Fact sheet on the proposed IPCC Special Report on 1.5°C in 2018

The request from the UNFCCC for the IPCC 1.5°C special report

The mandate for the special report is outlined in decision Paragraph 21/CP. 21 accompanying the adoption of the Paris Agreement:

> *"Invites the Intergovernmental Panel on Climate Change* ***to provide a special report in 2018 on the impacts of global warming of 1.5 °C*** *above pre-industrial levels* ***and related global greenhouse gas emission pathways****"*

The mandate explicitly calls for information on the **impacts of climate change at 1.5°C** that **should be comprehensively addressed** in the special report.

In addition, the reference to "related global greenhouse gas emission pathways" is linked within the CP.21 Decision text and the Paris Agreement to to the question of the need for increased ambition and emissions referred to in paragraph 17/CP. 21:

> *"Notes with concern that the estimated aggregate greenhouse gas emission levels in 2025 and 2030 resulting from the intended nationally determined contributions do not fall within least-cost 2 ˚C scenarios …, and also notes that* ***much greater emission reduction efforts will be required*** *… in order to hold the increase in the global average temperature to below 2 ˚C … or to 1.5 ˚C above pre-industrial* ***levels by reducing to a level to be identified in the special report referred to in paragraph 21 below.****"*

The recommendation of the IPCC Chair and Bureau to accept the invitation for the special report

The IPCC has been set up to provide scientific advice to the UNFCCC and its full assessments, special reports and technical papers have always responded to requests from the UNFCCC, including in relation to the timing and availability of these reports and products.

In responding to the request from the UNFCC and for decision at the IPCC 43rd plenary in Nairobi 11-13 April 2016 the Chair of IPCC and Bureau have put forward:

> *"A* ***recommendation to accept the invitation from the COP21 to*** *prepare a* ***Special Report on the impacts of global warming of 1.5°C*** *above pre-industrial levels and* ***related global greenhouse gas emission pathways*** *and* ***that the scope of such Special Report would be addressed during the scoping process.*** *"*[1]

This recommendation is independent from decision on other products and special reports that may be adopted. In particular, the recommendation is also **not to prejudge in any regard the scope of this 1.5°C report**.

[1] IPCC-43, Provisional Annotated Agenda; IPCC-XLIII/Doc. 1, Add. 1

Relevance of the 1.5°C Special Report for the UNFCCC and implementation of the Paris Agreement 2018 to 2020

Both the timing and content of the ***1.5°C*** Special Report are vital for the implementation of the Paris agreement and concern the following processes:

Input to the 2018 facilitative dialogue to strengthen the Nationally Determined Contributions (NDCs) in 2018:

> "…facilitative dialogue among Parties in 2018 to take stock of the collective efforts of Parties in relation to progress towards the long-term goal… and to inform the preparation of nationally determined contributions" (20/CP.21)"

By 2020, Parties with 2025 NDCs to communicate new NDCs, Parties with 2030 NDCs to communicate or update these contributions.

Provide best available scientific advice in relation to the aggregate ambition of INDC' and means of closing the gap implied by the current (i)NDCs in relation to the 1.5oC limit (17/CP.21)

Parties preparing long-term low greenhouse gas emission development strategies due to be communicated in 2020 (35/CP.21)

In this overall context, the the special report should provide **scientific assessment and benchmarks related to the 1.5°C** goal in the Paris agreement that are **essential for the successful implementation of the Agreement and its goals**:

- **Comprehensive information of the impacts of climate change at 1.5°C**, with a focus on impacts around this level of warming (above and below) and on all relevant timeframes, including decadal to multi-century impacts and risks
- **Emission levels in 2025, 2030 consistent with 1.5°C** to inform NDC assessment in the **2018 facilitative dialogue** (*17/CP.21*)
- **Emission levels in 2050 consistent with 1.5°C** to inform assessment of long-term low greenhouse gas emission development strategies (*35/CP.21*)
- **Timing of global peaking of greenhouse gas emissions** implied by the 1.5°C limit (Article 4.1)
- 1.5°C compatible **timing of achieving zero global emissions**[2] in the second half of the 21st century (Article 4.1)
- **Sustainable development and efforts to eradicate poverty in the light of the 1.5°C limit** and higher levels of warming (Article 4.1)

IPCC-related matters related to a follow up of COP-21 are also summarized in information document IPCC-XLIII/INF. 4.

