thus climate change. The carbon budget is a scarce resource to be divided up between countries, giving each country its own carbon budget which it must not exceed. The country could then give economic sectors each a share of the national carbon budget. This is thus called a “resource sharing” approach, and is a “top down” approach working down from an overall budget and sharing it out. It is also an *absolute* approach, because the carbon budget is a quantified absolute limit on total emissions.

MAKING AN EFFORT TO REACH A TARGET

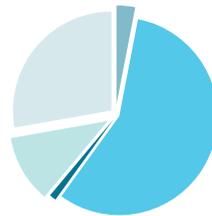
“Effort sharing” based on targets for reducing emissions is another approach. It is more risky, because there is no security that if we add up all the reductions, it will keep us within the global carbon budget we have to achieve. The targets can be set in one of two ways:

✓ **BASE YEAR** Emissions are cut down from the measured emissions in a certain base year in the *past*. The UNFCCC looks at cuts relative to 1990 levels.

✓ **BASELINE** Based on current trends, experts model what emission will be in *future* years, if we do nothing to reduce them. This yields a hypothetical baseline, usually referred to as “business as usual.” Cuts are made down from the levels described by the trajectory (so it might better be called a “topline” than baseline). This is South Africa’s approach.

The “effort” is what is needed to get emissions down from the base year or baseline levels to the desired levels. Different countries, sectors or parties make different contributions or efforts to bring emissions down from their rising trajectory. Therefore these are called “effort-sharing” approaches.

A base year target is an **absolute** reduction: “cut 30% compared to 1990 levels by 2030” gives a quantified target Gt amount of emissions in 2030, because the 1990 figure is known and fixed. Cutting down from a baseline can be a **relative** reduction: “cut 34% below ‘business as usual’ by 2020” will give different Gt target numbers depending on the level of the “business as usual” baseline. “If growth in the baseline is high and percentage reduction modest, a reduction against baseline may still allow growth in emissions in absolute terms.”



Economic sectors within countries would receive a share of the national carbon budget

¹⁰See a March 2012 paper commissioned by the National Planning Commission, “Methodologies for carbon budgets in South Africa” by Harald Winkler and Andrew Marquard of the Energy Research Centre. In effort-sharing “the area between the curves is divided up or allocated. The carbon budget approach allocates the area under the desired trajectory.”

PLOTTING EMISSION TRAJECTORIES

There are any number of different pathways of annual emissions that we can follow and still remain within the global carbon budget. But in reality some trajectories are more feasible than others. We cannot cut our annual emissions from 47 Gt CO₂e to 9.5 Gt CO₂e tomorrow. Some economic activities we are already busy with will continue increasing our emissions in the near future. For example, the new Medupi coal-fired power station in South Africa will only be financially cost-effective to decommission in about 30 years. The transition to a low-carbon economy will itself cause emissions in the process. Nor can we hope to continue emitting as we are and then suddenly drop to zero emissions at the last minute as the budget runs out. Considering that almost everything humans do involves burning fossils fuels or making cement or rotting waste, it is clear that we must be serious about actions to cut emissions in the near term.

Various studies* consider what annual levels of emissions could realistically allow a reasonable chance of staying below a 2 °C limit. Global emissions need to start declining no later than 2020, compared to 1990 levels be cut by 30% by 2030 and by 80% by 2050 (about 7 Gt CO₂e, excluding land use), and then get to around zero net emissions before 2100. These targets gives us a desired “trajectory” or “pathway” of emissions a level of emissions per year joining our current emission level to the target levels in these specific years.

* For example, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change at www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm; the WWF/Ecofys study; a study by M. Meinshausen, N. Meinshausen, W. Hare, S.C. Raper, K. Friele, R. Knutti, D.J. Frame, M. Allen, about which they wrote a letter “Greenhouse Gas emission Targets for Limiting Global Warming to 2°C” in Nature 2009



SOME APPLICATION ISSUES



Gigatonne Gap puts us on path to 3.5 °C

¹¹Emissions Gap Report: Are the Copenhagen Accord Pledges Sufficient to Limit Global Warming to 2 °C or 1.5 °C? in 2010 (at www.unep.org/publications/ebooks/emissionsgapreport), and Bridging the Emissions Gap in 2011 (at www.unep.org/publications/ebooks/bridgingemissionsgap, both accessed 27/7/2012), both by the United Nations Environment Programme (UNEP)

