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Adequacy of Copenhagen mitigations pledges:

The case for low carbon development strategies

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CLIMATE ANALYTICS

Table of contents

List of appendices

1. Executive Summary

This briefing is work in progress and is prepared in advance of the European Capacity Building Initiative (ECBI) workshop for Francophone Africa which will be held in Dakar, Senegal (5 to 7 July 2010).

Over 100 least developed countries, small island states, and others have called for global warming to be limited to 1.5°C increase above pre-industrial levels. Whilst the European Union's 2°C target has also been widely endorsed and is acknowledged in the Copenhagen Accord, it does not guarantee 'safety' from devastating impacts of climate change in Africa and jeopardizes the very survival of many small island developing states. The Copenhagen Accord mitigation pledges fall short of realising either the 2°C or 1.5°C global warming goals. A closer look at current pledges under the Copenhagen Accord reveal a number of fundamental flaws. Firstly, the 2020 pledges are inadequate when measured against the levels to which emissions need to be reduced in order to establish the world on an emissions path that can limit warming to either of the levels mentioned above - and are full of loopholes. Secondly, there is no global emission goal for the year 2050, which is important for the development of longer term, low carbon development plans and for showing that global warming limits are taken seriously. Thirdly, the Copenhagen Accord is silent on emissions from international aviation and shipping, yet these are likely to contribute around 3-4% of global emissions by 2020, and contribute much more in the longer term. Fourthly, the Copenhagen Accord lacks a science-based aggregate target and finally, its pledges are not legally binding. These deficiencies put the world on a course for a global warming of over 3°C above pre-industrial levels by 2100[i].

An assessment of individual countries pledges from both Annex I and Non-Annex I Parties reveals that of the Annex I Parties only Japan and Norway are pledging enough, based on a range of fair effort regimes developed by a cross section of researchers[ii]. The shining stars from the non-Annex I parties are Costa Rica and the Maldives for pledging carbon neutrality by 2020 and 2021 respectively. Brazil and Indonesia also have a pass mark due to their pledges to significantly reduce their deforestation emissions.

To ensure that a comprehensive, international climate agreement can achieve the ultimate objective of the Convention, which is to prevent dangerous anthropogenic interference with the climate system, it needs to be legally-binding and with science based overall emission targets for 2020 and a global goal for 2050. The latter goal, to reach either a 2°C or 1.5°C goal with high confidence, needs to be well below 50% of 1990 levels. For 2020, greenhouse gas emissions reductions need to be at least in line with IPCC AR4 findings for the lowest levels of greenhouse gas stabilization assessed in that report: 25-40% below 1990 levels for Annex I countries and significantly below business as usual (BAU) emissions in 2020 for the Non-Annex I countries as a group. Deforestation needs to be more than halved by this time. Loopholes that degrade reduction targets need to be excluded. Finally, the global goals and limits must include emissions from international shipping and aviation.

A legally-binding agreement that includes the elements identified above would demand a reasonable level of reduction efforts by 2020, sparking investments and innovation in the short-term. For Africa, the transition to a low carbon development

pathway could provide significant economic opportunities for the continent, enhance broader sustainable development goals and could create new options for funding, high value jobs and secure livelihoods. It is clearly in Africa's interest to make such a strategic choice sooner rather than later, to enjoy first mover advantage. This said, for low-carbon policy measures to be effective, a robust financial architecture that allows even the most vulnerable and least developed countries in Africa to be fully eligible for resources would need to be in place. Such an architecture would enable effective carbon markets, financial incentives and new technologies that can only be secured in a new climate deal guided by an ambitious and fair, shared vision.

2. Introduction

This briefing paper examines the overall mitigation pledges made under the Copenhagen Accord against the perspective of limiting warming to either the 2°C or 1.5°C goals, and looks at which levels of mitigation levels are needed, before concluding with an initial discussion of the implications for Africa

In 2009, the global warming limit of 2°C above pre-industrial levels was widely endorsed, including at the G8 meeting and the associated Major Economies Forum in July 2009. In his key note address at the Special Session of Africa Partnership Forum on 2 September 2009, Ethiopian Prime Minister Meles Zenawi, speaking on behalf of Africa, highlighted the non-negotiables for the continent: "Africa's interest is not to claim compensation for Climate Change and its damages. Our interest is to prevent that from happening in the first instance [...]. What we are not prepared to live with is global warming above the minimum unavoidable level. We will therefore never accept any global deal that does not limit global warming to the minimum unavoidable levels no matter what level of compensation and assistance are promised to us."[iii] The Copenhagen Accord (hereinafter 'the Accord') recognized "the scientific view that the increase in global temperature should be below 2 degrees Celsius."[iv] However, 2009 was also the year where more than 100 of the most vulnerable developing countries endorsed the goal to limit global warming to well below 1.5°C above pre-industrial levels as a much safer level of warming that the most vulnerable can bear.[v] As a consequence the Copenhagen Accord promised to review the issue of a 1.5°C goal in 2015.

It is clear from recent, peer-reviewed scientific literature that 2°C is neither the minimum unavoidable level of global warming nor "safe" to prevent dangerous climate change impacts in many regions. According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR4), Africa is expected to warm around 1.5 times the global average. Thus, a 2°C global warming poses large and, in many cases, unacceptable risks to key vulnerable natural and human systems. Africa as a whole is recognised as an especially vulnerable region to human induced climate change, and even regions which are well outside the Least Developed Countries (LDC) group, run severe risks in the future from climate change damaging the development prospects. Limiting warming below 1.5°C is much safer and will give natural systems a much better chance to survive and adapt as well as to avoid serious damage to the LDCs' societies and economies. It will reduce but not eliminate major risks and damages to LDCs, and many others in the developing world, who will still require major support from the

international community for adaptation, climate resilience and to ensure their development is not further hindered.

While the Copenhagen Accord referenced the 2°C goal[vi], as part of assessing the implementation of the Accord, its final paragraph on review proposes to consider strengthening the long-term goal, taking into account new scientific information "including in relation to temperature rises of 1.5 degrees Celsius". This can be interpreted as a consideration to revise the 2°C target in light of best available scientific evidence on 1.5°C. As this Accord states that it should be completed by 2015, any review should take the 5th assessment report of the IPCC (IPCC AR5) into consideration.

