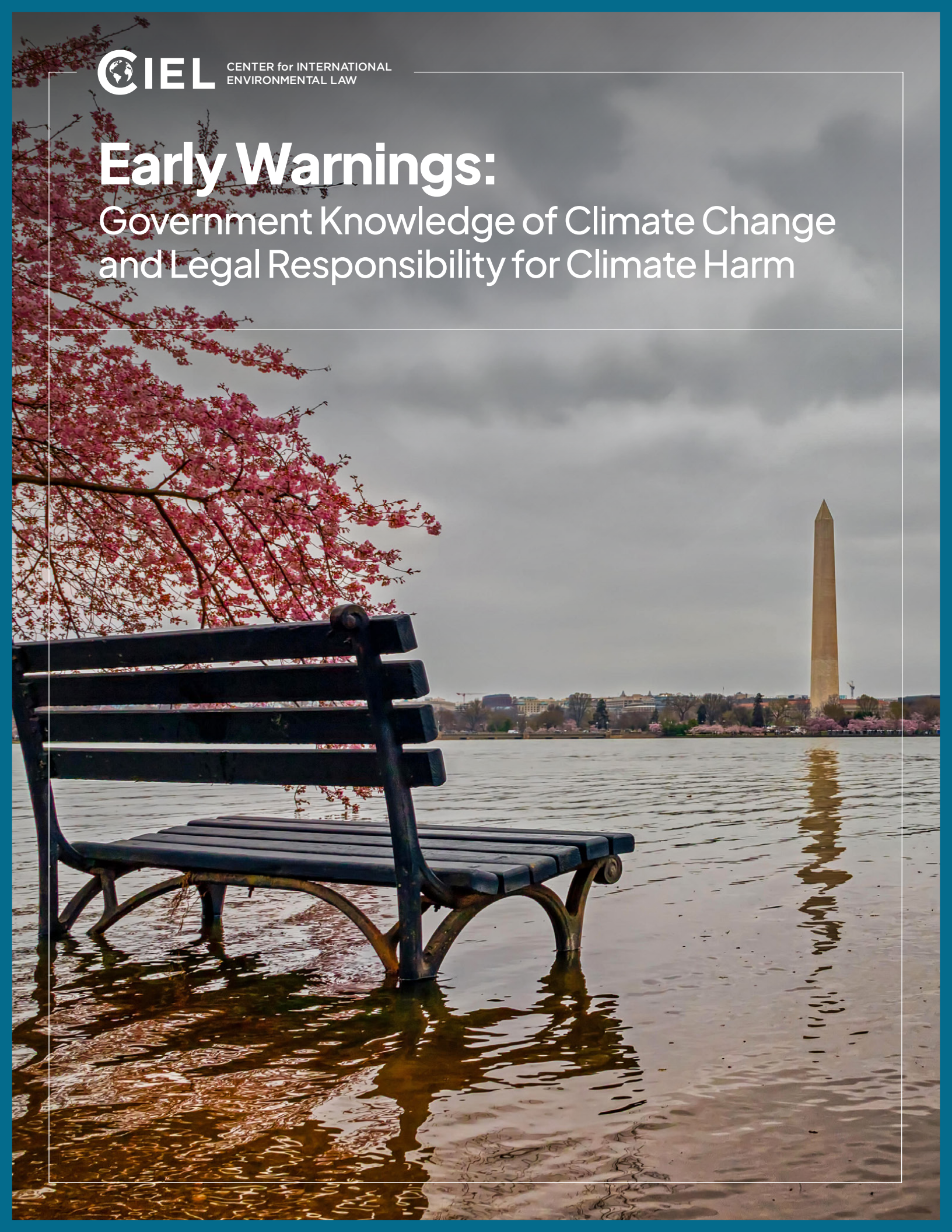




CENTER for INTERNATIONAL
ENVIRONMENTAL LAW

Early Warnings:

Government Knowledge of Climate Change
and Legal Responsibility for Climate Harm



Early Warnings:

Government Knowledge of Climate Change
and Legal Responsibility for Climate Harm

About CIEL

Founded in 1989, the Center for International Environmental Law (CIEL) uses the power of law to protect the environment, promote human rights, and ensure a just and sustainable society. CIEL is dedicated to advocacy in the global public interest through legal counsel, policy research, analysis, education, training, and capacity building.