¹²Copenhagen Accord Pledges are Paltry" an article in the 22/4/2010 edition of *Nature*, by J. Rogelj, J. Nabel, C. Chen, W. Hare, K. Markmann, M. Meinshausen, M. Schaeffer, K. Macey, N. Höhne, available at www.nature.com/nature/journal/v464/n7292/full/4641126a.html

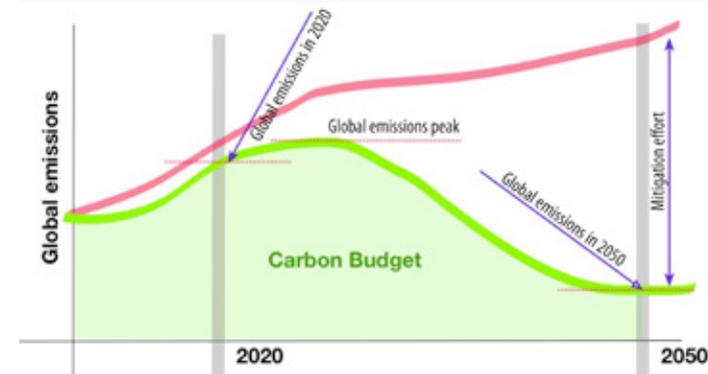
TOP DOWN OR BOTTOM UP Top-down approaches proceed from what is required by climate science, and allocate carbon budgets and/or set targets accordingly. Bottom-up approaches look at what mitigation is possible through various actions (the mitigation potential) and add up the emissions reductions this will give. The risk is that bottom-up approaches open the door for parties to say what emission cuts they are capable of doing, in their own opinion. There is no guarantee that these bottom-up undertakings add up to a total that is in line with the climate science. A practical process probably needs to work both top-down and bottom-up, and keep checking the one against the other.

(Note "top down" and "bottom up" in this context is about methods for mitigation strategies. It is not about whether a centralised authority drives the process, or the process is driven by independent companies, organisations and the "grassroots.")

GIGATONNE GAP Some countries have adopted base year targets to cut their emissions. UNEP reports¹¹ find that there is a significant gap of approximately 6 to 11 Gt CO₂e between countries' current pledged reductions by 2020, and emission pathways consistent with a 66% probability of holding warming below 2 °C. This gap puts us on a pathway for 3.5 °C warming¹² and the associated climate impacts. The 2011 UNEP report shows that it is still possible to close the gap, if we act rapidly on a range of technically feasible measures across different sectors.

INTEGRITY "Baselines by their nature are projections and thus open to gaming, that is, [some have] an interest . . . to artificially inflate the baseline projections. . . . These difficulties are significant, but methodologies exist to develop a baseline in a rigorous manner." A solution would be to fix the value of the baseline and not allow it to be recalculated when actual emissions turn out to exceed the projection – rather, the response should be greater efforts to get back on track with the absolute Gt levels calculated when the target was first set.

CARBON BUDGET VERSUS CARBON ALLOWANCE?



In this drawing, the reduction effort and the carbon budget are two different ways of looking at the same thing. That is because both are based on the same green line trajectory, tracing the global carbon budget required by science. But if a country sets its own pink and green lines, without starting from its share of such a global carbon budget, then the reduction effort it plans may not bring its emissions down to a "carbon budget" properly understood.

Say a country or other collective adopts a base year or baseline approach, setting targets for cuts down from the base. The target points can be joined together to create an desired target trajectory to meet those cuts. The picture will likely look similar to the one above. The amount of emissions that can still be emitted in achieving those cuts (the area under the target trajectory) is sometimes referred to as a "carbon budget." But it is not the same as a share of the budget required by science globally – the absolute amount of emissions involved is highly unlikely to be the same. Perhaps we should use another term such as "carbon allowance" to distinguish a base approach from a global budget approach designed to bring concentrations of greenhouse gases in the atmosphere down to safe levels.

Technical discussions must not be allowed to obscure the fact that the goal is to bring greenhouse gas concentrations in the atmosphere down timeously, such that we have the best possible likelihood of keeping global warming below dangerous levels. Any approach which does not amount to doing that is like fiddling while Rome burns. The science clearly calls for urgent, near-term action without any further procrastination.