3. Fundamental deficiency of the Accord's mitigation targets

A lot has been said about the Copenhagen Conference, both positive and negative. While there have been many questions about the future of international efforts to limit climate change arising, it is clear that the UNFCCC is the primary and central international arena to address and agree both mitigation and adaptation actions. In terms of mitigation targets, the Accord suffers from five fundamental deficiencies: lack of a long-term 2050 goal; the inadequacy of current mid-term 2020 pledges, especially with loopholes[vii]; the fact that it does not address emissions from international aviation and shipping; the bottom up approach of the pledges; and their non-legally binding nature. We will focus on the first three issues in the following paragraphs.

On one hand, the Accord does not specify any long-term global reduction goals. Draft versions of the Accord still contained a global reduction goal of halving emissions by 2050 from 1990 levels right up until a few hours before the final Accord was announced. Without a 2050 global goal, reduction targets for 2020 will not be enough to guide the policies required to ensure global warming stays below 2°C, let alone 1.5°C.

On the other hand, even if an appropriate emission level for 2050 had been defined, current reduction pledges for 2020 are inadequate, a situation exacerbated by the so-called 'loopholes'. These loopholes consist of provisions that allow real emissions to be higher than what is seemingly defined by the 'raw' reduction targets associated with the Accord. The Accord does not address these loopholes agreed during the negotiations under the Kyoto Protocol. If existing loopholes are not eliminated they may simply nullify the current aggregate Annex I emission reductions (see illustrations in Appendix A). The biggest loophole is created by surplus allowances. These originate from emission targets that were set too loosely, in particular for Russia, Belarus, Ukraine and Eastern European countries, and they account for 9-11billion tonnes of CO_2-equivalent ($GtCO_2$-eq) allowances for the first commitment period of the Kyoto Protocol (2008-2012). These countries suffered from an economic downturn following the collapse of the Soviet Union, enough to let projections of emissions over the Kyoto period to remain considerably lower than their Kyoto targets. This was recognized during the Kyoto negotiations (where these particular surplus allowances were coined 'hot air'), but the Kyoto targets could not be adjusted to eliminate the issue. The resulting surplus allowances can be sold to other countries to help them reach their commitments, or they can be banked for use in subsequent commitment periods. The second loophole originates

from land use, land use change and forestry (LULUCF) accounting and the special rules, which allow for additional emissions to be credited.

There are several consequences of the weak Annex I targets combined with the loopholes for Africa. A weak or non-existent demand for project based emissions reduction credits or funded mitigation activities, reduces the incentives for mitigation activities in Africa, and pushes these intrinsically towards low cost 'suppliers' of such credits. Without a large gap between expected Annex I emissions and the Annex I targets, demand for international mitigation activities will be small and political incentives to fund mitigation activities in developing countries will be low. A further effect is that technological innovation in the Annex I countries will be slower, leading to slow rate of introduction of new cleaner technologies, and resulting in higher mitigation costs globally, including in Africa.

The third fundamental deficiency of the Accord is that it does not address emissions from international aviation and shipping. Assuming these follow the modest announcements by the respective industry associations and Party positions, they would contribute about 3-4% to global emissions by 2020[viii,ix]. If these announcements and positions are not translated into policy, the contribution from international aviation and shipping to global emissions in 2020 will be much higher.

These deficiencies result in the current pledges leaving the world heading for a global warming of over 3°C above pre-industrial levels by 2100[x].

4. Assessment of mitigation pledges in the Accord

4.1. Developed Countries pledges

Under the current low ambition reduction pledges for developed countries, with loopholes, total emissions are allowed to exceed 1990[xi] level and even reach well above estimated emissions[xii] in 2020. This is based on a scenario that assumes no new mitigation efforts beyond today's. However, even if the loopholes are eliminated and all countries shift to the higher-ambition end of the proposed reduction targets, developed country emissions in aggregate would amount to about 16% below 1990. This estimate is still starkly inadequate, though it is based on the most optimistic interpretation of current proposals. Indeed, IPCC AR4 outlines that developed countries as a group need to reduce emissions to 25-40% below 1990 by 2020. This is required to achieve the lowest assessed stabilization scenarios for greenhouse gas concentrations, which are estimated to lead to warming of 2.0-2.4°C [xiii]. Because Africa is one of the most vulnerable regions to the effects of climate change, these temperature increases will have serious social, environmental and economic consequences on the continent, let alone under the 3°C or more that is likely to result from the Copenhagen Accord pledges.

Within the group of Annex I countries, individual assessments of these targets are more complex. Each country is unique, with its own historical emissions, own set of energy and industrial policies, and own set of natural resources. To be able to inter-compare country emission targets, there is a need to assess what a fair level of emission reductions is. To this end, researchers have developed different effort sharing

'regimes'[xiv,xv,xvi,xvii,xviii,xix], which indicate according to different perspectives what a fair level of emission reduction efforts are for each country. Assessing this fair level is based on various criteria such as responsibility, capacity, or potential. Data such as historical emissions, GDP, population, and other kinds of data may also be used as a measure of these criteria. These assessments also assume a particular goal, usually to limit warming to 2°C, or to stabilize greenhouse gas concentration at 450 ppm. The Climate Action Tracker (CAT) uses a range of these effort sharing regime results to rank country emission pledges or targets from **"*inadequate*"** to **"*role model*"** (see Climate Action Tracker[xx] for details). Countries whose emissions target is better than the effort sharing range are considered **"*role model*"** countries. Those with targets worse than this range are rated **"*inadequate*".** Countries' targets in the best two-thirds of the range are ranked **"*sufficient*",** while those in the worst third of the range are tagged **"*medium*"**.

In the current state of negotiations, each developed country favours a particular set of rules to account for LULUCF emissions. The option favoured by a particular country is often one that provides credits, which implies the reduction target is degraded. If we account for LULUCF using the particular set of rules favoured by each country to derive its effective target, the developed countries that have pledged ***sufficient*** targets are Japan and Norway, with their pledges of 25% below 1990, and 30-40% below 1990 respectively (see illustration in Appendix B). If the conditional targets of Australia and the EU27 were implemented, they would also be rated ***sufficient.*** However, these targets are conditional on a global agreement and the alternative lowest (unilateral) target is ***inadequate.*** Australia's "raw" targets without any provisions are ***inadequate,*** but they are greatly degraded as a result of including land use change (deforestation) in the base year[xxi] by roughly 30% relative to 1990 levels. The targets of other countries, after LULUCF accounting, are all within a few percent of 1990 levels or worse. These kinds of targets will not achieve the IPCC range of 25-40% below 1990 levels, much less the 2°C or even the 1.5°C temperature limits.

