The evolution of climate change science, ExxonMobil and its emissions

A table showing some of the main developments in the chronology of climate change science, alongside major events in the corporate history of ExxonMobil and the company’s cumulative emissions from 1882-2002
<table>
<thead>
<tr>
<th>The science evolves(^1)...</th>
<th>Year</th>
<th>ExxonMobil evolves(^2)... and the emissions pile up(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benjamin Franklin, described by NASA as a ‘climate giant’, begins his climate studies(^4)</td>
<td>1763</td>
<td></td>
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<tr>
<td>Fourier first describes the greenhouse effect(^5)</td>
<td>1824</td>
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<tr>
<td>Tyndall argues that water vapour and carbon dioxide are important for absorbing radiation and hence controlling climate(^7)</td>
<td>1839</td>
<td></td>
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<td></td>
<td>1861</td>
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<tr>
<td>John D. Rockefeller is born(^6)</td>
<td>1865</td>
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<tr>
<td>US Civil War begins (1861). Rockefeller gets involved in the oil business, along with partners Maurice Clark and Samuel Andrews (1863)^8</td>
<td>1870</td>
<td></td>
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<tr>
<td>Rockefeller buys out his partners and founds Rockefeller &amp; Andrews, Cleveland’s largest refinery</td>
<td>1882</td>
<td></td>
</tr>
<tr>
<td>The Standard Oil Company is established “for manufacturing petroleum and dealing in petroleum, and its products”(^9) in Cleveland, Ohio, with 4% of the refining business(^10), becoming “the largest concern in the oil region” in 1872(^11), “controll[ing] ninety-five per cent of the refineries in the oil region” in 1879(^12), and making Rockefeller one of the twenty richest men in the US(^13)</td>
<td>1888</td>
<td></td>
</tr>
<tr>
<td>Standard Oil Trust is established, along with the Standard Oil Company of New Jersey (SOC(NJ)), later Exxon, the Standard Oil Company of New York (SOC(NY)), later Mobil, amongst 30 regional companies of the Trust – “[o]ver every branch of the industry, in 1883, it was supreme.”(^14)</td>
<td></td>
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</tr>
<tr>
<td>First foreign affiliate, London-based Anglo-American Oil Company Limited is established</td>
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</table>
1892
Standard Oil Trust is dissolved, after the Ohio Supreme Court forbids the Trust from operating The Standard Oil Company (of Ohio). Taking advantage of newly liberalized state law in New Jersey, SOC(NJ) becomes the main vessel of the Standard holdings and "[s]ubstantial unity of action among the several companies was not changed".

1896
Standard Oil contributes $250,000 to Republican William McKinley's presidential campaign against Democrat William Jennings Bryan, a supporter of antitrust legislation.

1897
Arrhenius publishes first calculation of global warming from human emissions of CO₂

1899
Chamberlin produces a model for global carbon exchange including feedbacks

1899
SOC(NJ) becomes the sole holding company for all Standard Oil interests. At the turn of the century, "[t]he Standard controls ninety per cent of the export trade and eighty per cent of the domestic trade."

1907
The US government has seven different lawsuits pending against Standard Oil, arguing that it is more than twenty times the size of its closest competitor.

1911
US Supreme Court orders separation from SOC(NJ) of 33 of the major Standard Oil subsidiaries. Almost half of the total net value continues to be held by SOC(NJ), with SOC(NY) holding 9%.

1931
SOC(NY) purchases the Vacuum Oil Company and is renamed the Socony-Vacuum Corporation. "Esso" becomes the downstream identity of SOC (NJ) in the 1930s.

1932
Callendar argues that CO₂ greenhouse global warming is underway

1938
500 million tonnes; 97.6% emitted since
Ewing and Donn offer a feedback model for quick ice age onset. Phillips produces a somewhat realistic computer model of the global atmosphere. Plass calculates that adding CO\(_2\) to the atmosphere will have a significant effect on the Radiation balance.

Revelle finds that CO\(_2\) produced by humans will not be readily absorbed by the oceans.

