CLIMATE ACTION NETWORK

Preventing dangerous climate change

Summary

Climate Action Network calls on Parties to set limits to climate change as a matter of urgency

The Climate Action Network is concerned that Parties are losing sight of their ultimate obligation under the Climate Convention to prevent dangerous climate change. Parties should, as a matter of urgency, begin discussing the limits to climate change that would prevent dangerous changes from occurring.

Preventing dangerous climate change is an equity issue

Averting dangerous climate change is an equity issue. The IPCC Third Assessment Report has established that developing countries are most at risk of climate change and they will suffer damages at even quite low levels of warming. These damages rise rapidly with temperature. The human activities leading to dangerous climate changes are caused largely by the consumption levels, patterns, and associated production, of the wealthy industrialized countries, but their impacts will, and are, falling disproportionately upon the poor. As a consequence setting strong climate targets is an equity issue, both within the current generation, and in relation to those to come.

Some are already experiencing dangerous changes

Some communities, notably on some small island developing states and in the high Arctic, are clearly already suffering human induced climate impacts today. Drought in Southern Africa and India, recent unusual floods China, Vietnam and other parts of Asia and central Europe have been associated by scientists with projected human induced climate changes and clearly portend much worse to come.

Developing countries will suffer the most from already committed warming

Due to historical and current greenhouse gas emissions, and the fact that emissions cannot be reduced to zero overnight, we know we are already committed to future warming and sea level rise. This unavoidable commitment will cause increased risk of disease, hunger, water shortage and coastal flooding for somewhere between tens of millions and some billions of people depending on the impact area and the rate and extent of the warming. Major adaptation efforts will be required to minimize the adverse health, food security, water supply, storm and sea level rise consequences of these impacts.

Climate change should be kept below a peak of 2^{o}C warming and then reduced as rapidly as possible.

The Climate Action Network believes that the global mean warming needs to be limited to a peak increase of below 2^{o}C (above pre-industrial times) and that the warming should be reduced as fast as possible from this peak.

Peaking at less than 2°C will not prevent major damages, but we are already committed to a warming of over 1°C

Temperatures approaching 1-2°C entail significant damages, however, even if the atmospheric concentrations of greenhouse gases were held at present day levels, a warming of 1°C or above may not be avoidable. This committed warming is likely to cause irreversible damage to some unique ecosystems and the extinction of endemic species contained in them. Significant damages to agricultural production in some developing country regions, growing water shortages and increasing exposure to health risks will also occur. This is not 'acceptable' under any definition of the word.

Sea level rise will be difficult to stop; only rapid reductions in temperature have a chance.

Providing the temperature drops as quickly as possible (after peaking at below 2°C) there is the possibility that sea level rise over the next several centuries can be limited to half a metre and perhaps even arrested, but this cannot be guaranteed. There remains however the possibility that even these warming goals could trigger the collapse of the West Antarctic Ice Sheet with a resulting sea level rise of several metres over a number of centuries. There appears to be substantial likelihood that the even a warming of 1°C could lead to the decay or loss of significant ice mass from the Greenland Ice sheet in coming centuries, causing significant sea level rise.

Doubling CO_2 targets or 450 ppmv CO_2 stabilization targets will lead to dangerous climate change.

Long term climate targets such as doubling of CO_2 concentration (above pre-industrial levels) would result in temperature increases, when other gases are taken into account, significantly higher than 3°C. The new IPCC "low" concentration scenario results in a CO_2 concentration of 450 ppmv CO_2 and a total greenhouse gas concentration equivalent to approximately double pre-industrial CO_2 levels. This would produce a long-term temperature rise of 2.5°C for the IPCC best estimate of climate sensitivity and higher if the climate sensitivity is higher. If the scientific assessments of the impacts of climate change are correct, such increases would impact severely upon the vast majority of the earth's population. The resulting sea level rise over a few centuries could eliminate whole island countries in the Pacific, Indian Ocean and elsewhere, overwhelm Bangladesh and cause untold damage and suffering to regions with low lying coastal populations in the coming centuries. This would be totally irreversible on any meaningful timescale. Targets such as these are often cited in the economic literature, without formal justification, as "safe". It is clear that they are not.

Option of avoiding 2°C increase will disappear within the next decade or so unless urgent action is taken

It is clear from the IPCC Third Assessment Report that unless urgent action is taken to reduce emissions rapidly, beyond those reductions agreed in the Kyoto Protocol for its first commitment period, the option of limiting the temperature increase below 2°C will disappear from the policy map within the next two decades.