Acknowledgements

This report was authored by Lindsay Fenlock and Nikki Reisch, edited by Lucienne Noel, and designed by Tyler Unger, with additional contributions from Aidan Steer, Taylor Hodge, Barnaby Pace, Joie Chowdhury, Erika Lennon, and Rossella Recupero. The research in this report draws heavily on the work of other scholars, such as Naomi Oreskes, Spencer Weart, and Benjamin Franta, as well as prior CIEL publications, including *Smoke and Fumes: The Legal and Evidentiary Basis for Holding Big Oil Accountable for the Climate Crisis*. Special thanks to Carroll Muffett, whose early work in this area inspired this report, and to Pacific students and youth across the world, as well as to Vanuatu and other Global Majority States, whose vision and leadership made the International Court of Justice advisory opinion on climate change possible.

Errors and omissions are the sole responsibility of CIEL. This report is for general informational purposes only. It is intended solely as a discussion piece. It is not and should not be relied upon as legal advice. While efforts were made to ensure the accuracy of the information contained in this report, the information is presented “as is” and without warranties, express or implied. If there are material errors within this brief, please advise the authors. Receipt of this report is not intended to and does not create an attorney-client relationship. *Early Warnings: Government Knowledge of Climate Change and Legal Responsibility for Climate Harm* by the Center for International Environmental Law is licensed under a Creative Commons Attribution 4.0 International License.

Please send comments or questions to info@ciel.org to be sure of a reply.

Design & Layout: Tyler Unger

Cover Photo: © Bill Chizek Photography - Alamy

Cover Photo Caption: Flooding at the Tidal Basin in Washington, DC. Decades after governments were warned about the risks of climate change, its impacts are becoming an increasingly familiar reality.

Table of Contents

1	Executive Summary
4	Key Takeaways
7	Introduction
9	Part I. The Legal Significance of When Governments Knew About Climate Change
11	The International Court of Justice and the Question of Timing
12	Longstanding International Law Requires States to Act on Climate Change
13	Establishing Climate Risk
13	Knowledge Triggers Legal Responsibility ... and Denial
15	Connecting the Dots
17	Part II. Early Climate Science Milestones
18	Early Research Into Greenhouse Gases
19	Post World-War II Consensus Emerges
24	Beyond Consensus: Climate Change Moves Through the Political Realm
29	Box 1: Industry Knowledge of Climate Change
30	Part III. Government and Popular Perceptions of Climate Science
31	Perceptions of Early Discoveries on Carbon Dioxide
32	Twentieth Century Alarm Bells

34 Part IV. Country-Specific Examples

35	United States
41	Australia
43	Canada
46	Germany
48	Italy
49	Norway
50	United Kingdom
50	USSR/Russia

52 Conclusion**54 Endnotes**



Executive Summary

Among the greatest injustices of the climate crisis is that it was avoidable. Scientists have known for decades that greenhouse gas (GHG) accumulation in the atmosphere is raising the earth's temperature with dangerous consequences for the environment and all life that depends on it. That knowledge has been widely shared with policymakers and senior officials. Yet the activities producing GHG emissions — chiefly the production and use of fossil fuels — have not only continued, they've intensified. Understanding just how long experts have been sounding the alarm, and what governments did or did not do in response, sheds light on State responsibility for the planetary emergency and its escalating consequences.

The question of what governments knew about climate change and when they knew it is not just a matter of historical record — it is a matter of legal responsibility. Across the globe, a growing number of courts recognize that States have longstanding legal obligations under multiple sources of international law to prevent and remedy the harms caused by climate change. That legal clarity presents an opportunity to hold States that have flouted those duties to account.

“ The question of **what governments knew** about climate change and **when they knew** it is not just a matter of historical record — it is a matter of legal responsibility.

Establishing when a State's duty to prevent climate harm first arose can help show that the State has been in breach of its climate obligations over time and bears responsibility for ensuing damages. Doing so requires looking back at the history of scientific discoveries and at interactions between governments and researchers to identify when the State knew, or reasonably should have known, enough about the causes and consequences of climate change to take steps to prevent or minimize it. More specifically, when did they know that the continued production and use of fossil fuels — the principal source of anthropogenic GHG emissions — would drive escalating global warming with serious negative impacts on people and the planet?