Keeling accurately measures CO\(_2\) in the Earth's atmosphere and detects an annual rise.

Calculations suggest that feedback with water vapor could make the climate acutely sensitive to changes in CO\(_2\) level.

Boulder meeting on causes of climate change, in which Lorenz and others point out the chaotic nature of climate system and the possibility of sudden shifts.

International Global Atmospheric Research Program is established. Manabe & Wetherald make a convincing calculation that doubling CO\(_2\) would raise world temperatures a couple of degrees.

Studies suggest a possibility of collapse of Antarctic ice sheets, which would raise sea levels catastrophically.

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1942  1 billion tonnes; 95.1% emitted since

1952  2 billion tonnes; 90.1% emitted since

1955  Socony-Vacuum Corporation is renamed Socony Mobil Oil Company, Inc

1956  2.8 billion tonnes; 87% emitted since

1957  3 billion tonnes; 86.1% emitted since

1960  3.7 billion tonnes; 83.1% emitted since

1962  4 billion tonnes; 80.7% emitted since

1963  5 billion tonnes; 76.7% emitted since

1965  Socony Mobil Oil Company, Inc is renamed the Mobil Oil Corporation

1966  6 billion tonnes; 71.7% emitted since
Budyko & Sellers present models of catastrophic ice-albedo feedbacks. Nimbus III satellite begins to provide comprehensive global atmospheric temperature measurements.

Creation of U.S. National Oceanic and Atmospheric Administration, the world's leading funder of climate research. Aerosols from human activity are shown to be increasing swiftly. Bryson claims they are causing global cooling.

Study of Man’s Impact on Climate (SMIC) conference of leading scientists reports a danger of rapid and serious global change caused by humans, calls for an organized research effort.

The first United Nations Conference on the Human Environment identifies climate change as a pressing issue. Ice cores and other evidence show big climate shifts in the past between relatively stable modes in the space of a thousand years or so, especially around 11,000 years ago.

Manabe and collaborators produce complex but plausible computer models which show a temperature rise of several degrees for doubled CO₂. WMO holds International Symposium on Long-Term Climate Fluctuations.

Studies show that CFCs (1975) and methane and ozone (1976) can make a serious contribution to the greenhouse effect. Deep-sea cores show a dominating influence from 100,000-year Milankovitch orbital changes, emphasizing the role of feedbacks. Deforestation and other ecosystem changes are recognized as major factors in the future of the climate. Eddy shows that there were prolonged periods without sunspots in past centuries, corresponding to cold periods.

Scientific opinion, conveyed to the public by journalists, tends to converge on rapid global warming as the biggest climate risk.

