

# Finding Global Temperature Goals: How Science and Policy Interacted?

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## Abstract

*Climate change is a negative externality problem. The solution is to internalize the externalities. There are several ways for internalizing climate change externalities. Setting global warming limits is one option. A combination of the precautionary approach and risk-based approach has led to the emergence of global temperature goals.*

Many countries declared the goal of CO<sub>2</sub> net-zero emissions by 2050. The carbon-neutral world by 2050 is the requirement to limit global warming to 1.5 °C. How did the world agree on a specific temperature limit?

The aspiration to limit global warming stems from Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC) adopted in 1992 which defines the ultimate objective of the Convention as “achieving stabilization of the greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system” [UNFCCC, 1992]. The Convention did not specify what constitutes dangerous interference to the climate system but Article 3 binds the parties to take precautionary measures to mitigate climate change, noting that “lack of full scientific certainty should not be used as a reason for postponing such measures.”

The issues related to Article 2 of the Convention were addressed in depth by the Intergovernmental Panel on Climate Change (IPCC) in its Second Assessment Report (SAR) in 1995 which recognized uncertainties about what constitutes dangerous anthropogenic interference with the climate system and about measures to prevent such occurrence but indicated that precautionary approach and availability of no-regrets options provide rationales for action beyond no-regrets [IPCC, 1995]. It summarized the challenge as “not to find the best policy today for the next 100 years, but to select a prudent strategy and to adjust it over time in the light of new information.”

The first Conference of the Parties (COP) to the Convention held in 1995 decided to launch a two-year negotiation process to establish legally binding targets and timetables for reducing GHG emissions after 2000. The Alliance of Small Island States (AOSIS) proposed a draft protocol for emissions reduction because “they are being hit first and hardest by climate change that they are not responsible for and continuing emissions at present levels would be a disaster for all” [ENB, 1995].

In 1996, the European Council - environment declared 2 °C as the global warming limit and the corresponding concentration levels lower than 550 ppm CO<sub>2</sub> as guidance for global emission reduction efforts [EC, 1996]. This was the first instance that 2 °C was

proposed by a political body as global warming limit to avoid dangerous interference with the climate system [Carbon Brief, 2014].

The Council attributed the decision to the scientific findings of the IPCC SAR which had assessed, among others, four different future profiles of CO<sub>2</sub> concentrations and corresponding equilibrium temperature increases relative to 1990 that includes 2 °C as well as other warming levels. The IPCC reports are neutral, policy-relevant but not policy-prescriptive. The IPCC reports in 2001 pointed out that decisions on what constitutes dangerous interference are value judgments and what science can do is provide the information needed for decisions [IPCC, 2001].

The 2007 IPCC reports stated that “warming of the climate system is unequivocal” [IPCC, 2007] and the COP 13 held in the same year recognized in its decision the deep cuts that will be required to achieve the Convention’s ultimate objective and the urgency to address climate change as indicated in the 2007 IPCC reports. The AOSIS called for stabilization well below 445 ppm, noting the inadequacy of 2 °C limit [ENB, 2007].

Subsequently, in 2008 COP14, both AOSIS and the Least Developed Countries urged 1.5 °C temperature limit and GHG concentrations of no more than 350 ppm, noting that “a 2 °C temperature rise would take the world into the danger zone” [ENB, 2008].

The COP15 in 2009 adopted the Copenhagen Accord which has a specific reference to 1.5 °C in calling for consideration of strengthening the long-term goal to be below 2 °C [UNFCCC, 2009]. And the Cancun Agreement in 2010 tightened the link between the long-term goal and 1.5 °C, recognizing the need for deep cuts in GHG emissions to limit temperature increase below 2 °C above pre-industrial levels and consider strengthening the long-term goal in relation to a global average temperature rise of 1.5 °C [UNFCCC, 2010].

Given the increasing concerns about the adequacy of a long-term goal, the UNFCCC decided in 2012 in COP 18 to assess the long-term goals [UNFCCC, 2012]. A series of formal dialogues were held during 2013-2015 between parties and the scientific community on the adequacy of the long-term goal in the light of Article 2 of the Convention and the overall progress made towards achieving the long-term global goal.

