IPCC’s 1.5˚ report tough on overshoot, critical of geoengineering

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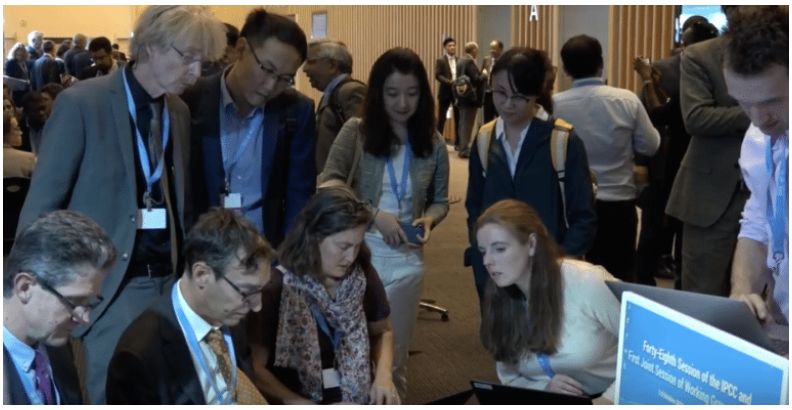

by Linda Schneider

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On October 8, 2018, the Intergovernmental Panel on Climate Change (IPCC) launched its Special Report on global warming at 1.5 above pre-industrial (SR1.5) The landmark report on 1.5 clearly is one of the most important scientific assessments conducted in the IPCC‘s 30-year history.

(The IPCC press conference was live-broadcasted and should be available on the IPCC YouTube channel shortly.)

The key messages of the IPCC‘s SR1.5 are surprisingly unwavering: 1.5 is feasible if radical emissions cuts, transformative pathways and the protection and restoration of natural ecosystems are implemented. But also: 1.5 is absolutely vital in order to contain the impacts of climate change and the risks for humans and ecosystems that are associated with it.

Emphasis on limiting warming to 1.5 without „overshoot“

The report accords particular, almost exclusive, attention to climate trajectories that keep global warming consistently below 1.5 throughout the 21st century or allow a limited „overshoot“ of 0.1°C at most, hence limiting global warming to no more than 1.6°C throughout the 21st century.
The focus on non-overshoot and limited-overshoot pathways is an important victory for all those who fought for a strict interpretation of the 1.5 target – above all, the Small Island Developing States and particularly vulnerable countries in the Global South.

So-called „high-overshoot“ pathways, in turn, would imply „overshooting“ the warming limit of 1.5 for a certain period of time (with global mean temperature rising up to <2°C) and then trying to lower the temperature with the help of geoengineering technologies that aim to suck CO2 from the atmosphere at mega-scales and bury it underground or in the oceans.

However, the report is clear on the implications of „overshooting“ 1.5: It would lead to irreversible impacts on humans and ecosystems, even if returning to 1.5°C towards the end of the century should turn out to be feasible (which is far from proven, as we‘ll see below):

> A3.2. Future climate-related risks depend on the rate, peak and duration of warming. In the

> aggregate they are larger if global warming exceeds 1.5°C before returning to that level by 2100 than if global warming gradually stabilizes at 1.5°C, especially if the peak temperature is high (e.g., about 2°C) (high confidence). Some impacts may be long-lasting or irreversible, such as the loss of some ecosystems (high confidence). {3.2, 3.4.4, 3.6.3, Cross-Chapter Box 8}

Moreover, there is a significant risk that a key tipping point in the climate system may be hit at around 1.5-2°C of global warming: Irreversible loss of the polar ice caps set the world on track for a multi-metre sea level rise in the long run:

> B2.2. Sea level rise will continue beyond 2100 even if global warming is limited to 1.5°C in the 21st century (high confidence). Marine ice sheet instability in Antarctica and/or irreversible loss of the Greenland ice sheet could result in multi-metre rise in sea level over hundreds to thousands of years. These instabilities could be triggered around 1.5°C to 2°C of global warming (medium confidence). {3.3.9, 3.4.5, 3.5.2, 3.6.3, Box 3.3, Figure SPM.2}

Climate change impacts at 1.5

Based on most recent scientific estimates, the report finds that warming of 1.0°C (+/- 0.2°C) has already occurred and that climate change impacts resulting from this warming are already being felt in many regions.
Global warming of 1.5°C, therefore, is a real danger for millions of people around the world and requires comprehensive adaptation measures as well as financial and technological support on the part of those historically responsible for climate change. This was a particular concern for many countries in the Global South:

> B2.1. Model-based projections of global mean sea level rise (relative to 1986-2005) suggest an indicative range of 0.26 to 0.77 m by 2100 for 1.5°C global warming, 0.1 m (0.04-0.16 m) less than for a global warming of 2°C (medium confidence). A reduction of 0.1 m in global sea level rise implies that up to 10 million fewer people would be exposed to related risks, based on population in the year 2010 and assuming no adaptation (medium confidence). {3.4.4, 3.4.5, 4.3.2}

Radical emissions reductions and transformative pathways

Due to all of these risks and potentially irreversible impacts, the report opts for a rigorous interpretation of the 1.5 target and focuses on mitigation scenarios that minimize or avoid overshoot altogether.