[2] Specified in Article 4.1 of the Paris Agreement as "a balance of anthropogenic sources and sinks of global greenhouse gas emissions".

Besides providing 2025 and 2030 emission levels in line with emission pathways that limit warming to 1.5°C above pre-industrial levels by 2100 to diagnose the gap between such pathways and what is implied by the iNCDs, **the special report should provide an implementation oriented focus on what policy instruments, technological changes and investment patterns are required** to close this gap.

Risks and issues relating to the 1.5°C special report at IPCC-43

1. The recommendation to accept the UNFCCC invitation for a 1.5°C special report and its proposed clustering with scenarios and low carbon development pathways

- IPCC will hold 43rd plenary session in Nairobi on April 11-13, 2016 to decide on "themes" for special reports during the Sixth Assessment Report (AR6) cycle. **Expected to approve 2 or maximum 3 Special Reports (SR)**, but received 31 proposals for special reports.

- The IPCC bureau has **clustered these 31 proposals into 9 clusters (see Annex)[3], which seems problematic** given the broad and cross-cutting nature of many of these proposals. Also the **1.5°C SR request from the UNFCCC,** although **a unique request of high political relevance and recommended by the IPCC chair**, **has been lumped into a cluster with proposals of scenarios and low carbon development** (Cluster F). **This is fully inappropriate** and falls short of the mandate of the special report in many ways including **to comprehensively assess impacts, vulnerability and risks, and links to sustainable development** associated with 1.5°C.

- It is important that the "***that the scope of such Special Report would be addressed during the scoping process"*** as recommended by the IPCC chair and **not prejudged on by any intransparent clustering** that has been put forward.

- **The scoping process needs to ensure that the 1.5°C report is balanced** and not biased in any way. **A comprehensive assessments of impacts, vulnerability and risks is needed in the 1.5°C SR** as there was not a focus of the AR5 on these issues around this level of warming and substantial knowledge gaps exist as was also **confirmed by findings of the structured expert dialogue under the 2013-2015 Review under the UNFCCC.**

2. Other proposals for special reports and their relation to a 1.5°C special report

- IPCC writes in annotated agenda for IPCC-43: "There was **broad convergence** in supporting **clusters A (land use, land degradation and agriculture), B (oceans and cryosphere), F (emissions pathways, including the 1.5°C proposal) and I (cities)** as priority themes."

- Request on **oceans and cryosphere** (IPCC Cluster B) **could be addressed within the 1.5°C SR given their special vulnerability and significance for the 1.5°C issue**. However, both of these issues would also have a big place in the AR6 in the larger context of the full assessment.

- Elements from **other SRs such as land-use, food and agricultural and desertification** (Cluster A) **could be incorporated** as elements in the 1.5°C SR, as **could health and security issues** (Cluster C), in so far as they relate to the 1.5°C impacts, vulnerability and risks.

- It appears unlikely that the IPCC could do more than three SRs at the same time as the AR6 is underway, and 2 appear more plausible, with three at a maximum. In addition, there is a

[3] IPCC-XLIII/Doc. 1, Add. 1

proposal for a separate regional report as a special report[4] that should be kept fully separate from the 1.5°C issue. In any case, workload for authors and potential duplications with the upcoming full report under the AR6 as well as **timing issues relating to the publication date and upcoming IPCC cycles** will have to be taken into account.

- **Other clusters may best be deferred or made into technical papers**, also a route that the IPCC has taken in the past in order to fully capture material from earlier assessments without doing a full new assessment on a particular subject, yet still meet the needs of different stakeholder groups effectively. Technical papers draw upon the material in the earlier assessments without adding new scientific results.