4.2. Non Annex I countries

Pledges made in the Copenhagen Accord's Appendix II by developing countries would lead their aggregate emissions to deviate from the BAU pathway to a level of 5-6% below BAU[xxii] by 2020 (without deforestation emissions). Most developing countries usually relate their pledges to BAU projections, or formulate them as emission intensity improvements. Estimating these targets requires estimates of future emissions and economic development, which introduces a level of uncertainty converting these to emissions in 2020. We can also compare Non Annex I country targets among themselves and with Annex I countries using the effort-sharing literature[xxiii], described above.

The Maldives and Costa Rica both pledge carbon neutrality by 2020 and 2021 respectively, and the Climate Action Tracker ranks them as **"*role model*"** nations. Brazil, with large forested areas, is rated as **"*sufficient*"** with its large reductions in deforestation. Specifically, Brazil has pledged a 36.1-38.9% reduction below BAU emissions in 2020, in large part due to a pledge of reducing deforestation in the Amazon by 80%, and a 40% reduction in deforestation in the Cerrado. Also, Indonesia has pledged to reduce 2020 emissions by 26% below 2020 BAU levels, a target that is rated ***"medium"*** by the Climate Action Tracker. Mexico and South Africa offer conditional

targets of 30% and 34% below 2020 business-as-usual levels, respectively. Mexico's target is contingent on a global agreement, and South Africa's target on financial investments. As such, they are currently rated ***"medium"*** and "***inadequate"*** respectively because of this conditionality by the CAT. However, if these targets are met, the CAT indicates that both would be rated ***"sufficient".***

Meanwhile, India's and China's emissions per unit GDP pledges are close to BAU emissions, but these are rated differently relative to the fair effort sharing range. India's 25% reduction in emissions per unit GDP in 2020 relative to 2005 levels is rated by the CAT as ***"medium***", since BAU levels are already within the ***"medium"*** effort sharing range. China's 40-45% reduction in emissions per unit GDP in 2020 relative to 2005 levels is rated ***"inadequate***" by the CAT and China would have to reduce emissions to 20% below BAU to be rated ***"medium"***. China also has a pledge to increase the share of non-fossil fuels in primary energy to around 15% by 2020, which is similar to the goal of their national plan. The national plan, as opposed to the Copenhagen Accord pledges, contains a large set of additional policy measures, and is estimated to fall within the *"**medium"*** CAT fair effort sharing range[xxiv].

5. Why are these targets inconsistent with the Accord's 2°C goal?

According to Rogelj et al (2010) the Accord's proposals, pledges and projections amount to global emissions reaching roughly 54 $GtCO_2eq$ by 2020, or 48 $GtCO_2eq$ for the higher-ambition end of the pledges and if banking of surplus allowances was eliminated. The latter still includes LULUCF credits[xxv], because the higher-ambition end of proposals is currently not likely to be combined with elimination of credits from LULUCF, since several countries have indicated that the higher-ambition proposal depends on the acceptance of certain rules for these[xxvi]. Rogelj et al (2010) argue that even in the latter, optimistic case, and even if combined with a halving of global emissions relative to 1990 levels by 2050, there is a less than 50% chance that global warming will stay below 2°C. In this scenario, temperature increase is very unlikely to stay below 1.5°C and also unlikely to drop again below 1.5°C after reaching its peak during the 21st century.

The high emission levels for 2020 arising from the Accord lead to a need for very rapid emission reductions after 2020 in order to reduce emissions to low levels by 2050: high emission levels in 2020 would demand, for decades to come, a global annual reduction rate that is more ambitious than is presently reported as technically and economically feasible. For example, minimum average global annual emission reductions as a fraction of 2000 emission levels have to be in the order of 3.5% per year for a 2020 emission level of 54 $GtCO_2eq$ and around 3.0% for a lower 2020 emission level of 48 $GtCO_2eq$[xxvii].

Global average reduction rates between 2020 and 2050 give an indication of the feasibility of a reduction pathway. If developed country reductions of 30% below 1990 levels were made and a reduction of 20% below business-as-usual for developing countries achieved by 2020, global average emission reduction rates could be limited to less than 2.5% per year between 2020 and 2050. In terms of emissions, the corresponding absolute 2020 emission levels for this example, based on the reference (BAU) scenario used in Rogelj et al[x], would be 40 $GtCO_2eq$, but could be up to 44 $GtCO_2eq$ for higher

reference scenarios. For the emissions analysis described above, the gap in 2020 between a plausible 2°C pathway and the Copenhagen Accord pledges is between 8 and 14 $GtCO_2eq$. A global emission pathway consistent with peaking by 2015 has an average reduction rate from 2015 to 2020 of about 2.5% per year and drops below 41 $GtCO_2eq$ by 2020. In this emission pathway, global reductions do not approach 3.5% per year until after 2030 and do not need to exceed this rate even to reach a total global emission level of 85% below 1990 by 2050.

Additionally, the low-ambition level of 2020 could lead to continued investments in carbon intensive technology in the coming decade, such that a quick changeover to lower emission energy sources, required by the strong emission reductions, implies losses in the previous investments (early retirement of coal fired power station, for example). Finally, even if such high reduction rates were feasible, this would still not be enough. In summary, although the Copenhagen Accord recognizes a broadly supported goal of keeping global warming below 2°C, the emission reduction pledges associated with the Accord, or unresolved by the Accord, are totally inadequate to this task.