SCHEMATICALLY:

Schematically:

- Green area: the global amount of emissions we can "safely" afford to emit.
- Green line: one global emissions trajectory which keeps emissions at this carbon budget. The line could vary as long as it is feasible.
- Emissions amounts in specific years, and a peak year, could be identified as points along the budget trajectory.
- Pink line: projected "business as usual" trajectory.
- Space between pink line and green line: the reduction effort required to stick to the budget.

WHAT SHOULD SOUTH AFRICA'S CARBON BUDGET BE?

SA WAS RANKED IN TOP 20 EMITTERS IN LAST OFFICIAL GHG INVENTORY

The conception and level of South Africa's "carbon budget" is the subject of ongoing debate and varies according to the perspective taken and the interests at work. The total emissions below are for the period to 2050.

FAST FACTS:

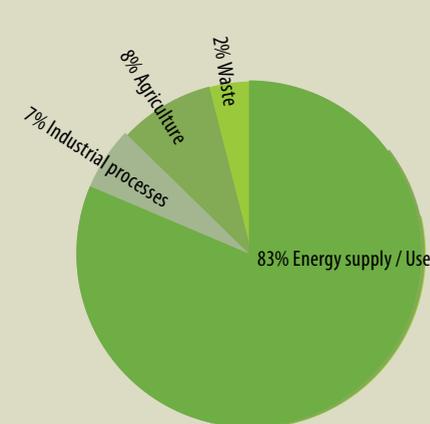
SOUTH AFRICA'S EMISSIONS

The last official greenhouse gas inventory for South Africa was for the year 2000.

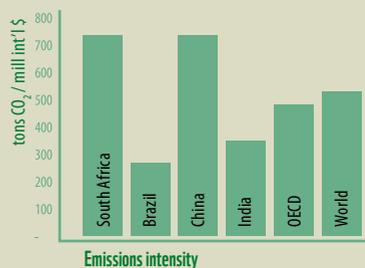
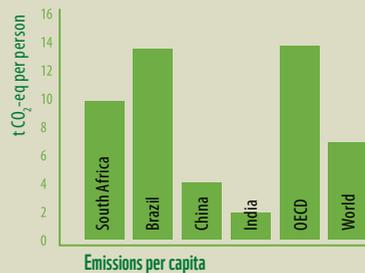
In that year, South Africa was ranked within the top 20 emitters on an absolute emissions basis and was responsible for about 1% of global emissions.

Excluding land use, total emissions were **461.2 Mt CO₂e**, up from 379.8 Mt in 1994. If we include land use, emissions in 2000 were **442.4 Mt CO₂e**, up from 361.2 Mt in 1994.

The breakdown of emissions by sector is:



from South Africa's Second National Communication under the UNFCCC, August 2010



SA HAS LESS THAN 23 YEARS BEFORE IT MUST STOP EMITTING CO₂

A FAIR SHARE OF A GLOBAL CARBON BUDGET

From the work by WWF and Ecofys mentioned above, South Africa's fair share of the 2009–2050 global carbon budget is in the range:

9 to 16 Gt CO₂e

Based on per capita equity considerations, also between developing countries, Chinese¹³ and Indian¹⁴ experts put forward a much smaller 2000–2049 budget for South Africa:

7 to 11 Gt CO₂e

Chief Executive of the Nedbank Group, Mike Brown, and Chief Executive of AngloGold Ashanti, Mark Cutifani, propose¹⁵ an ambitious 2011–2050 carbon budget for South Africa:

10.2 Gt CO₂e

They reason: "What share of the global carbon budget can South Africa expect? That depends on which calculation method one uses, but a range of 0.5%–2% has been suggested bearing in mind South Africa contributes about 0.58% of global gross domestic product and 1.29% of carbon emissions. . . . If one assumes South Africa is allocated 1.5% of the global carbon budget, that means a national budget of 10.2 Gt CO₂e to be emitted from [2011] until 2050. We currently emit more than 450 Mt a year . . . at that rate, we have less than 23 years before we must cease emitting CO₂. Given the high carbon intensity of our economy, this is a challenge we must understand and attack with creativity and intensity." Their estimate of current emissions at the time is probably lower than the actual levels in 2010, so even less time remains and the challenge is even greater.