Background on desirable scope of the 1.5°C Special Report

It is important that the details of the contents of the 1.5°C Special Report are not negotiated at the IPCC Plenary itself but are left to the scoping exercise. The information below is given as background and for further discussion

1. Impacts at around 1.5°C over all relevant timeframes

- **Physical climate changes**
  - Climate projections and changes in projected extremes
  - Sea level rise
  - Ocean acidification
  - Cryosphere
  - Extreme Weather events
  - Hydrological Cycle including changes in circulation patterns
  - Abrupt shifts and tipping elements in the earth system
- **Biophysical impacts**
  - Oceans ecosystems
  - Biosphere and ecological services
  - Agricultural yields
  - Water resources
  - (Ir)reversibility of climate impacts
- **Socio-economic impacts**
  - Impacts on livelihoods, poverty and food security
  - Human health, labor productivity

2. Emission pathways relevant to 1.5°C limit

- **1.5°C compatible pathways**
  - Inform on 2025 and 2030 emissions levels implied by 1.5°C pathways
  - Gap between NDCs's and 1.5° pathways
  - Options for closing emissions and sustainable development implications
  - Inform on 2050 levels as a basis of low GHG emission development strategies
- **Long-term mitigation goal expressed in Article 4.1**
  - **timing of zero emissions consistent with 1.5°**
  - Compatibility of NDCs with long-term mitigation goal
  - Technological requirements to achieve the long-term mitigation goal
- **Options to increase near term ambition**
  - Policy instruments to establish entry points for increased near-term ambition

[4] IPCC-XLIII/INF. 19

- Assessment of requirements in technological change, deployment and investment patterns to achieve 1.5°C limit
- Co-Benefits and side effects of stringent mitigation policies including health, revenue streams, energy and food security and poverty eradication

3. Implications for NDCs in 2025 and 2030 and 2050 long-term development strategies

- Assessment of the 2025 and 2030 total greenhouse gas emission levels implied by NDCs
- Detailed information on required increase in near-term ambition expressed in NDCs to inform facilitative dialogue
- Information on 2050 emission levels to inform development of mid-century, long-term low greenhouse gas emission development strategies

4. Implications for adaptation efforts

- Opportunities, Limits and Barriers to Adaptation at 1.5°C and higher levels of warming

Annexes

The Annex includes additional information

1. On the feasibility of limiting warming to 1.5°C
2. Additional science that has emerged since the AR5 related to the scope of the 1.5°C report
3. Clustering of proposals proposed by the IPCC

1. Feasibility of limiting warming to 1.5°C

Limiting warming to 1.5°C by 2100 is feasible[5]

The scientific findings based on low-emission scenarios (also assessed by the IPCC in its latest (Fifth) assessment report) show that it is both physically and economically feasible to limit warming to below 1.5°C by 2100, after temporarily exceeding 1.5°C in the 2050s (but still staying well below 2°C).

Limiting warming to 1.5°C by 2100 needs early and rapid action

Limiting warming to below 1.5°C by 2100 requires similar transformations in the energy system as holding warming to below 2°C during the 21st century, but the decarbonisation of the energy system needs to be faster and more pronounced. Holding warming below 2°C also requires early and rapid action with the level of action in the next ten years (until around 2025) very similar to 1.5°C. By the 2030 action towards 1.5°C needs to be faster than for 2°C.

Costs of renewable energy are declining rapidly

Costs of renewable energy have declined dramatically over the last years and much faster than previously expected. Several renewable energy technologies have already achieved market competitiveness, to varying extent across the wide variety in national, economic and resource circumstances globally.

Energy efficiency is key

Energy efficiency plays a critical role in low stabilisation scenarios in general. The related reductions in energy demand need to be greater, particularly from 2030, to hold warming below 1.5°C rather than 2°C.

Reaching the 1.5°C goal requires the same technologies as 2°C, deployed faster

A critical technology for both below 2°C and 1.5°C is negative CO2 emissions technology. This is necessary to compensate for the insufficient emissions reductions realised to date.
At this moment, the option that is seen as most likely to achieve large-scale negative emissions combines modern biomass energy systems with carbon capture and storage. While all elements of this technology are available and demonstration plants are already functional, very rapid upscaling is required in both 1.5°C and 2°C pathways in the 2030-2050 period.