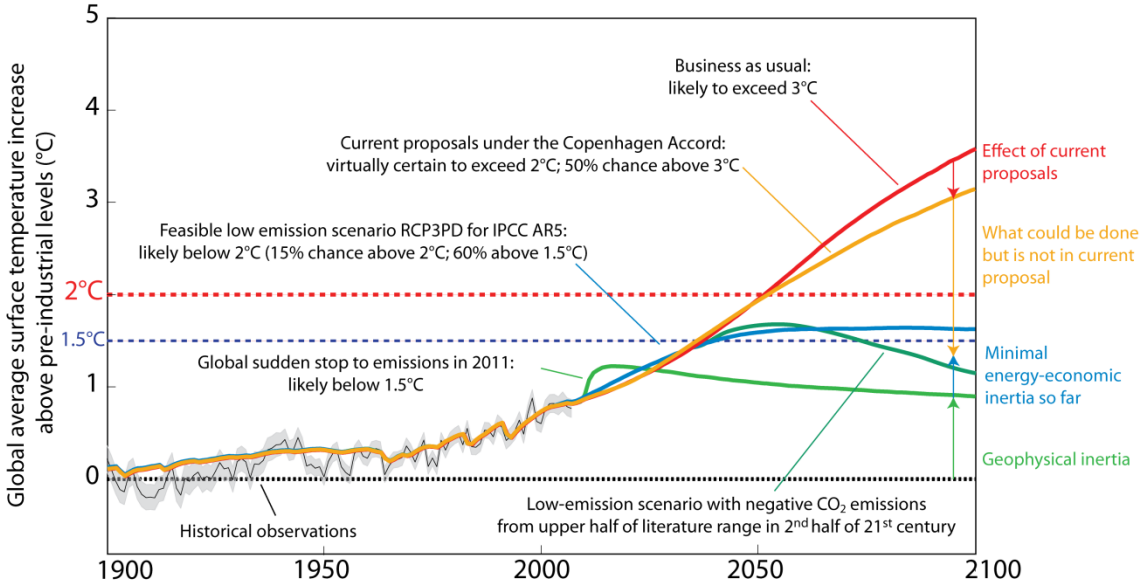


Figure 1: Illustration of the effect of the current proposals under the Copenhagen Accord to limit global temperature increase to either 2°C or 1.5°C above pre-industrial levels. Besides the pathways representing a business-as-usual (red line) the estimated emission based on the Copenhagen Accord proposals (orange line), three additional paths are shown. The green line indicates the expected temperature projections if global emission would become zero in 2011. It therefore illustrates the warming "inertia" due to the physics of the climate system. The blue line is the lowest IPCC AR5 reference concentration profiles (RCP3PD), behind which lies a scenario of global emission reductions which is technically and economically feasible, and will limit global warming to below 2°C (scenario from van Vuuren et al. 2008[xxviii]). The dark green line is a scenario similar initially to IPCC AR5 RCP3PD but which extends negative emissions to the lower half of the present scenario range in the latter half of the 21st century, Both of these represent what may be considered technically and economically feasible low emissions. A business as usual scenario will lead to exceeding 3°C before the year 2100 and possibly 4°C post-2100 (IPCC SRES scenario A1B). The pathway which incorporates the current proposals under the Copenhagen Accord will virtually certain exceed 2°C and has a more than 50% to exceed 3°C. The red arrow illustrates the effect of the current proposals, while the orange arrow indicates what could be done with increased political will and full exploitation of presently known options.

6. What needs to be done to meet the 2°C or 1.5°C goals?

To ensure a post-2012 climate agreement achieves the ultimate objective of the Convention to prevent dangerous anthropogenic interference with the climate system, a ***legally-binding*** comprehensive agreement (LBA) needs to: (1) include a sufficiently ***ambitious long-term global emission reduction goal*** of well below half of 1990 emissions by 2050 – the IPCC AR4 indicated CO_2 emission reductions of order 85% below 2000 levels may be needed, and more recent research indicates that a 50% reduction in all GHGs from 1990 levels would give about a 30% chance of exceeding 2oC and a 75% reduction about a 15% chance of exceeding 2oC[xxix]; (2) ***close loopholes*** that degrade reduction targets; and (3) ***enhance the ambition level of proposed 2020 targets*** to well beyond the most ambitious proposals on the table, to be at least in line with the upper range of emission reduction contained in the IPCC AR4. Besides emission reductions from developed and developing countries, also ***deforestation*** emissions should be ***more than halved***. Finally, it must include ***reducing emissions from international shipping and aviation***.

7. The case for low carbon growth strategies in Africa

Emissions are growing rapidly in major developing economies and it is estimated that by 2030, more than half of global emissions will be from developing countries[xxx]**.** Watkiss (2009) asserts that this trend, if unchecked, could 'lock-in' developing countries' economies into high-carbon growth paths[xxxi]. The concept of low-carbon growth (i.e. growth with lower emissions than would otherwise be the case) therefore offers scope for leapfrogging the pollution-intensive stages of development associated with the traditional development pathway.

So far, the focus of African countries, rightly, has been on ensuring adequate levels of finance for their immediate adaptation needs, as Africa is one of the most vulnerable regions to climate change and climate variability, a situation aggravated by existing developmental challenges such as poverty, governance and institutional issues, limited access to capital, ecosystem degradation and conflicts. It is also clear however that if impacts are to be manageable through adaptation, mitigation will be needed. One of the main findings of the IPCC AR4 is that it is "very likely" that unmitigated climate change can slow the pace of progress toward sustainable development either directly through increased exposure to adverse impacts or indirectly through erosion of the capacity to adapt. Over the next half-century, climate change could impede achievement of the Millennium Development Goals.[1] Developing countries and poorer communities, generally the ones with the least adaptive capacities to climate change, are particularly at risk of losing livelihoods. In addition to the more frequently occurring extreme weather events, many populations and economies are struggling with the more gradual impacts of climate change such as sea level rise and changing climatic patterns affecting seasonal cycles of precipitation and weather.

Even at the current 0.8°C warming above pre-industrial levels, significant impacts are already being observed globally including increased spread of vector borne diseases,

more intense floods, heat waves and intense storms. Damages to homes and communities from salt-water intrusion on agricultural lands and destruction of fresh water supplies are already occurring in many of the Least Developed Countries (LDCs) and are projected to increase. On average LDCs and SIDS have a higher share of their population living in coastal zones than OECD countries and therefore are more vulnerable to the effects of sea level rise on agriculture, infrastructure and residential settlements.

