What is the IPCC saying and what does it mean?

Scientists outline possible futures for policymakers to decide on

Background briefing accompanying the IPCC AR5 WG1 launch. 27.9.2013

"This report is about two different futures. Either we continue on the current path of burning fossil fuels and stoking the fires of climate change or we turn a different corner. By taking strong and rapid action to switch to renewable energy, phase out fossil fuels and protect our forests, we can still prevent catastrophic levels of warming of two degrees or more."

"There is a better future than the one we're currently facing and it's ours if we want it."

(Stephanie Tunmore, Greenpeace)

The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the scientific assessment of climate change. It is most known for its comprehensive Assessment Reports, published about every six years since 1990. The 5th Assessment Report (5AR) will be published during 2013 and 2014 in four stages. The first release - Working Group 1 report (WG1) – was launched on September 27th, 2013 in Stockholm.

The WG 1 report summarises what we know about climate change, what is causing it, how it can be observed and what's ahead in terms of temperature increase, sea-level rise, glacier melting, extreme weather events and so on, depending on future pollution. **The WG1 report does *not* discuss in detail the impacts of warming or ways to prevent it**. Impacts, adaptation and vulnerability will be covered by the Working Group II report in March next year, and ways to prevent further warming by the Working Group III in April. Finally, in October 2014, the Synthesis Report will bring the whole story together.

What are the main findings of the WG1?

The IPCC further confirms what we already knew with the help of new observations, theoretical analyses, and modelling studies.

Human-caused climate change can be detected around the world. Our greenhouse gas pollution has warmed the atmosphere and oceans, melted glaciers, raised sea levels, changed water cycles and increased some extreme weather events. In addition, our carbon dioxide emissions are turning oceans more acidic at an unprecedented rate[1], threatening marine life. It is now *virtually certain* that human influence has warmed the global climate system[2].

The decade of the 2000s has been the warmest in the instrumental record. Despite global-mean surface temperatures growing somewhat slower in the past 15 years, overall warming continues and the climate system as a whole, including the ocean below 700 m depth, has continued to accumulate energy. Observations of CO_2 concentrations, average temperature and sea level rise are generally well within the range of the earlier IPCC projections[3].

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There are alarming signs of accelerating impacts. In the past decade (2002-2011) Greenland Ice Sheet was losing mass about six times faster in average than just the decade before[4]. The Antarctic ice sheet, too, was losing mass five times faster[5]. Since 1993 sea-levels have risen twice as fast as in the past century on average[6]. Sea ice extent in the Arctic has been diminishing *significantly faster* than projected. The North Pole, a place we've learned to think of as permanently covered by ice, could in the future be ice-free in summer[7].

The longer we keep on burning fossil fuels and clearing forests, the worse the consequences will become. There are many impacts we can no longer avoid, even if emissions are cut fast. Temperatures will continue to increase, ice to melt, sea-level to rise, permafrost to retreat and extreme weather events will increase. But by acting now we can make a huge difference to how bad the impacts will get - especially in the longer run.

By keeping warming below 2°C we can significantly reduce future impacts. The IPCC has assessed four new scenarios for the future, one that would keep warming below 2 degrees Celsius (with median warming of about 1.5°C by 2100), one that's "business as usual", and could result in close to 5°C warming by 2100, and two in between[8]. Comparing these possible futures builds a strong case for rapid action. By limiting warming to less than 2°C above pre-industrial levels we can significantly lower the scale of further warming, sea-level rise, ice melting, ocean acidification and extreme weather events as well as lower the risks of triggering abrupt changes with unknown consequences[9].

Emissions must peak and start declining before 2020, towards a phase out of fossil fuel emissions. There's not much "space" left in the atmosphere for further emissions, if we want to avoid the worst impacts. If our fossil fuel and industry emissions continued to grow by 3.2 % a year, as they did in 2000-2009, almost half of our remaining "budget" would be used up in just little over a decade[10]. Following the lowest scenario assessed by the IPCC, that gives a 66% likelihood of staying below 2°C, growth of global emissions would need to peak before 2020 and rapidly decline towards zero emissions by 2070[11]. *Aiming for higher certainty, ruling out negative emissions or getting a slower start will require faster emission cuts.*

Lessons from past teach caution. During the last interglacial period, when the temperature was not more than 2°C above pre-industrial levels, global sea level was about 5m – 10m higher than present. This implies substantial melting of the Greenland and the Antarctic ice sheets and is an important reminder of why the target of keeping below 2°C matters. Such melting, if initiated by crossing a threshold, would take a long time to come to completion (centuries to millennium), but once triggered could be impossible to stop.