1969

1970

1971 7 billion tonnes; 65.5% emitted since

1972

1973 8 billion tonnes; 60.8% emitted since

1975

1976

1977 10 billion tonnes; 52.1% emitted since
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>Attempts to coordinate climate research in U.S. end with an inadequate National Climate Program Act, accompanied by rapid but temporary growth in funding.</td>
</tr>
<tr>
<td>1979</td>
<td>The first World Climate Conference is held in Geneva, and the World Climate Research Programme is launched to coordinate international research. US National Academy of Sciences report finds it highly credible that doubling CO₂ will bring 1.5–4.5°C global warming.</td>
</tr>
<tr>
<td>1979</td>
<td>The first WMO/UNEP/ICSU meeting on CO₂-induced climate change is held in Villach.</td>
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<tr>
<td>1979</td>
<td>Hansen and others show that sulfate aerosols can significantly cool the climate, raising confidence in models showing future greenhouse warming. Some scientists predict greenhouse warming “signal” should be visible by about the year 2000.</td>
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<tr>
<td>1980</td>
<td>Greenland ice cores reveal drastic temperature oscillations in the space of a century in the distant past. Strong global warming since mid-1970s is reported, with 1981 the warmest year on record.</td>
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<tr>
<td>1981</td>
<td>Reports from U.S. National Academy of Sciences and Environmental Protection Agency spark conflict; greenhouse warming becomes prominent in mainstream politics.</td>
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<tr>
<td>1982</td>
<td>Villach conference declares consensus among experts that some global warming seems inevitable, calls on governments to consider international agreements to restrict emissions. Antarctic ice cores show that CO₂ and temperature went up and down together through past ice ages. Broecker speculates that a reorganization of North Atlantic Ocean circulation can bring swift and radical climate change.</td>
</tr>
<tr>
<td>1983</td>
<td>Montreal Protocol of the Vienna Convention imposes international restrictions on emission of ozone-destroying gases. Antarctic ice cores show that CO₂ and temperature went up and down together through past ice ages.</td>
</tr>
<tr>
<td>1984</td>
<td>13 billion tonnes; 38.8% emitted since.</td>
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<tr>
<td>1985</td>
<td>14 billion tonnes; 33.4% emitted since.</td>
</tr>
</tbody>
</table>
Intergovernmental Panel on Climate Change (IPCC) is established. News media coverage of global warming leaps upward following record heat and droughts plus testimony by Hansen. Toronto conference calls for strict, specific limits on greenhouse gas emissions: 20% reduction of global CO\textsubscript{2} emissions by 2005\textsuperscript{26}. Ice-core and biology studies confirm living ecosystems make climate feedback by way of methane, which could accelerate global warming.

The summit on Protecting the Atmosphere is held in the Hague. The Noordwijk Declaration on Atmospheric Pollution and Climate Change advocates a 20% goal for emissions reduction\textsuperscript{27}.

IPCC First Assessment Report is published, finding that the IPCC is “certain [that] emissions resulting from human activities are substantially increasing atmospheric concentrations of greenhouse gases”. The Second World Climate Conference is held in Geneva.

United Nations Framework Convention on Climate Change (UNFCCC) is signed at Rio de Janeiro.

UNFCCC enters into force.

IPCC Second Assessment report is published, finding “a discernible human influence on global climate”.

Kyoto Protocol is signed, adopting legally binding greenhouse gas reduction targets.
1998

Exxon Corporation and Mobil Corporation agree to merge and become known as the ExxonMobil Corporation.

19 billion tonnes; 9.6% emitted since

1999

Shareholders of Exxon Corporation and of Mobil Corporation agree to merger.

20 billion tonnes; 7.1% emitted since

2001

IPCC Third Assessment Report is published, finding that “[t]he 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” and that “most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations”. The US National Academy of Sciences concludes that “[h]uman-induced warming and associated sea level rises are expected to continue through the 21st century”.

US National Academy of Sciences finds that “[a]vailable evidence suggests that abrupt climate changes are not only possible but likely in the future, potentially with large impacts on ecosystems and societies”.

21 billion tonnes; 2.3% emitted since

2002

21.53 billion tonnes

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1 Unless specifically stated, all information in this column through to 1988 is taken from the American Institute of Physics’ Discovery of Global Warming: Timeline of Milestones. See http://www.aip.org/history/climate/timeline.htm
3 Figures of million and billion tonnes in this column represent the cumulative carbon equivalent amount of Exxon Mobil emissions of carbon dioxide and methane since 1882 reached in the relevant year, alongside the percentage of those emissions, rounded to one decimal point, made since that year through to 2002, as provided in ExxonMobil Corporation Emissions Inventory 1882-2002, Methods & Results, plus associated spreadsheets (Heede, Climate Mitigation Services, 2003).
4 NASA’s Earth Observatory. See http://earthobservatory.nasa.gov/Library/Giants/Franklin/franklin_2.html
6 PBS, the US Public Broadcasting Service. See http://www.pbs.org/wgbh/amex/rockefellers/timeline/index.html
7 JFK School of Government, see note 5.
8 PBS, the US Public Broadcasting Service, see note 6.

Montague, see note 10, page 32.

Montague, see note 10, page 63.

Montague, see note 10, page 88.

Montague, see note 10, page 116.

Montague, see note 10, page 142.

Montague, see note 10, page 116.

PBS, the US Public Broadcasting Service, see note 6.


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