Short Paper on the UNFCCC Structured Expert Dialogue on the 2013–2015 Review, with a particular focus on the 1.5°C target

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In four sessions in the UNFCCCwith more than 70 experts in a face-to-face dialogue with policy makers, the Structured Expert Dialogue (SED)[1] on the 2013–2015 Review assessed the current state of science relevant to an evaluation of the adequacy of the long-term 2°C global goal and the overall progress made towards it. This **comprehensive assessment of different long-term global goals such as 2°C or 1.5°C**, drawing upon the IPCC AR5 as well as more recent literature, **makes the report an indispensable source of information for any assessment of the adequacy of the long-term global goal.**

The report on the SED **finds that the 'guardrail' concept,** in which up to 2°C of warming is considered safe, is **inadequate**. In fact, the report confirms significant climate impacts are already occurring at the current level of global warming and additional magnitudes of warming will only increase the risk of severe, pervasive and irreversible impacts.

Consequently, the report suggests that a long-term goal of below 2°C is defined as a 'defence line', rather than a 'guardrail', **confirming that warming of less than 2°C would be much more preferable and implying that a 1.5°C target would be more adequate.** The report advises the pursuit of emission pathways in the immediate short term that are consistent with limiting warming to below 2°C and keeping the option of limiting warming to 1.5°C open. In addition, the defence line concept implies the need for high-probability pathways below 2°C that will be consistent with 1.5°C, indicating that a target of below 2°C would only be secured by **aiming for 1.5°C.**

The outcome of SED should lead to increased recognition of the legitimacy and significance of the 1.5°C goal by all stakeholders in the climate negotiations.

Key Message: Impacts of Climate Change differ substantially between 1.5°C and 2°C

The SED report confirms that risks increase significantly between 1.5°C and 2°C: three out of five

'Reasons for Concern' as identified by the IPCC are rated as transitioning from moderate to high risk between these warming levels. Figure 1 illustrates the difference in key impacts as identified in the SED. The report finds that limiting global warming to below 1.5 °C would avoid or substantially reduce risks, including risks to food production or unique and threatened systems such as coral reefs or many parts of the cryosphere (glaciers, ice sheets of Greenland and Antarctica) and the risk of sea level rise.

The difference in projected risks between 1.5°C and 2°C of warming is in particular significant for highly temperature-sensitive regions, such as the polar regions, high mountains, the tropics and low-lying coastal regions.

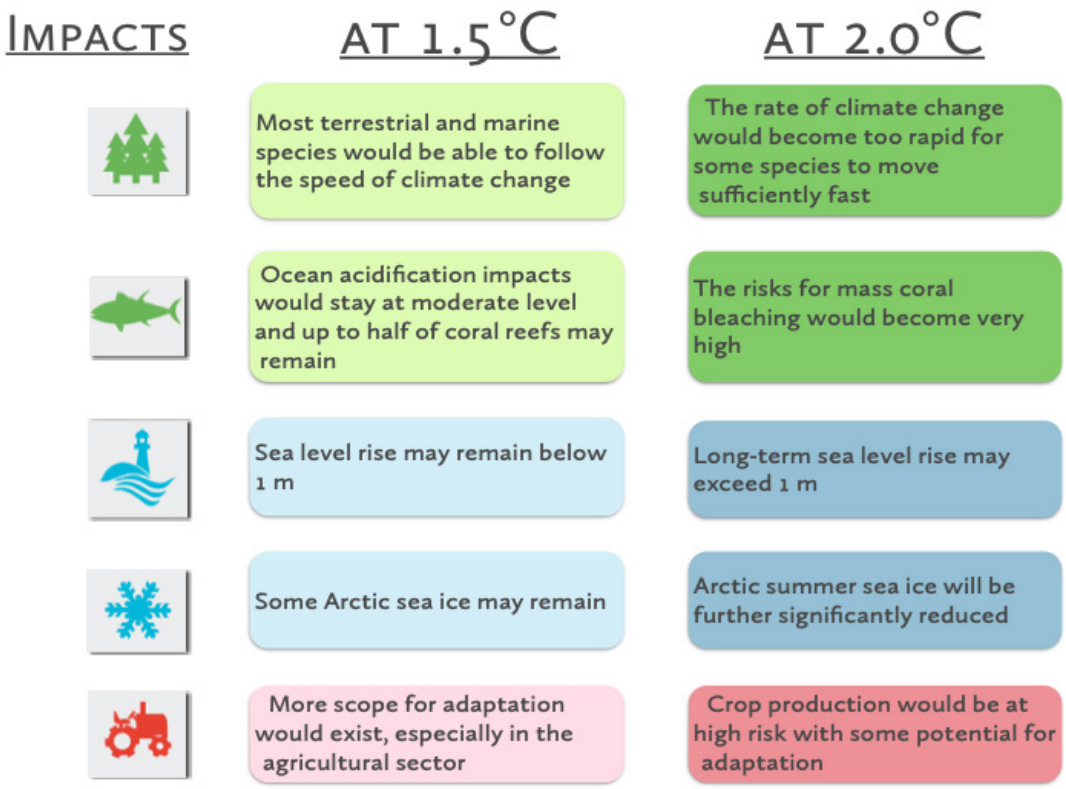
Regional food security risks may be significantly different between 1.5°C and 2°C of warming in Africa in particular, where the reduction in staple crop yields in some countries is projected to be higher than the global average.