Long-term warming trend is robust. Over shorter periods the rate of warming can vary and either be somewhat faster or slower. Trends on short periods like 15 years can vary a lot and do not in general reflect long-term climate trends. About half of the slower warming since 1998 can be attributed to natural variation including in atmosphere-ocean interaction where a larger part of the warming has been taken up by the ocean and less by the atmosphere (medium confidence). The other half can be attributed to current phase of the sun's 11-year cycle and the action of a series of small volcanic eruptions, which temporarily during this period has counteracted the forcing due to greenhouse gas emissions. **This temporary slow-down of warming doesn't change the nature of long-term warming trend.**

What does it all mean in terms of action needed?

It is still possible to prevent dangerous or even catastrophic warming of 2°C or more, which is the goal governments have agreed to under the UN climate negotiations. It's not easy, and it's not at all where we're currently heading, but it's technically and economically doable. If we followed the most optimistic scenario assessed by the IPCC (so-called RCP2.6 scenario) we would likely keep warming below 2 degrees[12]. **By 2100 temperature increase could be as low as 1.5 degrees above pre-industrial levels**, but not with good likelihood.

In light of the WG1 report, here's what's needed to prevent catastrophic climate change:

- **We stop the growth of global emissions well before 2020** and turn them into a rapid decline towards zero emissions around mid-century. Countries' current climate targets and policies must be tightened accordingly. Tackling coal emissions will be crucial as coal explains most of the record fossil CO_2 emissions growth in the past few years. In this light, the growing citizen movement around the world that's stopping coal plants and mines with demands for clean air, clean water and clean energy is truly inspiring. China's recent decision to ban new coal power plants in three major industrial regions and to peak and decline their coal use by 2017, due to air pollution concerns, marks a significant policy shift. So do the recent decisions by the World Bank and European Investment Bank to stop almost all coal lending. Some market analysts suggest we are already seeing the beginning of the end of coal.

- **We accelerate clean energy revolution**. Since the last IPCC report, renewable energy has grown fast around the world. There's now 10 times more solar panels, 6 times more concentrating solar thermal power and 3 times more wind power capacity in the world than there was in 2007[13]. Costs have come down remarkably and renewables are increasingly competitive in a growing number of markets. Citizens and communities are increasingly becoming drivers of clean energy revolution - with their own decentralised renewable energy production. Stopping energy waste and increasing efficiency will be fundamental in transitioning smart energy systems.

- **We accept that most fossil fuels found must remain on ground**. To stay below 2°C warming, most proven reserves of fossil fuels must stay in the ground. The IPCC findings further confirm this, by estimating the limited amount of carbon we can afford to burn. Governments, the energy industry and investors must truly factor this in, when making choices. Some already do. Storebrand, Norway's second-largest insurer and a leading pension fund in the Scandinavian region, recently decided to divest from 6 oil sands companies and 13 coal companies to reduce its fossil fuel exposure. Asset owners and managers can be expected to increasingly wake up to the realities of climate change and "unburnable carbon".

- **We accelerate global cooperation on climate**. Most big polluters in UN climate negotiations are simply playing time, blaming each other and waiting for somebody else to do something first. This is a lose - lose game. The logjam can only be unblocked by individual countries taking bold action. 2015 is when countries have agreed to seal a new global agreement. In 2014 they need to start making emissions reduction offers, explaining how their post-2020 emissions reductions targets would be fair and adequate contributions to keeping below 2°C as they've jointly promised - or even 1.5°C as rightfully demanded by vulnerable countries.

- **We protect the Arctic, our forests and our oceans and move to ecological farming, to build resilience.** A healthy ecosystem can better cope with external stress than one that's already in poor condition. That's why we must protect the Arctic, not exploit it. We need to establish networks of large-scale marine reserves to build resilience for ocean ecosystems that are under multiple stress due to overfishing, pollution, warming and acidification. We need to protect our forests and forestlands, as natural forests store more carbon than plantations and host rich biodiversity. And we move to ecological farming that will help coping with climate change.