¹³See "Equitable access to sustainable development: Carbon budget account proposal" a 2011 article by CASS/DRC joint project team in *Equitable access to sustainable development: Contribution to the body of scientific knowledge*, a publication by a group of experts from BASIC countries

¹⁴See "Equitable access to sustainable development: An Indian approach" by T. Jayaraman, T. Kanitkar and M. D'Souza, in the same publication

¹⁵See their article "Climate Change: Global Carbon Budget Gives All a Clear and Simple Target", which appeared in the *Business Day* on 20/10/2011, available at www.businessday.co.za/articles/Content.aspx?id=156468, accessed 27/7/2012

AN EFFORT-SHARING NATIONAL APPROACH

In the absence of an international agreement on dividing up the global carbon budget, South Africa has derived its own total **carbon allowance** for the period 2010 to 2050. This has been done by adding up **bottom up approaches** to see how much emissions could be reduced, setting **reduction targets against a baseline**, and deriving a “benchmark national emissions trajectory range.” This is what is being referred to as the country’s “carbon budget” – the overall quantity of emissions we should not exceed. After 2050 the idea is to live within a much smaller ongoing annual emissions allowance.

FOR UNRESTRAINED BUSINESS AS USUAL

The 2007 LTMS¹⁶ study modelled “required by science”, “current development path” and “growth without constraints” trajectories for South Africa’s emissions. “Growth without constraints” projects our emissions if we just continue as we have been and go all out with emissions, in which case South Africa could emit as much as:

42 Gt CO₂e

The study indicated that South Africa’s annual emission levels would still rise, before we would be able to level off and then reduce them – a “peak, plateau and decline” trajectory. The rise in emissions before peaking is due to: • some things which could not be reversed and which would increase emissions in the shorter term • the time lag needed to put low-carbon initiatives in place • the need for South Africa to extend the benefits of development to all (like access to water and energy, housing, decent jobs, which will all cause emissions while being put in place).

¹⁶Long Term Mitigation Scenarios study by the University of Cape Town’s Energy Research Centre under project leader Harald Winkler, commissioned by the Department of Environment Affairs and Tourism (at www.erc.uct.ac.za/Research/publications/07-Winkler-LTMS-Technical%20Report.pdf, accessed 26/6/2012).

¹⁷unfccc.int/files/meetings/application/pdf/southafricaphaccord_app2.pdf

¹⁸“Opportunities for and costs of mitigation in South African economy” by Andrew Marquard, Hilton Trollip, Harald Winkler. Paper for the Department of Environmental Affairs’ Climate Change Response Science-Policy Dialogue series in 2011



SA
COMMITMENTS
ALLOW FOR
NATIONAL
EMISSIONS
TO PEAK
BETWEEN
2020 AND 2025

AS PROMISED BY THE COPENHAGEN COMMITMENT

In early 2010 South Africa made a voluntary, conditional commitment¹⁷ to the UNFCCC to cut our emissions, informally referred to as our “Copenhagen commitment.” It undertook emission reduction targets of 34% by 2020 and 42% by 2025 below an unspecified “business as usual” trajectory. It said this would allow our emissions to “peak between 2020 and 2025, plateau for about a decade and decline in absolute terms thereafter.” Holding to the assumptions made at the time of the Copenhagen commitment, the targets translate to total emissions of around:

17.8 Gt CO₂e

We have seen the absolute amount of South Africa’s carbon allowance creep up. After Copenhagen, LTMS calculations were to be revised to cater for higher emissions from coal-fired electricity supply plans which had not been factored in before. While the “growth without constraints” trajectory was modelled as a worst case scenario, it was increasingly seen as the baseline against which the Copenhagen commitment cuts were to be made. One of the papers which informed the White Paper indicated that the “current proposed allowance [for 2010 2050] is in the region of 19 Gt CO₂e.”¹⁸ Some now argue that even “growth without constraints” is too low to be used as the “business as usual” trajectory, because reality has already diverged from its starting points. This is the risk with a “carbon budget” derived from cuts below a baseline – the absolute budget expands or shrinks as the baseline is moved up or down.

