The 2° C. Target **Information reference document**

Background on impacts emission pathways mitigation options and costs.

Prepared and adopted by the EU climate change expert group 'EG Science' 9 July 2008.

The 2.0° C. limit cannot be considered as entirely safe, as severe impacts are likely to occur increasingly as the global mean temperature rise approaches 2.0° C above pre-industrial levels. Changes in extremes such as heat waves, droughts, and extreme precipitation events will largely shape future climate change impacts. In particular significant impacts are expected species ecosystems, water resources, low latitude agriculture and small island states.

Water

Already at current levels of global warming significant changes in water resources are evident and impacts in the water sector will become increasingly severe as precipitation and evaporation will continue to be altered as a consequence of climate change. The numbers additional people at risk of water stress is projected to increase substantially with increasing temperature from 0 .4 to 1.1 billion for a 1 to 1.5° C. warming above industrial levels to 1.1 to 3.2 billion for 3 to 4° C. warming. Sea level rise will lead to salinization of groundwater affecting water supplies in coastal regions.

More than 1/6 of the world's population live in snowmelt and glacier fed river basins, and depend on these systems for water resources. These basins are subject to increased river run-off during the peak spring and summer melt time causing structural damage and flooding. Whilst water flows increase at first, as glacier mass declines melt and run of will substantially decrease. This will result in substantially increased water stress in such regions e.g. Ganges basin which is home to about half 1 billion people.

Agriculture and food security.

Risks to food production and security of projected to differ greatly by region. Above a global temperature rise of 1.5 to 2.0° C. there is an increasing risk of a declining global food production. Even below this level at lower latitudes especially in the seasonally dry tropics agriculture will be negatively affected by climate change with negative impacts on the yield of major cereal crops. Food security and agricultural incomes are likely to be under threat in many regions of Africa, Asia and Latin America.

Health

Human health will be strongly affected by climate change. Severe heat stress has already cost loss of life in Europe and other regions of the world. Even a moderate temperature increase well below 2° C. is likely to result in negative impacts in the health sector such as increased burden from malnutrition, increased incidence of diarrheal diseases, and many vector, food, and waterborne infectious diseases. In particular it will lead to a net increase in the geographic range of malaria and dengue fever. Adverse health impacts will be greatest in low income countries.

Extreme events

Increases in global mean temperatures will result in significant changes in the intensity frequency and location of extreme events such as heat waves, flooding, wildfire, and tropical cyclones even below 2°C rise in temperature. Greater warming is projected to further substantially increase the risk, frequency and intensity of many extreme events. Extended heat waves are projected to become more intense and frequent, adversely affecting human health, natural ecosystems, agriculture, and industry. Heat and drought would also strongly increase the risk and severity of wildfires. Tropical cyclone intensity is projected to increase with increasing tropical sea surface temperatures and hence with increasing levels of global warming.

Coastal zone small islands and sea level rise.

Even if the global temperature is stabilized, sea level would continue to rise for many **centuries to millennia** due to the enormous thermal inertia of the oceans and the slow melting major ice sheets. Sustained global warming greater than 1.5 to 2.5° C. is a threshold beyond which there is likely to be a commitment to at least partial de-glaciation of the Greenland ice sheet and possibly of the West Antarctic ice sheet causing sea level rise of 4 to 6 m over centuries to millennia.

Coastal zones are home to about 1/5 of the world's population and population growth rates in these areas of very high. Sea level rise, possibly in combination with changing atmospheric circulation patterns, will increase the risk of storm surges. Sea level rise also increases coastal erosion and has impacts on groundwater levels and ecosystems in coastal zones. Small islands are especially vulnerable to an increase in sea level.

Distribution of impacts

The impacts of climate change are not evenly distributed across regions and sectors. At global warming levels below 2° C a few sectors in certain regions might benefit from climate change (e.g. agriculture and tourism in high latitude regions), while in most other regions and sectors effects are likely to be negative and sometimes even severely so. For many countries a 2°C warming limit cannot be wholly safe. Generally less developed areas are at greatest risk to both higher sensitivity (e.g. small islands) and low adaptive capacity. Climate change is identified as a major obstruction to poverty reduction objectives and achievement of the millennium development goals.

Security and migration

Climate change could within a few decades become a major threat to international security. Climate change will add an additional burden to already existing pressures in relation to food security and water availability in many unstable regions particularly in the developing world. Moreover climate change is likely to increase storm and flood disasters. The population in already politically unstable states with poorly performing governments and institutions will be most affected since climate change will overwhelm local capacities to adapt. Climate change is likely to induce additional migration both within national borders and internationally. Europe and North America are unlikely to have to face substantially increasing migrate three pressure this migration will likely become an additional source of destabilization on national regional and international scales.

Economic impacts

Many Economic sectors and activities will be adversely affected by climate change. Current studies estimate that for global mean temperature increase of about 2 to 3° C. above preindustrial levels positive market impacts such as increasing crop yields in high latitude regions almost balance the negative market impacts of climate change giving rise to aggregate impacts of plus or minus a few percent of global gross domestic product. However positive impacts on not likely to be evenly distributed. Most people particularly in developing countries will be negatively affected.