To that end, the report issues a clear call for radical emission cuts: Global CO2 emissions need to be reduced by around 45% by 2030 (compared to 2010 levels), and reach zero in around 2050.

> C. Emission Pathways and System Transitions Consistent with 1.5°C Global Warming
> C1. In model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO2 emissions decline by about 45% from 2010 levels by 2030 (40–60% interquartile range), reaching net zero around 2050 (2045–2055 interquartile range). For limiting global warming to below 2°C11 CO2 emissions are projected to decline by about 20% by 2030 in most pathways (10–30% interquartile range) and reach net zero around 2075 (2065–2080 interquartile range). Non-CO2 emissions in pathways that limit global warming to 1.5°C show deep reductions that are similar to those in pathways limiting warming to 2°C. (high confidence) (Figure SPM.3a) {2.1, 2.3, Table 2.4}

The IPCC's recommendations for achieving those emission cuts? A faster and more comprehensive phase-out of fossil fuels, faster electrification, lowered energy demand, changes in consumption and dietary patterns, and protecting and restoring natural ecosystems.

Game over for fossil fuels

Of particular relevance for the German context: Among all fossil energy sources, coal shows the steepest decline in all 1.5 mitigation pathways. In 2030, the share of coal in primary energy has already dropped by 60-80% and reaches a 0% share in global (!) electricity in 2050:

> C2.2…. In modelled 1.5°C pathways with limited or no overshoot, the use of CCS would allow the electricity generation share of gas to be approximately 8% (3–11% interquartile range) of global electricity in 2050, while the use of coal shows a steep reduction in all pathways and would be reduced to close to 0% (0–2%) of electricity (high confidence). While acknowledging the challenges, and differences between the options and national circumstances, political, economic, social and technical feasibility of solar energy, wind energy and electricity storage technologies have substantially improved over the past few years (high confidence). These improvements signal a potential system transition in electricity generation (Figure SPM.3b) {2.4.1, 2.4.2, Figure 2.1, Table 2.6, Table 2.7, Cross-Chapter Box 6 in Chapter 3, 4.2.1, 4.3.1, 4.3.3, 4.5.2}

For rich industrialized and high-polluting countries with historical responsibility for climate change (with Germany at the sharp end), the upshot is straight-forward: An immediate coal phase-out!

Radical emissions reductions and transformative pathways are not only required in the energy sector, but also in industry, infrastructure, buildings, transportation and the land sector. The IPCC finds: Those system transitions are an enormous challenge, but feasible:

> C2. Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options (medium confidence). {2.3, 2.4, 2.5, 4.2, 4.3, 4.4, 4.5}

Rejection of geoengineering

The report articulates a surprisingly decided critique of geoengineering technologies. In a single, brief paragraph, Solar Radiation Management (SRM) is rated as uncertain and risky; in addition, concerns around international governance, ethics and impacts on sustainable development are stated:

> C1.4. Solar radiation modification (SRM) measures are not included in any of the available assessed pathways. Although some SRM measures may be theoretically effective in reducing an overshoot, they face large uncertainties and knowledge gaps as well as substantial risks, institutional and social constraints to deployment related to governance, ethics, and impacts on sustainable development. They also do not mitigate ocean acidification. (medium confidence).
> {4.3.8, Cross-Chapter Box 10 in Chapter 4}

Technologies for Carbon Dioxide Removal (CDR) such as Bioenergy with Carbon Capture and Storage (BECCS) are viewed critically in the report as well. In particular at scales that most of the „overshoot“ pathways rely on, their deployment will not be feasible, the report finds.
CDR technologies predominantly modelled in 1.5 pathways are BECCS and large-scale afforestation (usually monoculture tree plantations). The IPCC confirms them to carry enormous risks and adverse impacts on ecosystems, biodiversity and food security due to to the fact that they require exorbitant amounts of land as well as water, energy and resources