In addition to emission cuts, we must prepare realistically for the impacts that are no longer avoidable. There will be plenty of further climate impacts we can no longer avoid - due to pollution we've already emitted and are bound to emit. Any development plan, infrastructure project, water management or food security programme that fails to factor realities of climate change will mean money and opportunities wasted. For example, in a climate constrained world, where water stress will increase, coal based energy that requires a lot of water in both mining and production makes little sense.

For more information about:

Greenpeace solutions for energy, see clean energy briefing and www.energyblueprint.info
Greenpeace Quit Coal campaign, see: http://www.greenpeace.org/coal/
Greenpeace campaign to protect the Arctic, see: http://www.greenpeace.org/arctic
Greenpeace solutions for forest protection, see www.greenpeace.org/forests
Greenpeace campaign to defend our oceans, see: http://www.greenpeace.org/oceans/
Or contact: kaisa.kosonen@greenpeace.org

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[1] The IPCC says the pH of seawater has decreased by 0.1 since the beginning of the industrial era and that by the end of the 21st century surface ocean PH can decline about 0.065 and 0.31. While the IPCC itself doesn't explain the significance of this in a context, recent research suggest (for example Hönisch et al (2012) The Geological Record for Ocean Acidification) that this rate is unparalleled in Earth's history, going back to at least 300 million years.
[2] WG1, TS, page 39
[3] "Observations of carbon dioxide (CO_2) concentrations, globally-averaged temperature and sea level rise are generally well within the range of the extent of the earlier IPCC projections." (Chapter 1, page 2)
[4] "There is high confidence that the mass loss of the Greenland Ice Sheet has accelerated since 1992: the average rate has very likely substantially increased from 34 [–6 to 74] Gt yr^{-1} over the period 1992–2001 (sea-level equivalent, 0.09 [–0.02 to 0.20] mm yr^{-1}), to 215 [157 to 274] Gt yr^{-1} over the period 2002–2011 (0.59 [0.43 to 0.76] mm yr^{-1})." (SPM, page 5)
[5] "The average rate of ice loss from Antarctic ice sheet has *likely* increased from 30 [–37 to 97] Gt yr^{-1} (sea level equivalent, 0.08 [–0.10 to 0.27] mm yr^{-1}) over the period 1992–2001, to 147 [72 to 221] Gt yr^{-1} over the period 2002–2011." (SPM, pages 5).
[6] " It is *very likely* that the mean rate of global averaged sea level rise was 1.7 [1.5 to 1.9] mm yr^{-1} between 1901 and 2010 (…) and 3.2 [2.8 to 3.6] mm yr^{-1} between 1993 and 2010. It is likely that similarly high rates occurred between 1920 and 1950." (SPM, page 6)
[7] A nearly ice-free Arctic Ocean (sea ice extent less than 10^6 km^2) in September is likely before mid-century under RCP8.5 (medium confidence). This assessment is based on a subset of models that most closely reproduce the climatological mean state and 1979 to 2012 trend of Arctic sea ice cover.
[8] Note that these are median warming estimations for 2100, above pre-industrial levels, to help comparing to the 2 degrees target governments have agreed to under the UN. The IPCC WG1 expresses estimated warming levels differently, as warming by 2081–2100, above 1986–2005 levels, with average values of 1.0°C for RCP2.6 and 3.7°C for RCP8.5. For 2100 figures above pre-industrial levels, see Rogelj et al (2012) Global warming under old and new scenarios using IPCC climate sensitivity range estimates. Nature Climate Change 2, 248-253. Table 2. (Online: http://www.nature.com/nclimate/journal/v2/n4/fig_tab/nclimate1385_T2.html)
[9] If we followed the business-as-usual pathway (RCP8.5) instead of one that keeps below 2 degrees (RCP2.6), sea-level rise by 2100 would be about two thirds higher (i.e. 73cm median warming instead of 44cm), permafrost area loss double, surface acidification would worsen indefinitely instead of stabilizing around 2035 and oceans would become significantly warmer. There would be no hope for Arctic Sea-Ice and the estimated threshold (1°C - 4°C) for Greenland ice sheet loss would be crossed.
[10] Cumulative fossil fuel emissions for the 2012-2100 period compatible with the RCP atmospheric CO2 concentrations, as derived from CMIP5 Earth System Models, are 270 (140 to 410) PgC for RCP2.6 (i.e. about 990 Gt CO2 for the median value).
[11] WG1, TS, Figure TS.19
[12] WG1, TS, page 50.
[13] REN21. Renewables 2013 Global Status Report.