Global emissions need to peak within next 20 years

The inertia of the climate system means that keeping the global mean temperature increase below 2°C will require rapid global emission reductions, with emissions peaking within the next 20 years and declining quickly thereafter.

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Introduction

The primary and ongoing legal obligation on **all** countries belonging to the Climate Convention is to prevent dangerous climate change. The Climate Action Network supports this objective. This position paper outlines the position that CAN has reached on this issue after substantive deliberations based upon the IPCC Third Assessment Report and other inputs and considerations.

CAN believes that governments should move as a matter of urgency to consider and decide upon the limits to climate change that, if met, would enable fulfilment of Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC) which states:

> *"The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."*

In undertaking this work CAN believes that important principles embodied in the UNFCCC, other treaties and generally in international law need to be fully accounted for and in particular would like to remind governments that:

- The precautionary principle must be applied so that scientific uncertainties do not stand in the way of decisions that protect the climate system and prevent dangerous climatic changes. This is expressed, *inter alia*, in Article 3.3 of the UNFCCC.
- The general principle of international law must be observed that activities within the jurisdiction of one country must not lead to grave damage on another state's territory.
- The right to sustainable development in particular access to affordable energy services, livelihoods, food security, health, water and other basic human needs.
- The basic right to life and physical integrity, as they are embodied in a number of international treaties and the Universal Declaration of Human Rights, demand the immediate implementation of mitigating climate change.
- The obligations on Parties to treaties must be performed in good faith.

This paper describes the impacts that can be associated with different levels of global mean warming, discusses considerations on setting climate targets that might prevent dangerous

climate change, thereby operationalizing Article 2, climate targets and ceilings, and concludes by pointing out what the CAN climate targets and ceilings mean for emissions.

What are the impacts associated with climate change?

Setting long-term climate targets involves decisions as to whether or not the impacts projected at different levels of temperature change can be considered dangerous.

The IPCC Third Assessment Report (TAR) provides a very substantial amount of information on the impacts that can be expected from different levels of warming in the future. Below some of the key findings of the IPCC TAR are outlined with identified impacts associated with four ranges of temperature $< 1^{o}C$, $1\text{-}2^{o}C$, $2\text{-}3^{o}C$ and $3\text{-}4^{o}C$ or above. It will be seen that even small degrees of warming are very likely to result in substantial damages. It will also become clear that warming above $1\text{-}2^{o}C$ results in rapidly escalating damages whose magnitude and extent is qualitatively different from lower temperatures. Unfortunately it will also be clear that warming below $2^{o}C$, within the band of already committed warming, entails substantial damages to some developing countries and unique natural systems.

Firstly though it is important to recall the IPCC's finding that the climate changes that have occurred this century are already affecting human communities and ecosystems. The IPCC projects that much larger changes over the coming decades will occur unless decisive GHG emissions mitigation action is taken. Amongst the key findings in this context from the TAR are:

- There is new and stronger evidence that most of the observed warming over the last 50 years is attributable to human activities.
- The 20th century trends of increasing temperature, sea-level rise, and increased precipitation will very likely continue and intensify in the 21st century.
- The globally averaged surface temperature is projected to increase by 1.4 to 5.8°C over the period 1990 to 2100 and temperature will continue to rise in the following centuries.
- Global mean sea level is projected to rise by 0.09 to 0.88 metres between 1990 and 2100 and this rise will continue substantially unabated for many centuries, long after atmospheric greenhouse gas concentrations are stabilized.
- There is likely to be an increase in extreme weather events such as heat waves, droughts and in other places increased precipitation leading to floods, and higher minimum temperatures and fewer cold days.
- Glaciers and ice caps are projected to continue their widespread retreat during the 21st century, with tropical and subtropical glaciers retreating the most and in some case disappearing

Impacts at different levels of warming

Less than 1°C warming

- Developing countries
  - Net negative market sector impacts in developing countries and net market sector gains in developed countries. Applying more weight to impacts on poor countries indicates negative aggregate impacts globally.
  - Livelihoods of the most vulnerable populations adversely affected.
- Water
  - Shrinking ice and snow cover disrupts hydroelectric capacity and systems dependent on spring thaw timing.
- Ecosystems
  - Changes in growing seasons, shifts in population ranges, and premature reproduction in plants, insects, and birds threaten the integrity of complex systems dependent on timing of seed dispersal, pollination, availability of food, etc.
  - Extinction of some critically endangered and endangered species. Species immediately threatened by rising sea levels and shrinking ranges include the Bengal tiger (Ganges delta), the mountain gorilla (Central Africa), the spectacled bear (Andes mountains), resplendent Quetzal (Central America).