> C3.4. Most current and potential CDR measures could have significant impacts on land, energy, water, or nutrients if deployed at large scale (high confidence). Afforestation and bioenergy may compete with other land uses and may have significant impacts on agricultural and food systems, biodiversity and other ecosystem functions and services (high confidence). Effective governance is needed to limit such trade-offs and ensure permanence of carbon removal in terrestrial, geological and ocean reservoirs (high confidence). Feasibility and sustainability of CDR use could be enhanced by a portfolio of options deployed at substantial, but lesser scales, rather than a single option at very large scale (high confidence). (Figure SPM.3b). {2.3.4, 2.4.4, 2.5.3, 2.6, 3.6.2, 4.3.2, 4.3.7, 4.5.2, 5.4.1, 5.4.2; Cross-Chapter Boxes 7 and 8 in Chapter 3, Table 4.11, Table 5.3, Figure 5.3}

The IPCC's hope that a „portfolio approach" of CDR technologies will alleviate their individual risks and negative impacts is unfounded and objectionable: First, the scales of deployment of individual CDR technologies in a „portfolio approach" would still be gigantic.
Second, as the report itself concludes, many of the proposed CDR technologies imply consumption of vast areas of land, energy, water and resources. The risks and adverse impacts on human communities, human and land rights as well as natural ecosystems and biodiversity would therefore accumulate and amount to similarly devastating scales if those technologies were deployed in addition and on top of each other.

In addition, the report states that even from a climate system perspective, the effectiveness of large-scale CDR or so-called „negative emissions" is far from proven:

> C3.3. Pathways that overshoot 1.5°C of global warming rely on CDR exceeding residual CO2 emissions later in the century to return to below 1.5°C by 2100, with larger overshoots requiring greater amounts of CDR (Figure SPM.3b). (high confidence). Limitations on the speed, scale, and societal acceptability of CDR deployment hence determine the ability to return global warming to below 1.5°C following an overshoot. Carbon cycle and climate system understanding is still limited about the effectiveness of net negative emissions to reduce temperatures after they peak (high confidence). {2.2, 2.3.4, 2.3.5, 2.6, 4.3.7, 4.5.2, Table 4.11}

In fact, that somewhat bland sentence significantly understates the importance of the message the report is trying to convey here: It is far from clear if the hypothetical concept of „negative emissions" could ever deliver on its promise, even if technologies to remove CO2 from the atmosphere were developed and implemented at scale, despite the social and environmental risks associated with them.

The upcoming 6th Assessment Report (AR6, to be published in 2020/21) will attend to that question in more detail. To date, knowledge around the question on how the global carbon cycle will repond to large-scale CO2 removal is very limited. But what existing research suggests is that it might be more difficult as previously thought. Above all, that has to do with the fact that the climate is a dynamic system and doesn't always respond in a linear fashion – that is to say: Even if we were able to reduce CO2 concentrations after a temperature overshoot, that would not necessarily mean that other climate parametres, such as global temperatures, would follow suit. Moreover, tipping points that could be reached during an overshoot, and the feedback proccesses in the climate system thereby set in motion, are not reversible.

The land sector: Natural ecosystems or BECCS?

Quite unlike highly problematic geoengineering approaches such as BECCS, there are significant potentials to draw down and sequester CO2 in safe and sustainable ways through the protection and careful restoration of natural ecosystems – forests, above all, but also other terrestrial and marine ecosystems. The report gives them a very positive rating due to the benefits they bring for biodiversity, soil quality and local food security:

> C3.5. Some AFOLU-related CDR measures such as restoration of natural ecosystems and soil carbon sequestration could provide co-benefits such as improved biodiversity, soil quality, and local food security. If deployed at large scale, they would require governance systems enabling sustainable land management to conserve and protect land carbon stocks and other ecosystem functions and services

(medium confidence). (Figure SPM.4) {2.3.3, 2.3.4, 2.4.2, 2.4.4, 3.6.2, 5.4.1, Cross-Chapter Boxes 3 in Chapter 1 and 7 in Chapter 3, 4.3.2, 4.3.7, 4.4.1, 4.5.2, Table 2.4}

Systemic socio-economic and socio-ecological thinking is not the IPCC's first language, including thinking about ecosystem-based climate solutions. For that reason the IPCC has so far not been able to draw useful distinctions between geoengineering proposals such as BECCS and afforestation on the one hand and the protection and ecological restoration of natural ecosystems on the other hand. Instead the IPCC lumps all proposals to remove CO2 together under the label of Carbon Dioxide Removal (CDR).