AS SUGGESTED IN THE NCCR WHITE PAPER

Adopted in November 2011, the National Climate Change Response (NCCR) White Paper defines a “benchmark national GHG emissions trajectory range” with upper and lower limits. This translates into total emissions over the 40 years from 2010 to 2050 of between:

15 and 23 Gt CO₂e

IS THE “CARBON BUDGET” IMPLIED IN THE NCCR WHITE PAPER ADEQUATE?



The upper limit of the “trajectory range” allows for a national emissions peak of 614 Mt CO₂e, plateauing from 2025 and declining from 2035. The upper limit holds the risk that some interests will take the upper limit as the target, rather than aiming as close as possible to the original LTMS-aligned line.



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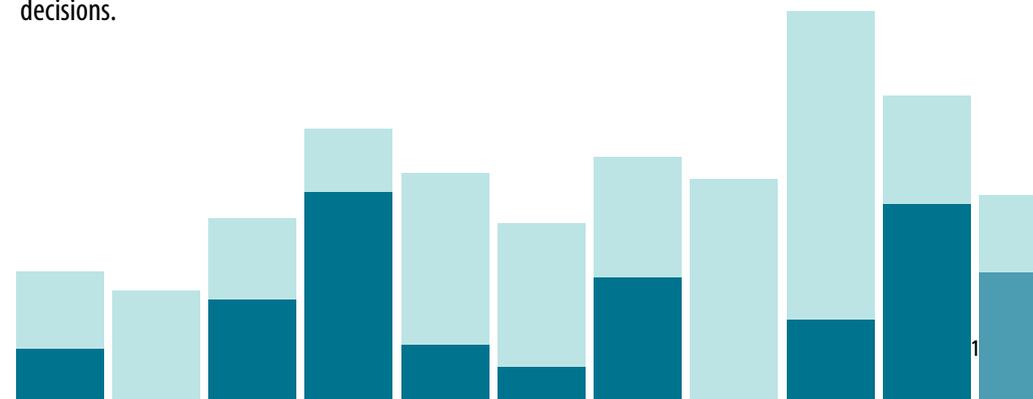
WWF supports the White Paper for initiating real action to cut our emissions, and recognising the overall framework of a carbon budget approach. However, WWF has some concerns regarding the “carbon budget” implied by the White Paper’s emissions trajectory range.

- Emissions should not be allowed to exceed 550 Mt CO₂e at any time, which would happen if the upper range of the emissions trajectory is followed, and
- Reduction in emissions in absolute terms should start from about 2025, rather than after 2035 as implied in the White Paper.

Delays in the date from which emissions begin to decline, makes later reductions both harder and more expensive to achieve. Furthermore, it will be more expensive to adapt to the ultimate impacts of climate change if these are more severe due to a low reduction effort.

Work needs to be done to tighten up the very wide “benchmark range” into an indicative carbon budget we are going to plan to remain within. The section above on ‘What should South Africa’s carbon budget be?’ makes it clear that there are very different answers to the question. Different answers lead to very different divisions of the budget between economic sectors, and mitigation decisions.

IT WILL BE MORE EXPENSIVE TO ADAPT TO THE ULTIMATE IMPACTS OF CLIMATE CHANGE IF THESE ARE MORE SEVERE DUE TO A LOW REDUCTION EFFORT



MOVING FORWARD ON A CARBON BUDGET APPROACH IN SOUTH AFRICA

LEARNING FROM THE LTMS

The LTMS modelled its “required by science” trajectory using a top-down approach. Using UNFCCC principles and the most recent climate science, before the 2007 IPCC Report, it considered what share of a global carbon budget South Africa could legitimately claim. The LTMS also used bottom-up analysis of the emission reductions that could be achieved. The mitigation potential was presented in sets of actions and these were added up.¹⁹ The total fell far short of meeting the “required by science” challenge.

The key finding of the LTMS study was that incremental mitigation actions will be inadequate. Transformation or “restructuring” of the economy as a whole will be needed if we want positive prospects for a robust South African economy beyond the short term.

THE NCCR WHITE PAPER MANDATE

The NCCR White Paper mandates that “carbon budgets” for significant emitting sectors are to be adopted by the end of 2013, with “desired emission reduction outcomes” (hopefully these will be absolute targets). By the end of 2014, there should be company-level targets for big emitters. At a national level, government will monitor that the total of all these reductions keeps our emissions within the benchmark trajectory range.