1-2°C global mean warming

- Developing Countries
  - Many developing countries will suffer from net market losses in important sectors.
  - Globally some regions may have net market benefits and others principally developing countries have net market losses.
  - Majority of people adversely affected by climate change and livelihoods of the most vulnerable populations dependent on natural ecosystems increasingly adversely affected.
- Food security
  - There is the likelihood of significant damages to crop production in tropical and subtropical countries sufficient, among other things to reverse agricultural self-sufficiency progress in many developing nations.

  Heat waves will damage crops (rice unable to form grains, fruit unable to set) and livestock will suffer from heat stress (reductions of milk production and conception difficulties in dairy cows).
- Water shortage
  - Decreased water supply and quality will occur in regions already suffering from water scarcity and drought such as the Mediterranean, southern Africa, and arid parts of central and south Asia affecting half a billion people.
- Floods
  - More flood damage will result from intense storms, especially in areas affected by deforestation, wildfires, insect infestations, and ecosystem degradation.
- Extreme events

  Increasing frequency and intensity of extreme weather events will result in increased insurance costs and decreased insurance availability (coastal areas, floodplains).
- Health effects
  - Direct - Increased heat related deaths and illness, affecting particularly the elderly, sick, and those without access to air conditioning;

- Indirect - more illness and death resulting from increased frequency and intensity of extreme weather events.
- Increased risks to human life, risk of infectious disease epidemics, and many other health risks where floods, droughts or storms increase in frequency and/or intensity.

· Ecosystems
- Wildfires and insect infestations will disrupt relationships in complex ecosystems already undergoing stress from direct effects of heat. Increased disturbances of ecosystems by fire and insect pests.
- **Coral bleaching** events will increase in frequency and duration, leading to destruction of brain corals and loss of related reef ecosystems.
- Loss of up to 10% of coastal wetlands globally from sea level rise will eliminate habitat of major migratory bird populations.
- 30-40% of nature reserves adversely affected

· Ice Sheets and Sea Level Rise
- Meltdown of the Greenland ice sheet is likely with global mean warming above 1-3^{o}C, and would lead to several meters sea level rise over several centuries with disastrous consequences for millions.

2-3^{oC} global mean warming:

· Developing Countries
- Most regions (developed and developing countries) will suffer net market losses in important sectors that will affect global economic aggregates e.g. net global economic losses are likely.

· Food security
- 50-120 million more people at risk of hunger, and food prices will increase throughout the global economy.
- Crop yields will drop in regions affected by more drought conditions and there is likely to be a general decrease in cereal crop yields extending beyond the tropics to mid-latitude and temperate regions.

· Water shortage
- More than 3 billion more people at risk of water shortage.

· Floods
- 100 million more people at risk of coastal flooding

· Extreme events
- Floods, droughts and other extreme event would further increase

· Health effects

- It is likely that 300 million people would be at greater risk of malaria and much increased exposure to dengue fever.

· Ecosystems
- Losses of unique ecosystems and their endemic species (e.g. Cape region of south Africa and some cloud forests)
- Substantial damage to coral reefs, reduced species biodiversity and fish yields from reefs.
- Significant damage or disruption to arctic ecosystems, boreal forests, mountain ecosystems.

· Ice Sheets and Sea Level Rise
- Rapid decay of the Greenland ice sheet for appears likely in this temperature range leading to 1-2 metres sea level rise by 2500 and 2.3-3.5 metres over the next thousand years depending on the extent of the heating.

- The model range for sea level rise induced by thermal expansion is 0.44-1.96 metres by 2500 and for greater than 1000 years 0.53m-1.96m (for doubling of CO_2).
- Increasing risk of instability or decay of the West Antarctic Ice Sheet

3-4°C global mean warming:

The IPCC was unable to assess impacts in details for temperatures much in excess of the 2-3°C warming range due to lack of literature however the following general conclusions can be made:

- Developing Countries
  - Economic damages rise more quickly
- Food security
  - Food security situation worsens
- Water shortage
  - Water shortages worsen
- Floods and Extreme events
  - More floods and other extreme events
- Health effects
  - Adverse health effects worsen
- Ecosystems
  - Elimination of tropical glaciers and significant reduction in ice cap and temperate glacier volume will alter hydrology and dependent ecosystems.
  - Coral death from sea temperature increases lasting for 6 months or more will eliminate whole reef ecosystems.
  - Other ecosystems under threat include atolls, mangroves, boreal and tropical forests, alpine meadows, prairie wetlands, and remnant native grasslands.
- Ice Sheets and Sea Level Rise
  - The decay of the Greenland ice sheets appears to be virtually certain at this level of warming.