As a consequence, in the medium to longer term, it may become virtually impossible for these countries, particularly the LDCs, to adapt to unabated climate change without loss of life, livelihoods and very significant levels of damage. The mitigation of greenhouse gas emissions globally is therefore fundamentally important to reducing the impact, and hence adaptation needs, in the future. Hence one of the main benefits that the most vulnerable countries could get from a robust and ambitious climate regime is reduced future warming as a consequence of high levels of mitigation action by all major emitters globally, including those from developing countries.

Further, Watkiss (2009) asserts that low carbon trajectories are crucial across Africa if the continent is to make the most of its planned development and allow maximum potential for capturing financing opportunities now and in the future. He further states that they offer "the potential to implement no regret (win-win) measures across many areas of economic activity, which are available at low cost now, and can improve economic efficiency, as well as delivering low carbon and development objectives [...]. There is also a need for major existing energy investment instruments to better help Africa exploit these least cost and low carbon options."

For Africa, the transition to a low carbon development pathway is strongly in its own interest (Watkiss, 2009)[xxxii]. It could provide significant economic opportunities for the continent and will create new opportunities for funding, high value jobs and securer livelihoods. *Prima facie*, it would appear that African countries would be better off if they took advantage of these new opportunities instead of following business as usual development pathways. New technologies, funding and capacity development are likely to be provided to support the development of nationally appropriate mitigation actions (NAMAs) that can advance sustainable development objectives whilst delivering the means and resources for zero or low carbon growth. African countries would need to ensure that the architecture for NAMAs allows even the most vulnerable and those with least technical capacities among them to be fully eligible and benefit and that specific, tailored procedures and funding windows are created. At present, the NAMA discussion is very much focused around the large emitting developing countries and it is clear that African countries could learn the lessons from the creation of the Clean Development Mechanism (CDM) which quickly became dominated by larger developing countries to the virtual exclusion of LDCs and smaller countries.

There are concerns that deep reductions in emissions, which include peaking global emissions by 2015 or 2020, could hurt sub-Saharan Africa. However, evidence from literature suggests otherwise. For example, the lowest future emission pathways assessed in IPCC AR4 involved stabilization at 450-490 ppm CO_2-equivalent, requiring global CO2 emissions to peak around 2015, followed by substantial overall reductions of global CO2 emissions by 50-85% compared from 2000 levels by 2050.

How does such a reduction scenario affect Africa economically? A large part of these scenarios assessed by IPCC were developed by the IMAGE group, who analyzed the economic effect of such reductions on Africa (den Elzen et al (2008))[xxxiii]. They distinguished 4 groups of regions on the basis of similar mitigation (abatement) costs as percentages of Gross Domestic Product (see illustration in Appendix C):

- the OECD regions with medium relative costs of about 1.5 times the world average;
- the Former Soviet Union and the Middle East and North Africa with low cost in the medium term, but relatively high costs on the long term (about two–three times the world average);
- South-East Asia & East Asia and Latin America with relatively low to average costs (50–80% of the world average); and
- (4) South Asia (including India) and ***Sub-Saharan Africa with net gains from emissions trading***. ***This particular group appears to be a net seller and benefit from permit trading.***

Further, Watkiss (2009) argues that, in many cases, low-carbon energy investments have similar or even lower marginal costs than fossil alternatives and that low-carbon development strategies provide opportunities for implementing win-win measures across many areas of economic activity in Africa.

The cost of this transition can be lowered by avoiding being locked into high carbon facilities and processes, although low-carbon transitions will vary from country to country given the differences in the pattern of emissions and the structures of economies of these countries. It may be possible to make substantial progress in many African countries by focusing on only a small number of sectors, given the concentration of their sources of emissions.

Take energy, for example, which is a more serious challenge in Africa than anywhere else in the world (Davidson et al, 2003)[xxxiv]. African populations have limited access to modern forms of energy despite the abundant and diverse energy potential. Davidson et al (2003) argue that most of Africa's energy consumption consists of various forms of highly inefficient traditional biomass. According to Davidson et al (2003), low energy consumption is both a cause and consequence of poor development in rural area. It is also a consequence of degradation of the natural environment in that uncontrolled use of biomass aggravates deforestation, soil erosion and flooding, which in return retard development actions. As countries in Africa develop they will require more energy. Watkiss (2009) asserts that there is also a large and untapped potential for low-carbon, pro-poor economic growth projects, which can achieve poverty reduction and emission benefits through low-carbon energy access programmes. According to De Gouvello et al (2008)[xxxv] Sub-Saharan Africa has a huge potential for clean energy and some 2,755 potential clean energy projects await financing to be implemented. Investments made in the next 10-20 years could lock-in very high emissions for the next half-century, or present an opportunity to move African countries onto a more sustainable path. This is a strategic forward looking political choice that African countries need to make and the sooner the better.

Watkiss (2009) argues, in many cases, low carbon energy investments have similar or even lower marginal costs than fossil alternatives. There are also important ancillary benefits such as reduction of energy imports, enhancing energy security, improving air quality and health, reducing pressures on natural resources, and improving adaptation capability by exploiting synergies.

There are existing international financing mechanisms for encouraging low carbon development paths in developing regions such as Africa, which potentially involve large-scale flows for investment. However Africa has not been able to take full advantage of such mechanisms partly to lack of capacity associated with the cumbersome rules and procedures of these institutions (e.g. GEF and World Bank). Effective low-carbon policy measures would need to be enabled by effective carbon markets, financial incentives and new technologies that can only be secured in a new climate deal with an ambitious and shared vision. Such a deal will need to have a robust architecture that takes into account specific needs of the most vulnerable and least developed countries in Africa.

End notes

[i] As shown by the latest analysis of current pledges by the Climate Action Tracker, released on June 10 http://www.climateactiontracker.org/pr_2010_06_10_en.pdf

[ii] See countries' ranking here : http://www.climateactiontracker.org/top10.php

[iii] http://www.africapartnershipforum.org/dataoecd/41/28/43636491.pdf

[iv] Para 1 of the Copenhagen Accord. No reference is made to the preindustrial reference commonly used for this goal. However it is assumed here that this applies.

[v] "Countries calling to limit warming to 1.5°C or 2°C above Preindustrial", December 2009

[vi] Paragraph 12 of the Copenhagen Accord

[vii] The two most important loopholes are banking of surplus emission allowances and accounting for additional activities under land use, land use change and forestry (LULUCF). These loopholes are included in the analysis below.