The IPCC 5th Assessment Reports released in 2013-2014 were the key input to this dialogue process. The IPCC reports provided updates on mitigation pathways associated with various warming levels, including

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warming below 2 °C relative to pre-industrial levels, and projected changes in the climate system and their impacts on natural and human systems [IPCC, 2014]. The IPCC also informed that there are only a limited number of scenarios to limit warming to 1.5 °C by 2100.

The UNFCCC-organized science/policy dialogue which was completed six months before the Paris COP in 2015 characterized the 2 °C limit as a defense line and concluded that while the science on the 1.5 °C warming limit is less robust, efforts should be made to push the defense line as low as possible and consideration on the long-term goal of 1.5 °C should continue [UNFCCC, 2015a].

This conclusion was captured in Article 2 of the Paris Agreement adopted in 2015 [UNFCCC, 2015b] which stipulates the warming limit to be “well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels”. And the parties to the Convention invited the IPCC to provide a special report in 2018 on the impacts of global warming of 1.5 °C above pre-industrial levels and related global emissions pathways.

The global mid-century net-zero CO<sub>2</sub> emissions were one of the key findings of the IPCC special report on 1.5 °C warming [IPCC, 2018]. It identified global emissions pathways to limit warming to 1.5 °C, a reduction of global CO<sub>2</sub> emissions to net-zero by 2050. The net-zero year moves to 2070 if the goal is to limit warming below 2 °C. The special report also identified significant differences in impacts between now -- already about 1 °C warmer -- and additional 0.5 °C warming and still additional 0.5 °C warming reaching 2 °C. It reported an unprecedented rate of warming in recent decades. The latest IPCC report confirmed these findings [IPCC, 2021]. There will also be major updates on the impacts of climate change and mitigation measures in 2022.

The temperature goal of 1.5 °C is the outcome of the 30-years of the global science-policy interface. Science provided information and evidence and policymakers made choices. Given the enormous differences across the countries in the state of socio-economic conditions, cultural underpinnings, and priorities, it is remarkable that we have a common goal to limit warming to 1.5 °C. The challenge is how the world will be able to realize this goal. An effective science-policy interface will continue to be crucial in meeting the challenge.

## References

Carbon Brief, “Two degrees: The history of climate change’s speed limit” 8 December 2014

ENB, <http://www.iisd.ca/climate/cop1>, 1995

ENB, <http://www.iisd.ca/climate/cop13>, 2007

ENB, <http://www.iisd.ca/climate/cop14>, 2008

European Council, Community Strategy on Climate Change – Council Conclusions, 1939<sup>th</sup> Council Meeting – Environment, Brussels, 25-26 June 1996

IPCC, 1995: *Climate Change 1995: A report of the Intergovernmental Panel on Climate Change, Second Assessment Report of the Intergovernmental Panel on Climate Change*, IPCC [pdf](#).

IPCC, 2001: Watson, R. T.; and the Core Writing Team (ed.), *Climate Change 2001: Synthesis Report, Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, ISBN 0-521-80770-0 (pb: 0-521-01507-3)

IPCC, 2007: *Climate Change 2007: Synthesis Report, Contribution of Working Groups I, II, and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K.Pachauri and A. Reisinger (eds)] IPCC Geneva, Switzerland in IPCC AR4 Synthesis Report website

IPCC, 2014: *Climate Change 2014: Synthesis Report, Contribution of Working Groups I, II, and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, R.K.Pachauri and L.A. Meyer (eds)] IPCC Geneva, Switzerland in IPCC AR5 Synthesis Report website

IPCC, 2018: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. In Press.

IPCC, 2021: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

United Nations Framework Convention on Climate Change, New York, United Nations, General Assembly, 1992

UNFCCC, Report of the Conference of the Parties on its fifteenth session, 2009

UNFCCC, Report of the Conference of the Parties on its sixteenth session, 2010

UNFCCC, Report of the Conference of the Parties on its eighteenth session, 2012

UNFCCC, Report on the structured expert dialogue on the 2013-2015 review. 2015a

UNFCCC, Report of the Conference of the Parties on its twenty first session, 2015b