Abrupt and irreversible changes

The impacts cited above do not in general assess the prospects of abrupt and irreversible changes in the climate system. One such potential change is the shutdown of the North Atlantic thermohaline circulation system which could occur, at thresholds that are uncertain, well within the range of temperatures projected over the next century and beyond. Such a shutdown is likely to have global implications with precipitation declines in the northern hemisphere and particularly large and rapid changes in South America and Africa, according to one model assessment.

Considerations on setting climate targets that might prevent dangerous climate change

As outlined above the IPCC in its Third Assessment Report has identified a range of impacts corresponding to different levels of global mean temperature increase however a decision as to what is dangerous is clearly a political issue and one driven by values.

The impacts outlined above for different ranges of temperature increase in global mean surface temperature show clearly that virtually any level of warming will result in adverse effects on developing countries and ecosystems. However it is clear that even if the atmos-

pheric concentrations of CO_2 and other greenhouse gases were held at present day levels a warming of 1-1.5^{o}C above pre-industrial levels is most likely not avoidable. This committed warming seems likely to cause negative market impacts for developing countries as well as yield reductions in highly vulnerable agricultural regions. Irreversible damage to some unique ecosystems and the extinction of many of the species contained in them also seems likely. Sea level rise commitment also appears significant. These and other factors mean that there will have to be substantial focus on adaptation in the most vulnerable regions.

Most of the impact analyses have focussed on the 21st century and not considered the inertia in the climate system which would continue to warm and result in rising sea levels for centuries after stabilization of atmospheric concentrations of CO_2 and other greenhouse gases. The shorter-term impacts identified for the 21st century at and above 2^{o}C warming already appear very severe with the scale of impacts rising in most cases very quickly beyond this level. For developing countries, and particularly for the poorest, a 2^{o}C warming is associated with very large impacts, which are only likely to worsen with time. These could undermine, if not reverse in some cases, progress towards sustainable development.

It seems doubtful that coral reefs, some Arctic and other sensitive ecosystems, would survive an extended period of global mean warming above 2^{o}C, with large damages already expected at or below this temperature range. Such damages would adversely affect the livelihood and well being of the human populations dependent upon them.

The future of the Greenland and West Antarctic Ice sheets, both of which contain ice sufficient to raise sea level by around 6 metres, is also under doubt for long-term global mean temperature increase beyond 1^{o}C. There appears to be a very high probability that a 1-3^{o}C warming could initiate the decay of the Greenland ice sheet if sustained for a significant period of time. For the West Antarctic Ice sheet there appears to be a significant risk that continued warming of the oceans around the ice sheet could trigger an unstable collapse leading to sea level rise of several metres over a number of centuries.

Arresting sea level rise due to thermal expansion is deeply problematic irrespective of the ice sheet response. The IPCC has found that the sea level rise would continue to rise for a very long time years after the 21st century stabilization of CO_2 at double pre-industrial levels. After 500 years the rise is estimated to be in the range of 0.5-2 metres, some 4-9 times **greater** than at the time of stabilization itself. And this likely to be only half of the eventual increase in sea level over a thousand years or more.

One of the consequences of human induced climate change is sea level rise, whose consequences are long lasting and essentially irreversible and which, unless urgent action is taken, could result in substantial or complete loss of territory of some countries, particularly small island states. More broadly it is becoming increasingly clear that human induced climate change caused substantially by one set of countries could cause significant harm to the health and welfare of people from a much larger poorer group of countries.

As a consequence of these and other considerations the conclusion reached by CAN is that the global mean temperature will need to be brought down as rapidly as possible from any

peak reached in the coming century. The factors leading to CAN concluding that global mean warming will need to be reduced as fast as possible after peaking include:

- Need to absolutely minimize and if possible limit long term sea level rise to permit the continued survival of a number of countries and coastal ecosystems.
- Minimize damage to many natural ecosystems by limiting the period of peak warming and to avoid and/or limit the potential for large-scale positive feedbacks from the carbon cycle.
- Limit the risk of major and irreversible ice sheet decay or even collapse which could lead to many metres of sea level rise in future centuries.
- Minimize damages to health, agriculture and water supply.
- Avoiding potentially irreversible non-linear climate impacts requires that atmospheric greenhouse gases return as close as possible to pre-industrial levels in the next few centuries.

Limiting the rate of change is also important, in order to allow natural ecosystems to "adapt" - if they can adapt at all. We need to keep the rate of temperature change at no more than about 0.1˚C/decade as much as possible, realising that we have already broken that barrier and will almost inevitably move well out of that range in the coming decades, with the corollary that the long term rate of change should approach zero and (hopefully) move into the negative range late this century or early next, until the anthropogenic influence on global temperatures is reduced below the level of natural variability.