[viii] The International Civil Aviation Authority proposed these targets as part of a global sectoral approach for aviation in the Copenhagen climate negotiations "a collective CO2 efficiency target should be established for the near-term through 2020. The aviation sector recommends that a target to improve CO2 efficiency by an average of 1.5 per cent per annum (on a CO2 emissions per revenue tonne kilometre (RTK) basis) be established. […] a mid-term target to stabilize net CO2 emissions from aviation from 2020 onward (carbon-neutral growth), […]. A long-term aspirational goal would be to reduce aviation net carbon emissions by 50 per cent in 2050, compared to 2005 levels." Source: ICAO 2009 A global sectoral approach for aviation. International Civil Aviation Organization Working Paper at the High-Level Meeting on International Aviation and Climate Change, Montreal, 7th to 9th October, 2009 http://www.icao.int/Highlevel2009/Docs/HLMENV_WP019_en.pdf and the Council of the European Union who proposed a target of -10% reduction from the international aviation sector below 2005 levels by 2020 to be implemented globally Source: EU 2009 Council Conclusions on EU position for the Copenhagen Climate Conference (7 – 18 December 2009) Council of the European Union, 2968th ENVIRONMENT Council meeting, Luxembourg, 21 October 2009.

[ix] The industry targets were taken from a statement by ICS: "The shipping industry therefore accepts that the CO2 emission reduction which ships must aim to achieve should be at least as ambitious as the CO2 emission reduction agreed under any new United Nations Climate Change Convention." Source: ICS 2009 Shipping, world trade and the reduction of CO2 emissions, International Chamber of Shipping http://www.marisec.org/shippingandco2/CO2%20Flyer.pdf and the Council of the European Union who proposed a target of -20% reduction from the international maritime sector below 2005 levels by 2020 to be implemented globally Source: EU 2009 Council Conclusions on EU position for the Copenhagen Climate Conference (7 – 18 December 2009) Council of the European Union, 2968th ENVIRONMENT Council meeting, Luxembourg, 21 October 2009

[x] Rogelj J et al(2010): "Copenhagen Accord pledges are paltry", opinion piece, Nature Vol 464 of 22 April 2010.

[xi] Estimated emission levels in 1990 are 18.7 GtCO2eq for Annex I Parties

[xii] In 2020 emissions are estimated to be about 18 GtCO2eq according to estimates in: PRIMAP (2009) PRIMAP4 Baseline Reference, <http://sites.google.com/a/primap.org/www/the-primap-model/documentation/baselines/primap4>.

[xiii] Gupta, S., Tirpak, D. A., Burger, N., Gupta, J., Höhne, N., Boncheva, A. I., Kanoan, G. M., Kolstad, C., Kruger, J. A., Michaelowa, A., Murase, S., Pershing, J., Saijo, T. and Sari, A. (2007) in "Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change", eds B. Metz et al., Cambridge University Press, pp. 860.

[xiv] M. den Elzen, Höhne N., van Vliet J. and Ellermann C. (2009): Exploring Comparable Post-2012 Reduction Efforts for Annex I Countries. MNP Report no. 500102019 http://www.economicsclimatechange.com/2009/02/exploring-comparable-post-2012.html

[xv] Project Catalyst (2009) Setting a Benchmark: How Developed Countries Might Equitably Contribute Towards a 450 ppm Pathway, http://www.project-catalyst.info

[xvi] Submission South Africa (2009), included in: A compilation of proposals by Parties for aggregate and individual figures for Annex I Parties, 28 August 2009, FCCC/KP/AWG/2009/10/Add.4/Rev.1

[xvii] H. Winkler, Marquard A. et al (2009), Analysis of possible quantified emission reduction commitments by individual Annex I Parties, http://www.erc.uct.ac.za/Research/publications/09Winkler-etal-possible-reduction-commitments.pdf

[xviii] N. Höhne, C. Michelsen, S. Moltmann, H. E. Ott, W. Sterk, S. Thomas, R. Watanabe, S. Lechtenböhmer, K. O. Schallaböck. (2008): Proposals for contributions of emerging economies to the climate regime under the UNFCCC post 2012, Ecofys and Wuppertal Institute. For the Federal German Environmental Agency, Germany, http://www.umweltdaten.de/publikationen/fpdf-l/3658.pdf

[xix] N. Höhne, Phylipsen D., Moltmann S. et al. (2007): "Factors underpinning future action". For the department for Environment Food and Rural Affairs (DEFRA), UK ,http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=None&Completed=2&ProjectID=14848#RelatedDocuments

[xx] See http:www.climateactiontracker.org

[xxi] This refers to the second sentence of Article 3.7 of the Kyoto Protocol, which allows those countries with a net source of emissions in their Land Use Change and Forestry sector to add Land Use Change (deforestation) emissions to their base year emissions when calculating their assigned amount units.

[xxii] In 2020, emissions are estimated to be about 35.6 $GtCO_2eq$ as BAU according to estimates by www.climateactiontracker.org.

[xxiii] See http:www.climateactiontracker.org

[xxiv] http://www.climateactiontracker.org, from June 2010.

[xxv] In the analysis to follow in this section, we have assumed a continuation of the rules outlined in the Marrakesh Accords for the period from 2013 to 2020, except for mandatory accounting of forest management with a cap of 4% of 1990 emissions. We have chosen this particular option to illustrate the effect of an overall LULUCF accounting regime applied to all Annex-I Parties, as opposed to the 'favorite options' applied in the previous section. This overall regime leads to a medium aggregate LULUCF credit compared to other accounting options universally applied.

[xxvi] The most optimistic case for Rogelj et al (2010) assumes LULUCF credits not to deteriorate the targets. The inclusion of LULUCF would therefore not change the overall assessment.

[xxvii] These are minimum average reduction rates over the entire period from 2020 to 2050. Reduction rates in specific decennia and years are path dependent and can be higher.

[xxviii] van Vuuren, D., M. den Elzen, P. Lucas, B. Eickhout, B. Strengers, B. van Ruijven, S. Wonink, R. van Houdt, 2007. Stabilizing greenhouse gas concentrations at low levels: an assessment of reduction strategies and costs. Climatic Change, doi:10.1007/s/10584-006-9172-9.