Some of the biggest cumulative emitters of GHGs assert that global awareness of climate change emerged only around 1990, when international climate negotiations first began. Given the extensive evidence of prior government knowledge, however, such claims collapse under scrutiny. They belie much earlier warnings from scientists, many issued through government-supported programs and disseminated in the popular press, that burning fossil fuels would warm the planet, dangerously destabilize weather patterns, and cause sea level rise — with dire consequences.

This report illustrates evidence of governments' early knowledge about the causes of climate change and the risks it posed, which triggered those countries' legal obligations to take preventive measures. The analysis explains the legal significance of what States knew and when (Part I) and then presents a historical overview of scientific discoveries related to GHGs and the dissemination of this information in many countries (Part II).

Examples of government documents and press coverage (Part III) reflect State awareness and popular perceptions of climate change throughout the twentieth century. These materials show that State officials in multiple high-emitting countries engaged directly with climate science, in some cases at the highest levels of government, and that from at least the 1960s onward, they knew fossil fuels were significantly altering the global climate. The final section (Part IV) highlights evidence from select States — the United States (US), Australia, France, Germany, Italy, Norway, the United Kingdom (UK), and the USSR/Russia — demonstrating widespread government awareness of the serious risks posed by climate change in the 1960s and 1970s, if not before.ⁱ

ⁱ Publicly available evidence on the US government's knowledge of climate change far exceeds the evidence available on other countries. In an effort to cover multiple countries equitably, and in view of the extensive literature that already exists regarding the history of climate research and knowledge in the US, this report provides only a limited overview of the available information regarding the US. For a more detailed look at the US government's early engagement with climate change, see Naomi Oreskes et al., "Climate Change and the Clean Air Act of 1970 Part I: The Scientific Basis," *Ecology Law Quarterly* 50, no. 811 (2024): 811, <https://doi.org/10.15779/Z38DV1CP99>; James Gustave Speth, *They Knew: The US Federal Government's Fifty-Year Role in Causing the Climate Crisis* (The MIT Press, 2022). Some early documents on the US government's knowledge of climate change are also published through the Center for International Environmental Law (CIEL)'s Smoke and Fumes project available at <https://www.smokeandfumes.org/documents>.

As the countries and communities least responsible for climate change continue to be among those most devastated by it, demands for climate justice mount. Why should those who did not create this crisis bear its costs? As those costs continue to rise, steps that were once unthinkable from a diplomatic perspective — such as one State suing another for climate protection and damages — may now seem necessary. Facts like those laid out in this report could help build such a case. They also help root policy demands for climate action, finance, and repair in the legal responsibility polluting States bear for decades of inaction on rising emissions, and for actively perpetuating the chief causes of such emissions.

This report does not conclusively establish any single State's legal responsibility for climate change and resulting harm. The history of a State's knowledge of climate risk is necessary to show how long the State has been under a duty to prevent it, but it is not sufficient or the sole factor relevant to apportion liability for climate harm. A State may be liable for damages caused by its cumulative contribution to planet-warming emissions – including emissions that predate its knowledge of their danger – under longstanding principles of strict liability for transboundary harm or allocation of loss in absence of wrongful conduct.

Moreover, a State's conduct before climate harm was foreseeable remains legally relevant because it helps to determine 1) when impacts reached a threshold that triggered a duty to prevent further emissions, and 2) whether a State acted with requisite due diligence to avoid injuries resulting from their acts and omissions. Beyond calculating a State's total share of both historical and current emissions, additional steps are required to establish the wrongfulness of the State's conduct and the related legal consequences. This includes showing what the State did or did not do once it had knowledge of climate risk, linking its subsequent action, or inaction, to climate change, and linking climate change to specific harms. The attribution science connecting those dots is getting stronger by the day, and so, too, is the case for holding major emitters to account.

Too many countries not only failed to rein in their fossil fuel production and use over the years since they knew of its dangers, they also actively expanded their own fossil dependence and exported it around the world. Righting the record about when their legal duties to reverse course kicked in could help guide how remedy for the ensuing harms, and measures to prevent their recurrence, are meted out.

This report contributes toward that end, but it is neither comprehensive nor exhaustive. It does not cover all the countries responsible for climate change, nor does it present all available evidence on each State considered. Traditional ecological knowledge (TEK) of Indigenous groups regarding human interference with the climate likewise has a much richer history than its brief treatment here would suggest. The limited discussion is not meant to minimize the importance of TEK and its early warnings but rather is due to the difficulty of accessing such information and the limited examples of government officials from high-emitting States engaging with it. The research reflected below is based largely on materials available online, free of charge, and in English. The proof of each country's early knowledge of climate change thus undoubtedly exceeds what is presented here.