Operationalizing Article 2

CAN believes that global mean temperature is the most appropriate surrogate for impacts of all kinds in operationalizing Article 2. It is recognizing that this has limitations but policy needs to have a relatively simple measure to guide action and there is no other readily obvious measure that can be used in setting global targets. Where there is uncertainty in converting local and regional estimates of damages to the global mean level the precautionary principle should be applied. Once a global mean surface temperature limit this needs to be converted into greenhouse gas emissions over timeframes ranging from five year commitment periods to centuries. It seems clear, given the complexities of the climate system and the remaining uncertainties in climate science, particularly in the area of climate sensitivity, that setting a specific long-term GHG concentration target to correspond to such limits is not feasible and may not be wise.

The scale and magnitude of the impacts and risks identified above raise a further key issue in relation to the operationalizing of Article 2 of the UNFCCC. Many have assumed that prevention of dangerous climate change would be associated with the stabilization of greenhouse gas concentrations at above current levels and sometime in the coming century or century and a half. As described in the preceding section the Climate Action Network has reached the conclusion that the global mean warming will need to be reduced over time from whatever peak is reached. This means that a stable atmospheric concentration of CO_2 and other greenhouse gases may not be approached for several centuries.

Climate targets and ceilings

Taking account of the issues and factors mentioned above the Climate Action Network believes that:

- The global mean temperature increase should be kept below 2˚C above pre-industrial levels with the temperature being reduced as rapidly as possible after the time of peaking.
- The rate of warming should be brought below a ceiling of 0.1°C temperature change per decade as soon as possible in order to allow ecosystems to adapt.

Limiting the global mean increase of temperature to below 2˚C is unlikely to be "safe" in the sense that risk of large damages or of rapid irreversible changes are completely avoided. The best that can be said is that the lower the peak temperature, the lower is the risk. Nevertheless peaking the warming at below 2°C and reducing as fast possible thereafter will reduce the probability of large scale dangerous changes for most regions and hopefully limit the damage to natural and human ecosystems.

What do these targets and ceilings mean for emissions and concentration

The consequence of these targets for the peak concentration of CO_2 in the coming century cannot be determined with precision as it would depend on reductions taken for other gases, on the climate sensitivity and other factors. Nevertheless a plausible range of parameters indicates that CO_2 concentration would have to peak no higher than 450 ppmv and probably somewhat lower[1]. As a consequence of the need to reduce the warming, arrest the thermal sea level rise and minimize the risk of ice sheet decay or collapse cited above, the CO_2 concentration would then have to be reduced.

In practical terms emissions corresponding to progress towards meeting the temperature targets will need to be calculated at each time step (e.g. five year commitment period) taking into account the temperature change and sea level rise targets, scientific uncertainty in relation to the climate sensitivity, carbon cycle and other system components, and the potential for extreme outcomes, abrupt change and surprises. Article 3.3 of the Climate Convention requires the application of the precautionary principle in this context to ensure that emission reductions in each period are consistent with the achievement of the climate targets and ceilings. It is beyond the scope of this paper to describe the range of emissions that would correspond at each five-year period, however some important conclusions can be reached as to the overall shape of the global emission reductions needed.

[1] Other non-CO2 greenhouse gases would add approximately 100 ppmv CO_2 equivalent to give an effective CO2 concentration of around 550 ppmv CO_2 equivalent. The equilibrium warming that would result from this is in the range of 1.5-4.5°C for the IPCC estimate of the range of climate sensitivity to a doubling of CO_2 or 2.5°C for the IPCC's best estimate. With a transient peak in greenhouse gas concentrations the equilibrium would of course not be reached, however a sizeable fraction of it would and for mid range climate sensitivities would almost certainly approach and could exceed 2°C.

The slow rate of uptake of CO_2 by the ocean means that global CO_2 emissions to the atmosphere will need begin to drop quite rapidly well before the peak concentration is reached, and will need to be close to zero by 2100. Absolute reductions of about 80% by Annex 1 countries by mid-century relative to 1990 are needed, followed by further reductions towards zero by 2100. Per capita emissions in Annex I countries have to fall quickly as a consequence. Rapid decoupling of economic growth and emissions in developing countries will also need to start soon to ensure that global emissions of CO_2 reach close to zero by the end of the century. In achieving full account must be taken of the rights of people to sustainable development and in particular the provision of affordable energy services.

ENDS