

SUPPLEMENTARY MATERIAL

Table 1. Key Developments in Climate Science, 1896--1995

For post 1995 developments, see subsequent IPCC group 1 assessment reports: *Third Climate Change 2001: The Physical Science Basis*; *Fourth Assessment Report, Climate Change 2007: The Physical Science Basis*; *5th Assessment Report, Climate Change 2013: The Physical Science Basis*; *6th Assessment Report, Climate Change 2021: The Physical Science Basis*. See also R. Somerville, H. Le Treut, U. Cubasch, Y. Ding, C. Mauritzen, A. Mokssit, T. Peterson, and M. Prather (2007). Historical overview of climate change. In *Climate Change 2007: The Physical Science Basis*, Cambridge University Press, 93-127.

Knowledge issues about climate change	Date	Reference / Comments
Anthropogenic emissions of CO ₂ may be large enough to influence the global climate.	1896	Arrhenius S., "On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground," <i>Philosophical Magazine and Journal of Science</i> 5:41, 1896, 237-276.
CO ₂ and water vapor absorption spectra do not entirely overlap, and CO ₂ may accumulate in the upper atmosphere where water vapor is absent, thus increasing the infrared optical depth of the atmosphere.	1931	Hulburt E.O., "The Temperature of the Lower Atmosphere of the Earth", <i>Physical Review</i> vol. 38, 1876-1890.
CO ₂ from fossil fuel combustion is accumulating in the atmosphere and may not be offset by absorption from oceans and plants, leading to a possible continuous increase in the concentration of CO ₂ in the atmosphere	1957	Brannon H.R. et al., "Radiocarbon Evidence on the Dilution of Atmospheric and Oceanic Carbon by Carbon from Fossil Fuels", <i>Transactions of the American Geophysical Union</i> , 38(5), (1957), 643-650
Atmospheric carbon dioxide concentrations show a continuous annual increase.	1960	Keeling C.D., "The Concentration and Isotopic Abundances of Carbon Dioxide in the Atmosphere", <i>Tellus</i> , 12(2), (1960), 200-203
The increase in atmospheric carbon dioxide is expected to produce a global warming effect by the year 2000, with significant impacts on future climate and sea level.	1965	President's Science Advisory Committee (1965). <i>Restoring the Quality of Our Environment: Report of the Environmental Pollution Panel</i> . The White House.

<p>First 3D global climate modeling : “According to our estimate, a doubling of the CO₂ content of the atmosphere has the effect of raising the temperature of the atmosphere (whose relative humidity is fixed) by about 2C”</p>	<p>1967</p>	<p>Manabe S., & Wetherald R.T., “Thermal Equilibrium of the Atmosphere with a Given Distribution of Relative Humidity”, <i>Journal of Atmospheric Sciences</i>, 24 (3), (1967) 241-259</p> <p>For a retrospective analysis of the impact of this paper, see also Weart, S. (2003). <i>The Discovery of Global Warming</i>. Cambridge, Harvard University Press</p>
<p>A 25% increase in CO₂ concentration could cause 1.1-7.0 °F of global warming by the year 2000, whereas global aerosols is expected to produce a much smaller global cooling effect of about 0.1°F.</p>	<p>1969</p>	<p>Peterson E.K., “Carbon Dioxide Affects Global Ecology”, <i>Environmental Science and Technology</i> (1969): 1162-1169.</p>
<p>A positive feedback between planetary warming and melting ice and snow (i.e., changes in the Earth’s albedo) can be detected</p>	<p>1969</p>	<p>Budyko M.I., “The effect of solar radiation variations on the climate of the Earth”, <i>Tellus</i>, 21(1969): 611-619.</p> <p>For a retrospective analysis of the impact of this paper, see also Weart, S. (2003). <i>The Discovery of Global Warming</i>. Cambridge, Harvard University Press.</p>
<p>Three-dimensional global climate models indicate potential global warming of 0.5°C by the year 2000 and 2°C in the 21st century.</p>	<p>1970 - 1971</p>	<p>SCEP Report (MIT), <i>Man’s Impact on the Global Environment</i>, 1970. SMIC Report (MIT), <i>Inadvertent Climate Modification Report: Report of the Study of Man’s Impact on Climate</i>, 1971.</p>
<p>Global warming from anthropogenic greenhouse gases will dominate global cooling from pollution aerosols.</p>	<p>1970s</p>	<p>Peterson T.C., Connolley W.M., and Fleck J., 2008, “The Myth of the 1970s Global Cooling Scientific Consensus”, <i>Bull. Bitter. Meteor. Soc.</i>, 89, 1325-1338</p>
<p>Doubling atmospheric carbon dioxide is expected to produce global warming of 3°C plus or minus 1.5°C.</p>	<p>1979</p>	<p><i>Carbon Dioxide and Climate: A Scientific Assessment</i> (“Charney Report”, Nat. Acad. Of Sciences)</p>

<p>The time required for renewables to penetrate half of the energy market is estimated to be roughly half a century, indicating the need for prompt action to prevent severe global warming.</p>	<p>1983</p>	<p>Rose D., Miller M., Agnew C., <i>Global energy futures and CO₂ induced climate change</i>, MIT Energy Laboratory, 1983.</p>
<p>“We are certain of the following: there is a natural greenhouse effect [...]; emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse gases. [...] Under business-as-usual, increase of global mean temperature during the 21st century of about 0.3 °C per decade (with an uncertainty range of 0.2 to 0.5 °C per decade).” (Executive Summary, xi) “ Our judgement is that: global mean surface air temperature has increased by 0.3 to 0.6 °C over the last 100 years.” (Executive Summary, xii)</p>	<p>1990</p>	<p>First Assessment Report (IPCC)</p>
<p>“(...) the essential message of this report continues to be that the basic understanding of climate change and the human role therein, as expressed in the 1990 report, still holds: carbon dioxide remains the most important contributor to anthropogenic forcing of climate change; projections of future global mean temperature change and sea level rise confirm the potential for human activities to alter the Earth's climate to an extent unprecedented in human history; (...) many important aspects of climate change are effectively irreversible. Further, that observations suggest ‘a discernible human influence on global climate’, one of the key findings of this report, adds an important new dimension to the discussion of the climate change issue.” (Preface, xi)</p>	<p>1996</p>	<p><i>Second Assessment Report Climate Change 1995 The Science of Climate Change</i> (IPCC)</p>