[xxix] Meinshausen, M., N. Meinshausen, et al. (2009). "Greenhouse-gas emission targets for limiting global warming to 2oC." Nature 458(7242): 1158-1162. See Supplementary Figure S1(b).

[xxx] MacPherson, K (2009): "New Princeton method may help allocate carbon emissions responsibility among nations - Targets individuals, tagging high polluters everywhere". Article posted on 6 July 2009 at the following website: http://www.princeton.edu/main/news/archive/S24/60/53S34/index.xml

[xxxi] Watkiss, P (2009): "The economics of climate change- Key messages". Policy brief produced for the Financing for Development Conference on Climate Change, Kigali, 21-22 May 2009

[xxxii] Watkiss, P (2009): "The economics of climate change- Key messages"Policy brief produced for the Financing for Development Conference on Climate Change, Kigali, 21-22 May 2009

[xxxiii] den Elzen MGJ, Lucas PL, van Vuuren DP (2008) "Reductions of greenhouse gas emissions in Annex I and non-Annex I countries for meeting concentration stabilisation targets", Climatic Change DOI 10.1007/s10584-008-9466-1

[xxxiv] Davidson, O; Halsenaes,K; Huq,S; Kok,M; Metz, B; Sokona,Y; and Verhagen,J (2003):"the development and climate nexus:the case of sub-saharan Africa". Accessed online at www.sciencedirect.com .

[xxxv] De Gouvello et al (2008) "Low-carbon Energy Projects for Development in Sub-Saharan Africa, Unveiling the Potential, Addressing the Barriers", Norwegian Trust Fund for Private Sector and Infrastructure & World Bank

APPENDIX A : ILLUSTRATION OF LULUCF LOOPHOLES AND SURPLUS AAUs

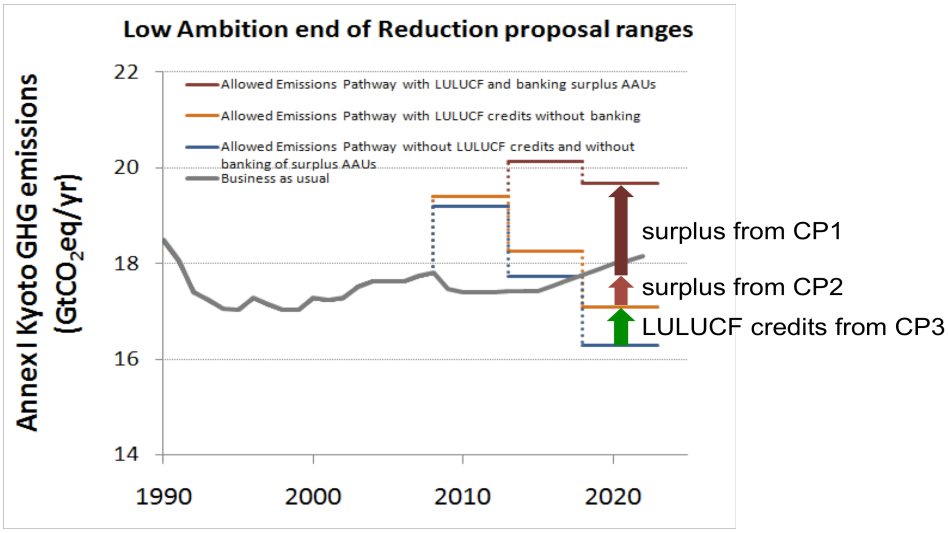


Figure A1: Effect of Surplus AAUs - Lowest Annex I targets proposed as of 3 June 2010. Business as usual emissions are based on national inventory submissions to the UNFCCC by parties for the 1990-2007 period, followed by growth rates from POLES[xxxvi]. Allowed emissions in CP3 are defined by the countries reduction proposals for 2020. CP2 is defined here by drawing a straight line from KP.CP1 allowed emissions in 2010 to current proposals in 2020 and setting the CP2 allowed emissions equal to the 2015 emissions on this straight line.

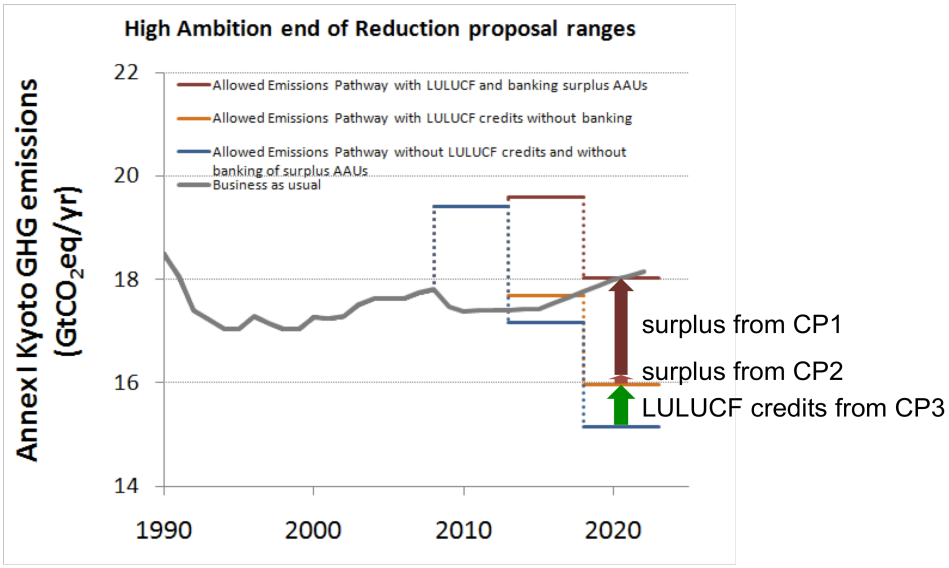
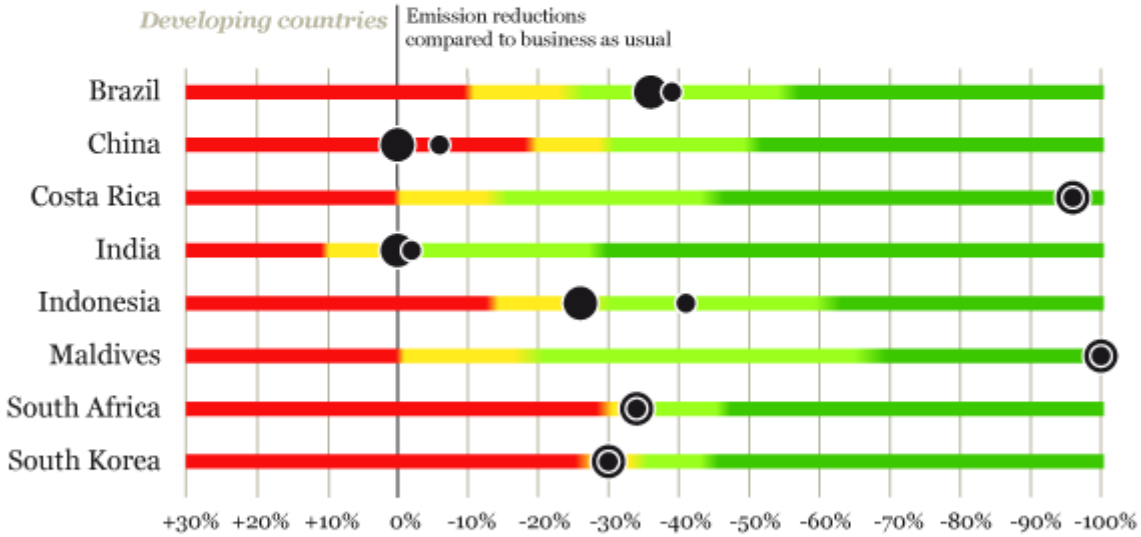
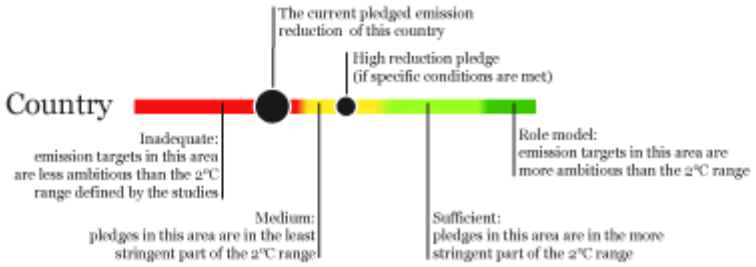