Reaching the 1.5°C goal will require similar bioenergy supply level as 2°C

Science is clear that the bioenergy demand for a 1.5°C goal is not higher than for a 2°C limit, but needs to be introduced faster. In fact, all energy-economic scenarios, even without these temperature limits, see a rapid growth of bioenergy, due to an anticipated continued competitive development of modern bioenergy options, technologies and infrastructure.
Large-scale deployment of bioenergy is therefore not unique to 1.5 and 2°C scenarios and in all cases must rely primarily on “second generation” options, derived from agricultural and forestry residues, dung and organic waste, to prevent conflicts with food security. Comprehensive policies can safeguard against any remaining risks. However, in any consideration of food security, it must never be ignored that even present-day climate extremes pose very large risks to food security in many

[5] For a detailed technical background see: Feasibility of limiting warming to 1.5 and 2°C

countries, due to crop losses and spikes in food prices, and that these risks are set to increase with temperature increases under 1.5°C and more rapidly on our way to 2°C or higher.

Substantial reductions in global greenhouse gas emissions needed by 2050 and emissions reach zero by 2060-2080

The long-term mitigation goal expressed in Article 4 of the Paris Agreement to "*achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century*" is equivalent to achieving global zero greenhouse gas emissions. Total greenhouse gas emissions have to reach global zero by 2060 to 2080 for 1.5°C compared to 2080-2100 for 2°C, in line with this goal.

2. Elements of the 1.5°C Special Seport and relation to other submissions for special reports including post-AR5 literature

As the cut-off dates of the literature included in the IPCC AR5 dating back to 2013, plenty of new literature has become available that is directly relevant for the 1.5°C special report. In addition, the AR5 did not have a specific 1.5°C focus and thereby a comprehensive assessment of also AR5 literature on impacts, vulnerabilities and risks with regard to the 1.5°C issue should be undertaken.

1. The need for a comprehensive assessment of climate impacts, vulnerability and risks at 1.5°C warming

Climate impacts, vulnerability and risks at a warming of 1.5°C have not been comprehensively assessed in the AR5, which makes a full assessment of these components, also in relation to sustainable development, necessary to fulfil the mandate of the 1.5°C SR requested by the UNFCCC.

This has been highlighted by the findings of the structured expert dialogue (SED) under the 2013-2015 Review under the UNFCCC[i] that reported that while

> *"limiting global warming to below 1.5 °C would come with several advantages in terms of coming closer to a safer 'guardrail'", "the science on the 1.5 °C warming limit is less robust than for the 2 °C warming limit or warming beyond this limit."* (SED, Message 10).

In addition, the SED also outlines key impacts that are relevant for the 1.5°C limit that as special report might want to particularly consider. These include risk to

> *"food production or unique and threatened systems such as coral reefs or many parts of the cryosphere, including the risk of sea level rise"* (SED, Message 10)

and outlines that

> *" it is unclear whether the difference between 2 °C and 1.5 °C of warming is really only a matter of a gradual increase in risks or also includes some non-linear effects, as some evidence from the paleo-record indicates."* (SED, Message 10)

2. Impacts to key vulnerable systems at 1.5°C and their consequences for assessing levels of dangerous interference with the climate system

The special report should give special consideration to biophysical and social systems most vulnerable to the impacts of climate change. On many of these matters, literature has come available since the AR5 that is of key relevance in assessing levels of dangerous interference. These include among others:

- Analysis of the risk of crossing critical thresholds of large-scale ice-sheet disintegration in Antarctica[ii] and Greenland[iii]

- Risks to ocean systems including by ocean acidification[iv]
- Risks to polar systems and new evidences of large-scale circulation pattern changes affecting extreme event patterns related to northern high-latitude warming and sea-ice loss[v]
- Risks of abrupt shifts in the climate system[vi]
- Vulnerability of tropical agricultural systems also to climate extremes[vii] that have not been taken into account fully in the analysis of the agricultural impacts of climate change in the AR5

3. *Near-term mitigation efforts as entry points to deep decarbonization including sustainable development co-benefits*

Besides providing 2025 and 2030 emission levels in line with emission pathways that limit warming to 1.5°C above pre-industrial levels by 2100 to diagnose the gap between such pathways and what is implied by the iNCDs, the special report should provide an implementation oriented focus on what policy instruments, technological changes or investment patterns could help to close this gap. As this is a very active research area and has not been fully in the focus of the AR5 report.