In relation to the risks for the five 'Reasons for Concern' identified by the IPCC, the SED finds for a warming of 2°C that:

- **Unique and threatened systems would be at high risk,** in particular systems with limited or barely any adaptive capacity, e.g. Arctic sea ice and coral reefs.
- **Extreme weather events would pose a high risk for human** health, urban housing and infrastructure in megacities, and in relation to the urban heat island effect, air pollution and differential vulnerabilities; displacement and permanent migration; livelihood struggles and conflict in resource-dependent livelihoods, such as agriculture and pastoralism; **and high impacts on livelihood** (trapped populations are more vulnerable to environmental change because of their inability to move).

1 http://unfccc.int/resource/docs/2015/sb/eng/inf01.pdf

- **The risks will be increasingly unevenly distributed, and are generally greater for disadvantaged people and communities in countries at all levels of development**; populations that experience shifts from transient to chronic poverty and related social marginalization and food insecurity; and the elderly, children, the socially marginalized, and outdoor workers, who are disproportionally at risk from heat stress.
- Global aggregate impacts show a moderate economic impact, but these aggregates may mask impacts across sectors and regions (evaluations are incomplete, in part because they do not take into account large-scale singular events affecting several sectors at once or other effects from disrupted interdependencies).
- The risk of large-scale singular events, such as the disintegration of ice sheets in Greenland and Antarctica, would be moderate.



Key Message: The 2°C limit should be seen as a defence line, while less warming would avoid substantial impacts

The SED finds that the 'guardrail' concept, in which up to and including 2°C of warming is considered 'safe', is inadequate and would therefore be better seen as a defence line that needs to be stringently defended, while less warming would be preferable. Significant climate impacts are already occurring at the current level of global warming and additional magnitudes of warming will only increase the risk of severe, pervasive and irreversible impacts. Arguably this conclusion was already recognized in Copenhagen with insistence by many parties that the 2°C warming goal be qualified as limiting warming 'below 2°C'. The SED findings confirm this policy judgment from 2009 and extend it by referencing the substantially reduced impacts and risks at 1.5°C.

The proposed defence line concept has substantial implications for the assessment of potential emission trajectories. For a defence line that needs to be stringently defended, while 'less warming would be preferable' an emission pathway that only has a likely chance (> 66%) of avoiding a 2°C increase, as specified in IPCC AR5, for example,, may not provide a sufficient level of security.

Consequently pathways with higher probability (85% or above) would appear far more consistent with the SED's findings. While the SED does not provide information on the specific characteristics of such high-probability emission pathways, scientific results from the IPCC AR5 and the 2014 UNEP Emissions Gap report, and other recent scientific literature, provide guidance on this[2]: **Emission pathways that hold warming below 2°C throughout the 21st century with a high probability (above 85%) also limit warming below 1.5°C by 2100 with a 50% or greater probability.**

Key Message: Limiting global warming to below 2°C is still feasible and will bring about many co-benefits, but poses substantial technological, economic and institutional challenges

While the world is not on track to achieve a long-term global goal of 2°C, the report confirms that limiting global warming to below 2°C is still feasible and will, while posing substantial technological, economic and institutional challenges, bring about many co-benefits. To hold warming below a 2°C target with a likely probability (>66% chance), the SED cites IPCC AR5 findings that a reduction in global greenhouse gas emissions of 40–70 per cent by 2050 relative to 2010 levels is required[3]. Cost-effective pathways are characterized in particular by immediate action. The costs are manageable, even without taking into account the co-benefits of mitigation, and various policy options could be deployed to manage the risks of the necessary mitigation action. The technologies required for the 1.5°C scenarios are the same as for the 2°C pathway, but need to be deployed faster, and energy demand needs to be reduced earlier, implying a higher direct mitigation cost than in the 2°C scenarios.

On the comparison of costs and avoided impacts between the 1.5°C and 2°C warming limits, the IPCC drew a distinction between mitigation costs and net benefits, noting that a simple cost-benefit analysis is inadequate to determine whether or not to pursue the 1.5°C warming limit.

Additional Literature

The findings of the SED are underlined by findings of the recent scientific literature that have not been fully assessed under the SED but are summarized here.