Because Integrated Assessment Models (IAMs) – which play a very dominant role in IPCC reports – find it much easier to model monoculture tree plantations and bioenergy than biodiverse and complex ecosystems, there is a strong need for improvement in the way the IPCC views the land sector.
There is hope, however, that the upcoming Special Report on land (the second in a series of three Special Reports that will feed into AR6) will already accomplish some of the necessary precision work in that direction and deliver a more nuanced, in-depth assessment of climate solutions in the land sector.

Relevant in this context are both the potential for avoided emissions from agriculture when shifting to alternative modes of agricultural production (read: agroecology rather than „intensification") and the potential of natural ecosystems to draw down CO2 in a much more stable and socially and environmentally sustainable way than monoculture tree plantations or geological storage.

In that regard, we're delighted to announce a key report that will be published next week: The Climate Land Ambition & Rights Alliance (CLARA) – an alliance of civil society groups, peoples organizations, faith-based groups and independent researchers with a strong focus on human and land rights, in particular those of Indigenous Peoples and local communities, natural ecosystems, agroecology and food sovereignty, of which Heinrich Böll Foundation is a member – launches its ground-breaking report on rights-based and ecosystems-based approaches in the land sector. We'll be back with a blog on this next week.

Radical Realism at the IPCC?

The IPCC's language on issues of social justice and equity is surprisingly bold as well: The report describes social justice and reduced inequality as key pillars of climate-resilient (and climate-just!) futures. It also underscores the importance of local and indigenous knowledge:

> D6. Sustainable development supports, and often enables, the fundamental societal and systems transitions and transformations that help limit global warming to 1.5°C. Such changes facilitate the pursuit of climate-resilient development pathways that achieve ambitious mitigation and adaptation in conjunction with poverty eradication and efforts to reduce inequalities (high confidence). {Box 1.1, 1.4.3, Figure 5.1, 5.5.3, Box 5.3}
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> D6.1. Social justice and equity are core aspects of climate-resilient development pathways that aim to limit global warming to 1.5°C as they address challenges and inevitable trade-offs, widen opportunities, and ensure that options, visions, and values are deliberated, between and within countries and communities, without making the poor and disadvantaged worse off (high confidence). {5.5.2, 5.5.3, Box 5.3, Figure 5.1, Figure 5.6, Cross-Chapter Boxes 12 and 13 in Chapter 5}

Quite interestingly, the report makes a pronounced statement on redistributive policies that can prevent mitigation measures from reinforcing existing inequalities (that, among other effects, result in hunger and malnutrition, poverty and energy poverty), or indeed reduce existing inequalities:

> D4.5. Redistributive policies across sectors and populations that shield the poor and vulnerable can resolve trade-offs for a range of SDGs, particularly hunger, poverty and energy access. Investment needs for such complementary policies are only a small fraction of the overall mitigation investments in 1.5°C pathways. (high confidence) {2.4.3, 5.4.2, Figure 5.5}

We can almost suspect Radical Realism making inroads into the IPCC: The report puts a clear spotlight on mitigation pathways that reduce global energy demand, resource and material consumption and show changes in dietary and food consumption patterns. Those pathways, the IPCC finds, have strong synergies with sustainable development and with achieving the Sustainable Development Goals (SDGs), as well as reduce the need to bet on high-risk and uncertain CDR technologies.

> D4.2. 1.5°C pathways that include low energy demand (e.g., see P1 in Figure SPM.3a and SPM.3b), low material consumption, and low GHG-intensive food consumption have the most pronounced synergies and the lowest number of trade-offs with respect to sustainable development and the SDGs (high confidence). Such pathways would reduce dependence on CDR. In modelled pathways sustainable development, eradicating poverty and reducing inequality can support limiting warming to 1.5◦C. (high confidence) (Figure SPM.3b, Figure SPM.4) {2.4.3, 2.5.1, 2.5.3, Figure 2.4, Figure 2.28, 5.4.1, 5.4.2, Figure 5.4}

Even if the negotiations almost fell apart at the last minute when a small number of oil-exporting countries did everything they could to prevent mention of nationally determined contributions (NCDs) submitted under the UNFCCC as well as mention of the Paris Agreement altogether (!), on balance, the report offers a good and forward-looking result.

The political messages coming out of the IPCC at this point are precisely what the world needs to hear: It is possible to limit global warming to 1.5, and it is necessary to contain the impacts of the climate crisis. 1.5°C, essentially, is the new 2°C. However, limiting global warming to 1.5°C requires fast and spirited climate action and deep emissions cuts that can be achieved through a timely and managed decline of fossil fuel production, the comprehensive upscaling of renewable energy, but also through changes in production and consumption patterns as well as the protection and vast but carefuly restoration of our natural ecosystems.