Government has set up Technical Working Groups²⁰ with experts drawn from a range of stakeholders. Bottom-up work has started on a Mitigation Potential Analysis with “effort sharing” amongst current emitters. We also need to start top-down analysis that will consider “resource sharing” of a carbon budget consistent with that “required by science”. In conjunction, these complementary processes will give us a full picture of opportunities.

**SIGNIFICANT
EMITTING
SECTORS TO
ADOPT CARBON
BUDGETS
BY END 2013**

¹⁹The study uses the term “wedges” for the emissions reductions of the sets or “packages” of actions.

²⁰These are an Adaptation Working Group, a Mitigation Working Group, and a Monitoring & Evaluation Working Group. WWF serves on the last two.

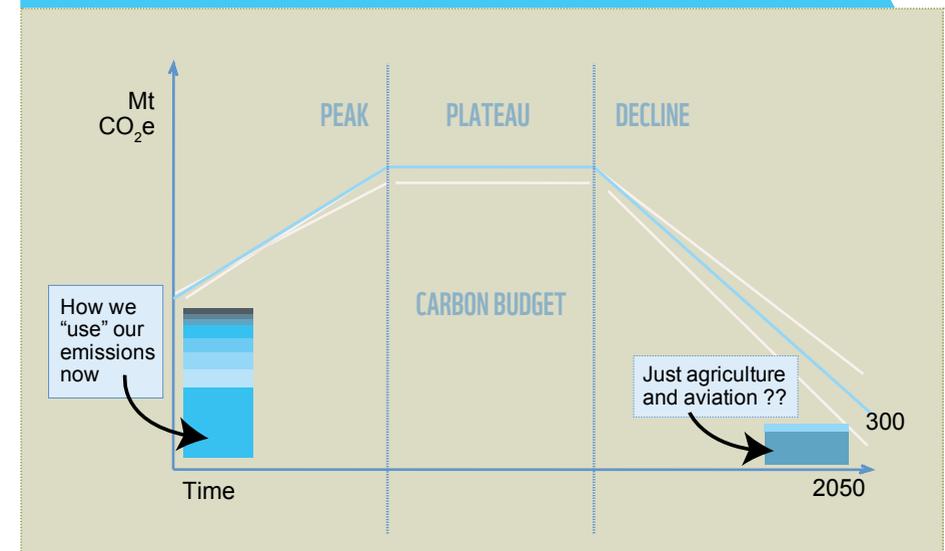
THE BENEFIT OF GETTING GOING ON A CARBON BUDGET

We know we must transform our economy and society from one of high emissions intensity, to one that is largely decoupled from carbon and addresses poverty and inequality. A carbon budget approach looks at **how best** to use our limited remaining carbon budget to achieve our developmental objectives.

Budgeting focuses on where maximum output or benefit is achieved per unit of emissions. It looks at emissions across the economy, and how the distribution and the extent of total emissions could and should change over time. It will enable informed, forward-looking and strategic choices which serve the national interest and development objectives. We can prioritise services, welfare and macro-economic outcomes alongside emissions objectives and above short-term cost minimisation. Mitigation efforts can be aligned with socio-economic strategy.

**HOW CAN WE
BEST USE
OUR LIMITED
CARBON BUDGET
TO ACHIEVE
DEVELOPMENTAL
OBJECTIVES??**

CHANGES IN THE ALLOCATION OF OUR CARBON BUDGET THROUGH TIME



WITHOUT A CARBON BUDGET APPROACH, THE FOCUS MAY GET STUCK ON WHAT OUR ECONOMY IS, RATHER THAN WHAT IT CAN BECOME

SOME EXAMPLES OF WHAT A CARBON BUDGET APPROACH HELPS WITH WITH:

- Where should we prioritise our efforts and investment? It will give guidance to government fiscal decisions, plans and programmes, and similarly for the private sector. What should we invest in now?
- What interim arrangements need to be made while we transition to a low-carbon economy? For example: Should we allow Sasol to offset (rather than eliminate) much of its emissions for many years?
- Questions of trade-offs, such as should we allocate emissions for minerals beneficiation rather than the acceleration of mining; or for aviation emissions for luxury agricultural exports versus agricultural emissions for domestic biofuel production?
- What low-carbon infrastructure do we need to put in, by when, and how much emissions will be caused by doing this? For example, for electric vehicles.
- By when do we need to shut down which high-carbon infrastructure or operations?
- What should be done earlier to open up opportunities later? Which initiatives can wait?
- How much of the carbon budget must be reserved for new sectors of the economy that will still emerge and grow? Similarly, for new technologies, and new companies.
- The carbon budget is for a period of time, so how we are still going to allow for emissions in years to come (principle of inter-generational equity)?
- How ready can our economy be, how quickly, to take the lead or respond to international low-carbon developments?