Table 2. Main archival documents consulted at Total Archives cited in this article

As state-owned enterprises, Elf and Total established well-organised archives services in the 1980s. The archives are now available to researchers at Total’s headquarters (Tour Coupole, 2 place Jean Millier, 92078, Paris La Défense Cedex).

General presentation:

https://listes.services.cnrs.fr/wws/arc/athena/2018-09/msg00012/AH_Guide_des_sources_2016_V2.0.pdf

Digitized inventory available at: <https://francearchives.fr/fr/inventaires/TOTAL#/>

Archive box number	Comments
50ZZ507/58	Vincent Labouret papers (General Secretary). Elements on CFR-Total communication policy, on the development of the magazine <i>Total information</i> in the late 1960 and drafting of the op-ed (signed by the CEO by written by Labouret) of the 1971 issue of <i>Total Information</i> , on environmental issues. This issue, as well as the full journal collection, is also available at the Bibliothèque Nationale de France
92AA091/160	Total - Direction de l’Information et des Relations Extérieures – Pollution. Documents Total’s “coordination environnement” in the 1970s
09AH0416/1-34	CFP-Total Press review of energy issue in France and the world
07AH0077/1-36	Elf R&D department (1970-1995). The Environment Direction was part of this department. This includes 07AH0077/4 - Dossiers liés à la protection de l’environnement, 1993-1994. In this box, can be found <ul style="list-style-type: none"> - the memo from F. Girault (Director for Prospective), “note à l’attention de MM les membres du comité de Direction Générale, Effet de serre (proposition de plan d’action), March 12, 1993 - the memo from F. Girault, “Effet de serre et écotaxe. Propositions d’action”, Nov. 17, 1992. - The internal report “Environnement Énergie 1994. Bilan Perspectives”, presented in april 1994 to Elf’s executive committee - The letter sent by Philippe Jaffré (Elf’s CEO) to Alain Juppé (French Minister for Foreign Affairs), Oct. 14th, 1994.
11AC0783/106	Elf R&D department. This box includes the 1985 Environment Department annual report as Preparatory document to the Elf executive committee, 4 March 1986: Bernard Tramier. <i>L’environnement dans le groupe Elf Aquitaine – Bilan 1985. Document préparatoire à la réunion du comité exécutif du 4 mars 1986.</i> Fév 1986.
09AH0492/4	Leaflets, including: Union des Chambres Syndicales de l’Industrie du Pétrole, <i>Industrie pétrolière et environnement</i> , 1971.
00AH001/1-	Chronologies historiques, plaquettes de présentation, revues du groupe.

428	Box 00AH001/142 includes a cardboard folder distributed by Elf before and during the Rio 1992 conference. It entails an article “Environment: Lucidity and Pragmatism” by Jean-Philippe Caruette in <i>ÉnergieS</i> [Total’s corporate magazine], n°9, May-June 1992, 13-14
05AA594/1-15	TOTAL - Environnement et développement durable (Archives from the Environment Direction), 2000-2004) Box 05AA594/14 includes documents from the 2002 and 2003 internal workshop on Sustainable Development. This includes the transcript of the speech by CEO Thierry Desmarest at the 1st “Séminaire Développement Durable” (Sept. 30- Oct. 2, 2002).

Table 3. Interviews conducted for this research

All interviews are not cited in this article but helped to provide an extensive knowledge of our case study and write an initial longer draft. These interviews were conducted by C. Bonneuil)

Interview Date(s)	Comments
Sep. 23, 2020	Anonymized (at the request of the interviewee), Former Staff (early 1970s to mid 1980s), Elf.
Nov. 5, 2020 Nov. 24, 2020	Bernard Tramier, Former Environmental Director (1983-2003), Elf and then Total-Fina-Elf.
Nov. 20, 2020	Jean-Paul Boch, Former Staff at the Environmental Direction (early 1992-2008), Elf and then Total-Fina-Elf.
Feb. 1, 2021	Brian Flannery, Former Environmental Director, Exxon.
Nov. 2, 2020	Pierre-René Bauquis, Former Total executive (1972-2000s), Advisor of Total CEO from 1995 to 2001.
Aug. 6, 2020	François Durand-Dastès, Professor of Geography, Univ. Paris 7, author of a 1971 article on atmospheric pollution in Total corporate magazine.
May 28, 2021	Jacques Theys, Former High level staff, French Ministry of the environment (1970s-2000s).
June 1, 2021	Jean Audouze, Former scientific advisor of the French President (F. Mitterrand), 1989-1991.
January 1, 2021	Jean-Charles Hourcade, Energy economist, former IPCC coordinating lead author.
May 31, 2021	Jean Jouzel, climatologist, former vice-chair of IPCC Group 1.
April 4, 2021	Brice Lalonde, former French Minister of the environment, 1988-1991.
Nov. 18, 2021	Cédric Philibert, Former advisor of the French Ministry of the environment (1988-1991).
Nov. 3, 2020	Jean-François Saglio, Former High level staff, French Ministry of the environment (until 1979), then Elf executive (1979-1988).