This could include among others:

- Analysis of the iNDCs as they have been put forward and what increases in ambition are needed to hold respective long-term targets[viii]
- Policy instrument analysis also focusing on fiscal aspects and potential co-benefits[ix,x]
- Country specific analysis of mitigation potential and low-carbon development trajectories (as e.g. have come forward under the Deep Decarbonization Project[xi])
- Implications for fossil fuel technology deployment[xii,xiii]

4. *Climate impacts and sustainable development*

Given current emission trends, a warming of 1.5°C will already materialize around 2030 and a near-term focus of climate impacts, adaptation needs and development implications is indirectly implied by focusing on 1.5°C. Therefore, the IPCC could draw and emphasize on a wealth of literature that has partly been assessed already in the IPCC AR5, but would provide the very timely focus to inform for the needs of the scaling up of global adaptation efforts.

In addition, such a focus could strengthen the focus of the interlinkages between climate adaptation, climate resilient development and the sustainable development agenda agreed in 2015 under the sustainable development goals (SDGs). In particular, this could take up and further build on analysis that has come forward under the 2015 World Bank Report on Climate Change and Poverty[xiv].

This would also need to take up question on climate change and food security focusing on very immediate threads to food security arising already in the near term and how climate change, and potential climate change mitigation efforts, would influence such risks.[xv,xvi]

3. Clustering of SR-proposals by the IPCC

4. 31 proposals for Special Reports during AR6: These have been allocated to 9 clusters with 2 or 3 reports possible
5. According to the annotated agenda for IPCC-43: "There was **broad convergence** (-within the bureau-) in supporting **clusters A (land use, land degradation and agriculture), B (oceans and cryosphere), F (emissions pathways, including the 1.5°C proposal) and I (cities)** as priority themes."
6. A full list of all proposals including comments from the Co-Chairs of Working Groups I, II and III can be found in IPCC-XLIII/INF. 9

Cluster A: Land use, food and agriculture (including desertification)	7 proposals
Cluster B: Cryosphere, oceans and mountains	8 proposals
Cluster C: Health and security	2 proposals
Cluster D: Integrating adaptation and mitigation	5 proposals
Cluster E: Carbon pricing	1 proposal
Cluster F: Scenarios and low-carbon development	4 proposals including UNFCCC 1.5°
Cluster G: Managing climate data and information	1 proposal
Cluster H: Updates policy relevant messages/extreme events	2 proposals
Cluster I: Cities	1 proposal

References

[i] UNFCCC, Report on the structured expert dialogue on the 2013–2015 review, FCCC/SB/2015/INF.1

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[iv] Gattuso, J.-P. *et al.* Contrasting futures for ocean and society from different anthropogenic CO2 emissions scenarios. *Science (80-.).* **349,** aac4722 (2015).

[v] Coumou, D., Lehmann, J. & Beckmann, J. The weakening summer circulation in the Northern Hemisphere mid-latitudes. *Science (80-.).* **348,** (2015).

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[viii] Meinshausen, M. *et al.* National post-2020 greenhouse gas targets and diversity-aware leadership. *Nat. Clim. Chang.* 1–10 (2015). doi:10.1038/nclimate2826

[ix] Bertram, C. *et al.* Complementing carbon prices with technology policies to keep climate targets within reach. *Nat. Clim. Chang.* **5,** 235–239 (2015).

[x] Edenhofer, O. *et al.* Closing the emission price gap. *Glob. Environ. Chang.* **30,** 132–143 (2015).

xi http://deepdecarbonization.org/

xii Steckel, J. C., et al. Drivers for the renaissance of coal. Proc. Natl. Acad. Sci. 112, E3775–E3781 (2015).

[xiii] Edenhofer, O. King Coal and the queen of subsidies. Science (80-.). 349, 1286–1287 (2015).

[xiv] Hallegatte, S. *et al. Shock Waves: Managing the impacts of climate change on Poverty*. (World Bank Publications, 2015).

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[xvi] Smith, P. *et al.* Biophysical and economic limits to negative CO2 emissions. *Nat. Clim. Chang.* (2015). doi:10.1038/nclimate2870