Key Takeaways

- 1** Evidence of early State knowledge about climate change carries legal weight because it shows just how long countries have had a duty to act.

Amid the rising tide of climate litigation and the growing push to hold public and private polluters accountable, evidence substantiating when governments knew about the causes and consequences of climate change can help determine their legal responsibility for the crisis and resulting harm.

- 2** Scientists and government officials recognized that fossil fuels could potentially warm the planet by the late nineteenth century.

The basic science proving that carbon dioxide has the potential to warm the atmosphere was established by the mid-1800s. The impact that the burning of fossil fuels would have on the climate was modeled and discussed beginning in the late 1800s.

- 3** Governments, scientists, and industry monitored the warming impact of fossil fuel emissions beginning in the mid-twentieth century.

The science demonstrating that global temperatures were increasing due to the burning of fossil fuels emerged before World War II, and by mid-century, scientists were measuring the excess amount of carbon dioxide in the atmosphere.

- 4** Governments were on notice from the inception of climate studies because they funded much of the research and it was widely publicized.

Early research on climate change was often conducted with government resources and within scientific institutions formed to advise States. In some instances, scientists produced this research for senior officials and departments at the highest echelons, including the office of the presidency. In the US, for example, key studies on climate change and memos regarding the need to address it were released by the White House. Findings were broadly circulated in mainstream news outlets throughout Europe, Australia, and North America.

5

States shared early climate change research with each other.

Before the 1950s, much of the research underpinning climate science occurred in Europe and the US. Scientists and governments in other parts of the world were made aware of this research on climate and the risks of fossil fuel combustion by at least by 1957, when the International Geophysical Year encouraged nations to coordinate on atmospheric research.

6

Throughout the 1950s and 1960s, top scientists concluded that global climate change was likely to occur, that burning fossil fuels was the primary cause, and that these climatic changes risked causing severe harms.

Scientists regularly communicated this fact to government officials in several high-emitting countries, along with details of the potential consequences.

7

By the 1970s, Indigenous leaders in the Arctic were reporting changes to sea ice, wildlife, and precipitation patterns in their traditional territories.

These early climatic changes were communicated to government bodies, adding to centuries of warnings from Indigenous groups about environmental damage being wrought by Western societies.

8

The US acknowledged the climate problem internally in the 1960s.

Troves of documents from the 1960s show US government officials discussing climate change and contemplating what to do about it.

9

By at least the 1970s, other States that relied heavily on fossil fuels acknowledged the “carbon dioxide issue.”

States including Germany, France, the United Kingdom, and Canada all had public discussions about climate change in the 1970s. In some cases, that recognition occurred at the highest levels of government.

10 The international scientific community has been discussing responses to climate change for over half a century.

In the 1970s, international gatherings of scientists, including events sponsored by the United Nations, were convened to discuss responses to global warming. By the end of the decade, scientists and government officials were discussing the need to make changes to the global energy system.

11 The fossil fuel industry's own research confirmed, and sometimes preceded, what States were learning.

Companies published key findings about climate change as early as the 1950s, and several government-owned or affiliated oil companies were aware of that research as early as 1960.

12 Claims that governments first became aware of the need for climate action in the late 1980s or early 1990s don't stand up to scrutiny.

Ample evidence shows that many States have known the source of the climate crisis for the better part of a century and have had the duty to curb fossil-fueled GHG emissions since then. However, States not only have failed to rein in their fossil fuel activity, they have actually increased it.

Applying the law to these facts, the conclusion is clear: many States have been, and remain, in breach of their duties to prevent harm from climate change. They bear responsibility not just for the damage inflicted by their current and future conduct, but for the harm caused by their past action and inaction. **Accountability is overdue.**



Introduction



On June 23, 1988, James Hansen, a scientist from the United States (US) space agency, the National Aeronautics and Space Administration (NASA), delivered a stark message to the US Senate Committee on Energy and Natural Resources. Hansen told the room of lawmakers and press that the greenhouse effect had been detected definitively and that the global climate was actively changing, with severe consequences looming.¹

Governments often cite Hansen's address as the first call to action to do something to prevent catastrophic climate change.² But his speech was actually the culmination of more than a century of repeated admonitions by scientists about the clear causes and dire consequences of global warming. A closer look at the history of climate science, traditional ecological knowledge (TEK) systems, media messaging, and international environmental negotiations shows that far from initial notice to climate-polluting countries, the statements by Hansen and other scientists in the late 1980s and early 1990s were more like final warnings — pleas to governments that the issue about which they had been sounding the alarm for decades had grown too severe to ignore any longer.

