Timeline of Climate Change Warnings

For over a century, scientists have warned us: human-generated greenhouse gas emissions are heating up our planet. This timeline highlights key milestones in our understanding of climate change, its human origins, and scientists' increasingly urgent warnings about the consequences we face.

1856

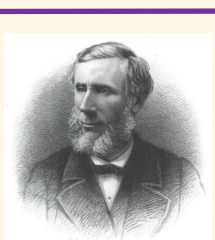
Eunice Newton Foote

In 1856, American scientist and women's rights activist Eunice Newton Foot demonstrated the warming effect of sunlight on carbon dioxide. She predicted that higher concentrations of CO_2 in the atmosphere would lead to warmer temperatures. [1, 2]

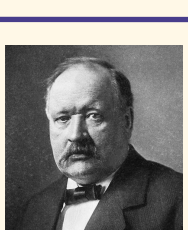
1859

John Tyndall

Irish physicist John Tyndall measured the heat absorption of various greenhouse gasses including carbon dioxide, methane, ozone and water vapor. Tyndall is generally credited with discovering the greenhouse effect in 1859. [3]



1896



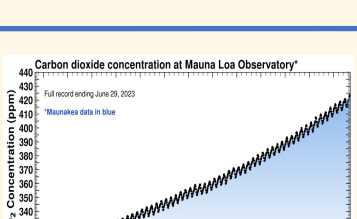
Svante Arrhenuis

Swedish chemist and Nobel Laureate Svante Arrhenius calculated how much Earth's temperature would change given variations in greenhouse gasses. In 1896, he concluded that CO_2 emissions from human activity such as burning fossil fuels are large enough to cause global warming. [4]

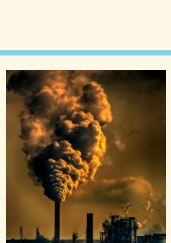
1959

The Keeling Curve

In 1959, Charles David Keeling started daily measurement of the atmospheric concentration of CO_2 at Mauna Loa, Hawaii, which continues to this day, giving us the Keeling Curve. [5]



1977



Exxon Scientists' Warning

Exxon scientists alerted company management in 1977 to the high likelihood of climate change through CO_2 emissions from burning fossil fuels. Exxon spent millions of dollars over the next several decades promoting climate misinformation. [6]

1988

James Hansen's Senate Testimony

James Hansen, director of NASA's Institute for Space Studies, testified before the US Senate Energy and Natural Resources Committee in 1988: "Global warming has reached a level such that we can ascribe with a high degree of confidence a cause and effect relationship between the greenhouse effect and observed warming," [7]

1990

IPCC Assessment Report 1

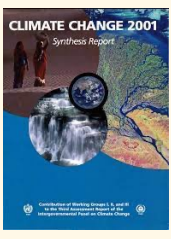
Established in 1988, the UN's Intergovernmental Panel on Climate Change (IPCC) published its first Assessment Report in 1990, saying: "… emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse gases: carbon dioxide, methane, chlorofluorocarbons (CFCs) and nitrous oxide. These increases will enhance the greenhouse effect, resulting on average in an additional warming of the Earth's surface." [8]

1995

IPCC Assessment Report 2

"The atmospheric concentrations of the greenhouse gases, and among them, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), have grown significantly since pre-industrial times (about 1750 A.D.) … These trends can be attributed largely to human activities, mostly fossil-fuel use, land-use change and agriculture." [9]

2001



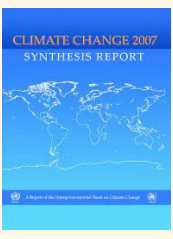
IPCC Assessment Report 3

"The Earth's climate system has demonstrably changed on both global and regional scales since the pre-industrial era, with some of these changes attributable to human activities." [10]

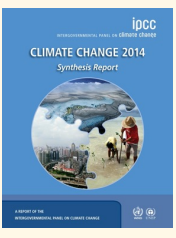
2007

IPCC Assessment Report 4

"Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level." [11]



2014



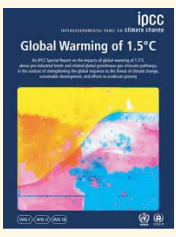
IPCC Assessment Report 5

"Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems." [12]

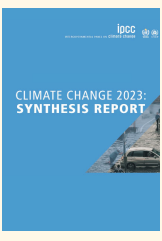
2018

IPCC Special Report: Global Warming of 1.5°C

"Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a *likely* range of 0.8°C to 1.2°C. Global warming is *likely* to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate." [13]



2023



IPCC Assessment Report 6

"Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020." [14]

"Continued greenhouse gas emissions will lead to increasing global warming, with the best estimate of reaching 1.5°C in the near term in considered scenarios and modelled pathways. Every increment of global warming will intensify multiple and concurrent hazards." [15]

Notes

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7. Wikipedia contributors, "James Hansen," *Wikipedia, The Free Encyclopedia,* https://en.wikipedia.org/w/index.php?title=James_Hansen&oldid=1163238569 (accessed July 9, 2023).
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13. IPCC, 2018: Summary for Policymakers. In: 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 [Masson-Delmotte, V., 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, and T. Waterfield (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. https://doi.org/10.1017/9781009157940.001. p. 4
14. IPCC 2023: Summary for Policymakers. In: Climate Change 2023: Synthesis Report. A Report of the Intergovernmental Panel on Climate Change. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (eds.)]. IPCC, Geneva, Switzerland. p. 4.
15. Ibid. p. 12.