1. Differences in impacts between 1.5°C and 2°C

1.1. Ice-sheet response and long-term sea-level rise

- Large parts of the cryosphere may be much more vulnerable to the impacts of climate change than previously thought and in particular the West-Antarctic Ice Sheet may already be in an unstable retreat.[1]
- Evidence from the paleo-record indicates that past sea levels have been between 6 and 13 metres higher for global mean temperatures not warmer than 2°C above pre-industrial levels.[2]
- Paleo- as well as modelling evidence indicates a multi-millennial averaged increase in sea-level rise of about 2.3 metres per °C of warming, with a steep rise in risk between 1.5°C and 2°C due to a potential collapse of the Greenland ice sheet.[3]

2 Below 2°C or 1.5°C depends on rapid action from both Annex I and non-Annex I countries *http://climateanalytics.org/publications/2015/benchmark-emission-levels-for-2025-and-2030-consistent-with-the-below-2c-limit-and-the-1-5c-limit*

3 Timetables for Zero emissions and 2050 emissions reductions: State of the Science for the ADP Agreement *http://climateanalytics.org/files/ca_briefing_timetables_for_zero_emissions_and_2050_emissions_reductions.pdf*
http://climateanalytics.org/files/infosheet_timetables_for_zero_emissions_and_2050_emissions_reductions_20150211_final.pdf

1.2. Risks for tropical coral reefs

- Tropical coral reefs, one of the most precious and at the same time most vulnerable ecosystems, might not only be threatened by ocean acidification and increased bleaching, but also by increased disease-related mortality due to climate change.[4]
- Literature assessed in the recent IPCC report and in the SED indicates that even without this risk, virtually all global tropical coral reefs would be under extreme risk of warming exceeding 1.5°C.[5]

1.3. Risks posed by extreme events

- An analysis of the emergence of an anthropogenic footprint in the occurrence of climate extremes has indicated that such a footprint had already emerged by 2014 for temperature-related extremes in most world regions.[6]
- The increase in climate extremes is substantial between 1.5°C and 2°C and has been found to almost double for heat extremes.[7]

2. Feasibility of holding warming below 1.5°C by 2100

There are more than 30 scenarios in the scientific literature that show that holding warming below 1.5°C by 2100 is still feasible.

As found in the SED report, these scenarios are characterized by similar technological requirements as likely below-2°C pathways (that have a greater than 66% probability of meeting this target). These include deep emission reductions particularly in the energy sector, rapid and sustained improvement in energy efficiency of the global economy and extensive use of carbon capture and storage (CCS) in particular in conjunction with bioenergy technologies.

Specifically, the differences between pathways that have a 50 per cent chance of holding warming below 1.5°C by 2100 and pathways that have a 66 per cent chance of holding warming below 2°C over the 21st century have been assessed recently[8]. 1.5°C scenarios are characterized by:

- Aggregated long-term mitigation costs that are about 1.5 to 2.1 times higher for 1.5°C than for 2°C scenarios, with a larger effect on near-term costs than on long-term costs.
- The range of emissions in 2030 that still keeps the option open to limit warming to below 1.5°C by 2100 is significantly lower than for 2°C. Diverting investments towards low-carbon technologies in the coming decade is therefore critical. In particular, there is no scenario in the scientific literature in line with the 1.5°C target that has 2030 total greenhouse gas emission levels exceeding 40 Gt CO_2 equivalent.
- Energy efficiency plays a critical role in low-stabilization scenarios in general. Climate-policy-induced demand reductions are greater in 1.5°C than in 2°C scenarios.
- Additional mitigation efforts in the industrial, building and transport sectors lead to significantly lower emissions from these sectors by mid-century;

At the same time, the need for CCS and negative emission technologies is generally moved forward in time by a decade or two, but is comparable in scale to typical likely 2°C scenarios.

Note that these differences hold for 1.5°C scenarios compared to scenarios that hold warming below 2°C with greater than 66 per cent probability, but do not hold warming below 1.5°C with a greater than 50 per cent probability. In other words, the overlap between below-2°C scenarios and 1.5°C scenarios is removed first. This overlap is considerable, because in general scenarios that hold warming to below 1.5°C by 2100 with a probability of 50 per cent or greater, also hold warming below 2°C with 85percent probability or greater. Hence, there is no difference in required system transformation between 1.5°C scenarios and 'high-probability' 2°C scenarios.

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Editors Note:

Climate Action Network introduction to the SED:

In 2012, the United Nations Framework Convention on Climate Change (UNFCCC) decided to establish a structured expert dialogue (SED) with the aim to support the work of a Joint Contact Group of two bodies in the UNFCCC, the Subsidiary Body for Scientific and Technological Advice (SBSTA)and Subsidiary Body for Implementation (SBI), to ensure the scientific integrity of a review in 2013-2015 on the adequacy of the long-term global goal in light of the ultimate objective of the Convention. Through a focused exchange of views, information and ideas SBSTA and SBI should give recommendations in relation to party commitments. The message of the SED could not be clearer: 'Climate change is here and it is a matter of survival'.

The SED has shown to be an appropriate vehicle for open and substantive discussions between Parties on the scientific knowledge and evidence based climate policy formulation. It considered scientific information, especially the latest IPCC Report (Fifth Assessment Report), relevant to the review through regular scientific workshops and expert meetings and assisted in the preparation and consideration of synthesis reports on the review.

Climate Action Network demands zero emissions which means phasing out all fossil fuel emissions and phasing in 100% renewable energy with sustainable energy access for all, as early as possible, but not later than 2050. CAN has no specific position on BECCCs.

About AirClim

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