Without a carbon budget approach, the focus may get stuck on what our economy is, rather than what it can become – not only in terms of carbon emissions, but also to achieve a flourishing South Africa. We risk being restricted by what a sector says it can do without “unreasonable” cost, and by assumptions that any emitting activity must continue indefinitely- in other words “grandfathering” all emissions allowances to those who have been emitting to date. We could implement a patchwork of mitigation initiatives that don’t add up to a strategy or to sufficient emission cuts.

ALLOCATION OF SECTORAL CARBON BUDGETS

Starting from an indicative national carbon budget allows us to examine what share of that budget each sector should get, and how this should change over time. We can devise transparent and practical criteria and methods to do this, based on a national version of “common but differentiated responsibilities and respective capabilities”. This provides a benchmark to shape and evaluate the sectoral mitigation analyses, and guide implementation. Without this we are left with every sector clamouring for a bigger share.

A WWF project exploring a “Low Carbon Action Plan”²¹ for South Africa made proposals for a process to allocate a national carbon budget to different sectors. One idea was that sectors should motivate for their share of emissions based on the best allocation of emissions in the national interest, in particular the most carbon-effective contribution to South Africa’s development needs.

WWF’S WORK ON CARBON BUDGETS AND LOW-CARBON DEVELOPMENT FRAMEWORKS

WWF South Africa continues to extend its work on carbon budgets and the transition to a low-carbon economy. We focus on mitigation and access in the energy and transport sectors, the water/food/energy nexus, and the finance sector. Our transport low-carbon frameworks project aims to provide a platform, expertise and interactive modelling to support labour, business and government in engaging with the challenges of a transition towards a lower carbon transport sector. Transport mitigation interventions will need to REDUCE movement of goods and people; SHIFT to low-carbon modes of transport, from private to public, from road to rail; or IMPROVE fuel efficiency and energy options (including transforming our electricity supply, so that we can optimise benefits of electric vehicles). The WWF project includes an extensive stakeholder engagement process, publication of a range of briefing notes²² and research studies, and development of quantitative information to support decision-making. The work is to be grounded in existing initiatives in the transport sector, including government plans.



WWF’S TRANSPORT LOW-CARBON FRAMEWORKS PROJECT AIMS TO PROVIDE A PLATFORM, EXPERTISE AND INTERACTIVE MODELLING TO SUPPORT LABOUR, BUSINESS AND GOVERNMENT IN ENGAGING WITH THE CHALLENGES OF A TRANSITION TOWARDS A LOWER CARBON TRANSPORT SECTOR.

²¹“Development of a Low Carbon Action Plan for South Africa.” The full report compiled by The Green House consultancy for WWF in June 2011 is available on request. *Approaching the ‘Why, What and How’ of Low-Carbon Planning in South Africa* is a non-academic synopsis, available at awsassets.wwf.org.za/downloads/lcap_report_2011_web.pdf.

²²The first being *Briefing Note on Transport Emissions in South Africa*, written by Kyle Mason-Jones and reviewed by Brett Cohen of The Green House in 2011, available at www.wwf.org.za/media_room/publications



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WWF South Africa

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WWF UNDERSTANDING CARBON BUDGET

ZERO NET EMISSIONS

We have already emitted most of our global carbon budget in the past 20 years, leaving us with about 870 Gt CO₂e from 2009 – 2100. After that we need to approach no net emissions

CARBON BUDGET APPROACH

How best can we use our limited remaining carbon budget to best achieve our developmental goals?



450PPM

Greenhouse gas concentrations must stabilise at 450ppm CO₂e. As of April 2012 global concentrations were at 396.18ppm CO₂e

83%

Of South Africa's emissions come from energy supply and use



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.

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