Land biosphere.

Currently the global land biosphere acts as a net sink for CO2. Projected climate change is likely to add CO2 to the atmosphere and to increase the fraction of anthropogenic emissions the stay airborne producing an additional warming of 0.1 to 1.5° C, which is already included in the AR4 temperature range 1.1 to 6.4° C. However additional releases of CO2 and methane are possible from permafrost, peat lands, wetlands, and large stores of marine hydrates in high latitudes. These feedbacks are generally expected to increase with climate change. Some models indicate the risk that the land biosphere turns into a net source of CO2 by the 2050s. A number of models also project an increase in biogenic methane emissions from wetlands and permafrost associated with a warming climate. Methane is the second most important contribution to the anthropogenic greenhouse effect. Several studies indicate that a warming of 2° C. would result in about a 20% growth in methane emissions from wetlands and the emissions are likely to further increase at higher temperatures. Furthermore methane stored in the form of methane hydrates on the seafloor and in permafrost soils could become increasingly unstable with rising temperatures. Even though the catastrophic sudden release of large amounts of methane is considered unlikely to happen on short to medium time scales, ongoing chronic release of methane as a result of anthropogenic warming could result in a substantial increase in its atmospheric concentration thus further amplifying climate change.

Concentration stabilization levels for keeping below 2° C.

The complexity of the climate system does not allow the temperature response to greenhouse gas emissions to be estimated with certainty. For example the IPCC estimates that doubling the atmospheric greenhouse gas concentrations relative to preindustrial levels i.e. to about 550 ppm CO2 equivalent , is likely to increase the global temperature by at least 2.0° C. and up to 4.5° C. above preindustrial temperatures . The best guess is that this doubling of concentrations will cause of global average temperature increase of 3.0° C. In order to meet the 2.0° C. target with at least a 50% probability atmospheric CO2 equivalent concentration would need to be stabilized at approximately 440 ppm. or lower. Stabilization at 400 ppm. CO2 equivalent or lower would raise the probability of keeping the temperature increase 2.0° to about 66%.

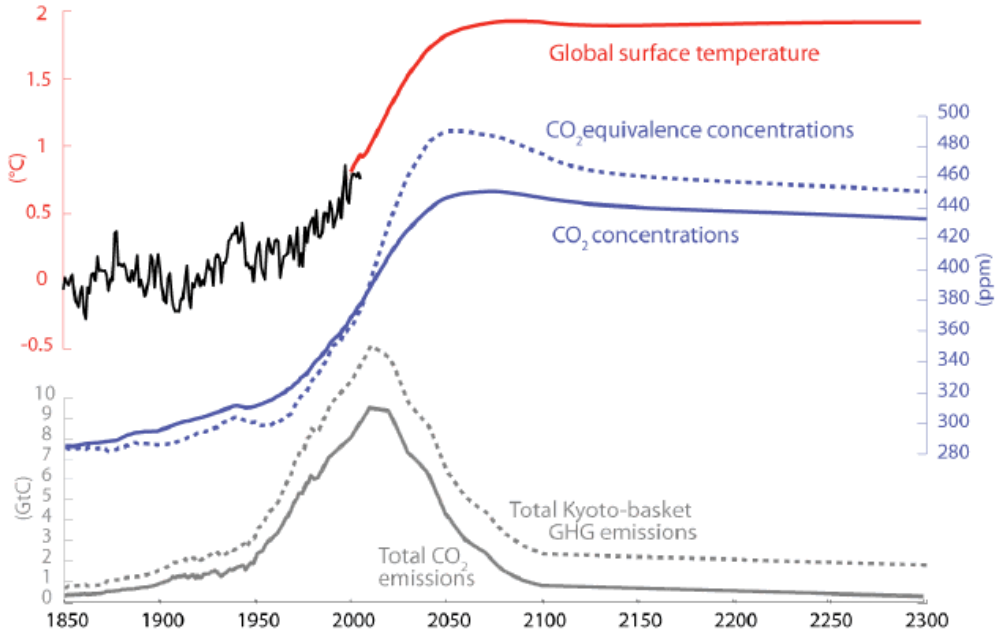

Fig 3.3: Schematic overview of historic total CO_2 emissions (grey), concentrations (blue) and global mean temperatures (black/red) and illustrative time-series for a future evolution highlighting the inertia of the climate system and the different peaking years. If global emissions peak in the near term, CO_2eq concentrations could peak around the middle of the century before approaching long-term stabilisation levels consistent with a 2°C target. Owing to the inertia of the climate system, the peak in concentrations is not necessarily reflected in the global mean temperature[7].

Summary

Global warming of 2.0° C. above preindustrial levels cannot be considered safe. Considerable climate change impacts are already felt today and will have to be faced in the future even below 2.0° C. Beyond this level climate change impacts will increase substantially in scale and severity including threats to unique ecosystems risks of multimedia long-term sea level rise and both more frequent droughts and floods across the globe. If no action is taken we may exceed 2° C. already by the middle of this century. [….]

In summary acting on climate change ambitious dream swiftly is the only rational insurance strategy against the risks of irreversible climate change damages. This is why the EU believes that the 2.0°C can and should guide global efforts to address climate change.