Figure A2: Effect of Surplus AAUs - Highest proposed Annex I targets as of 3 June 2010. Data sources: see caption Figure A1.

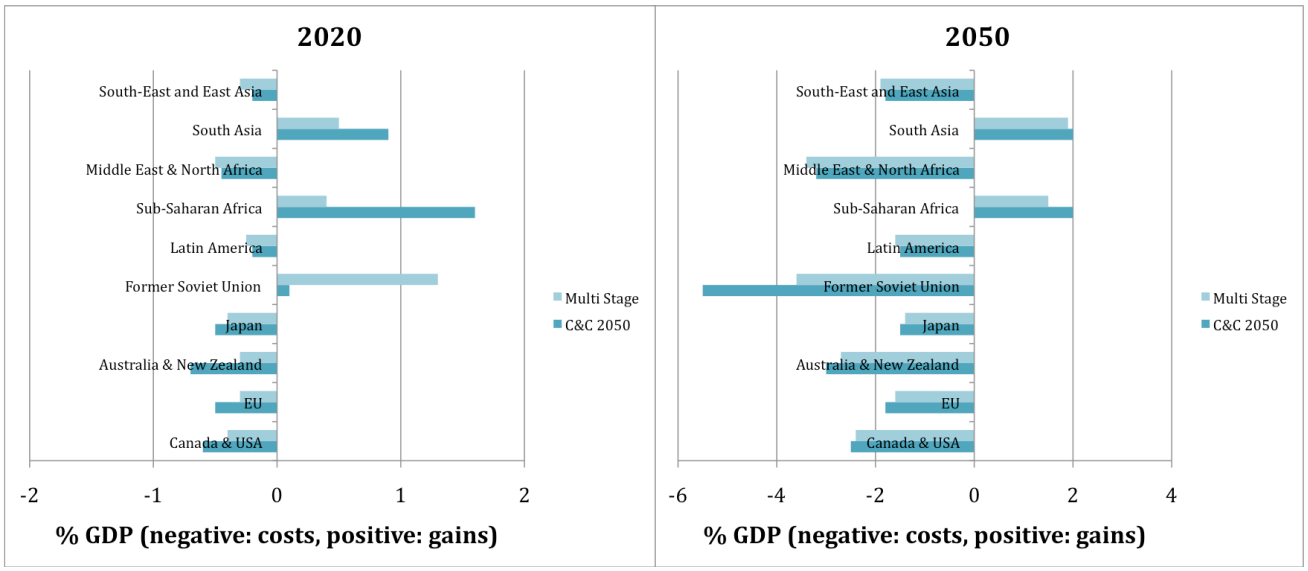
APPENDIX B : ILLUSTRATION OF COMPARABILITY OF EMISSIONS REDUCTION EFFORTS

(source: www.climateactiontracker.org)





APPENDIX C: ABATEMENT COSTS FOR SELECTED REGIONS



Abatement costs for selected regions from den Elzen et al (2008) for a mitigation pathway leading to greenhouse-gas concentrations of 450 ppm CO2eq. Costs are expressed as cumulative discounted abatement costs (or gains) as % of cumulative discounted GDP. Globally, costs increase from 0.3% by 2020 to 1.7% of GDP by 2050. Left panel: regional costs/gains by the year 2020. Right panel: for 2050. The overall mitigation effort is split between regions using two so-called effort-sharing regimes. ***Multi Stage*** is an allocation approach that assumes a gradual increase in the number of parties taking on mitigation commitments and in their level of commitment as they move through several stages according to participation and differentiation rules.
C&C 2050 is 'contraction an convergence' by 2050. The C&C regime assumes universal participation and defines emission allowances on the basis of the convergence of per capita emission allowances under a contracting global emission profile

Costs are highest for regions with high emissions per capita and/or high emission intensity (emissions per unit GDP).

[xxxvi] POLES (Prospective Outlook on Long-term Energy Systems), ENERDATA: http://www.enerdata.fr/enerdatauk/tools/Model_POLES.html
http://webu2.upmf-grenoble.fr/iepe/textes/POLES8p_01.pdf Data Provider: Enerdata, www.enerdata.fr

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