High-emitting countries have known that burning fossil fuels was likely to cause adverse impacts on the global climate since at least the 1960s — and these States knew about the potential warming effect of fossil fuels well before then. By the 1970s, various governments began to coordinate on international environmental issues, including climate change. It was not until the late 1980s and early 1990s that the international community finally agreed to take formal collective action by forming the Intergovernmental Panel on Climate Change (IPCC) and commencing international climate treaty negotiations. By that time, governments and scientists around the world had known about the crisis and its drivers for decades.

Yet even since then, States have not only failed to rein in the planet-warming greenhouse gases (GHG) altering the climate, they have also continued to increase emissions by expanding their chief cause: fossil fuel production and use.

In 2025, the International Court of Justice (ICJ) — the world's highest court — issued a unanimous ruling, affirming that every State has a legal obligation to use all means at its disposal to prevent harm from climate change.³ The ruling clarified that when States shirk their duties to regulate and control polluters, they may face legal consequences, including the obligation to cease the breach and provide reparations for resulting injuries. Recognizing that historical and current emission levels vary greatly across countries and regions,⁴ the Court confirmed that the countries responsible for the largest cumulative GHG emissions could be found in breach of their duties and thus liable for the damages to the environment and human rights wrought by climate change.⁵



Climate advocates call for government action following the international Court of Justice's landmark legal decision
© Holland Park Media

However, the ICJ did not explicitly identify the legal responsibility of any single State or group of States. Holding any particular State accountable requires not only determining its cumulative contribution to GHG emissions, it also requires connecting the dots between that State's duties, what it did or did not do to comply with them, the impact of that conduct on the climate, and the ensuing injuries. Doing so also requires showing when the State's obligation to prevent climate change first arose, and what it did or did not do thereafter to rein in emissions or make them — and resulting harm — worse.⁶ While attribution science can link specific sources of emissions to climate change, and climate change to specific impacts,⁷ less has been written about the first part of the evidence chain: the proof that States knew fossil fuels would drive climate destruction and when such knowledge triggered their duty to act.

What is perhaps most devastating about the climate crisis is that the world knows and has known for many decades what is causing it, and yet those most responsible have not only failed to act, they have actively made the crisis worse and continue to do so. Using illustrative examples from publicly available information, this report summarizes facts indicating that the governments overseeing multiple major-emitting economies — including, but by no means limited to, the US — knew about the causes and consequences of climate change for well over sixty years. Yet since then, these governments failed to act on that knowledge in line with their legal duties and, in some instances, denied, distorted, or defunded the science, further delaying action.

This report almost certainly understates how much governments knew about climate change, and just how early they knew it. The facts discussed below are representative, but far from comprehensive. The research skews towards publicly available, English language sources. Therefore, the case against the world's biggest cumulative polluters is stronger than it appears here.

Part I

The Legal Significance of When Governments Knew About Climate Change





In March 2023, the United Nations General Assembly adopted a resolution requesting that the ICJ issue an advisory opinion to clarify the obligations of States in respect of climate change.⁸ The historic resolution was adopted without objection⁹ following a global campaign sparked by Pacific Island students and spearheaded by the small island State of Vanuatu — leaders in the movement for climate justice with deep expertise rooted in their cultures and experiences on the frontlines of

the climate crisis. Noting that GHG emissions continue to rise despite the scientific consensus on climate change, the request asked the Court to answer:

1. What States are required to do to protect the climate and environment from human-generated GHG emissions.
2. What legal consequences States face if they fail to uphold those duties and cause significant harm.

The written and oral proceedings before the Court saw unprecedented participation. By April 2024, the Court received ninety-one written submissions from States and international organizations,¹⁰ followed by sixty-two comments on those submissions in August 2024.¹¹ In December of that same year, the ICJ held nearly two weeks of hearings regarding the advisory opinion. The case was by far the largest in the Court's history, with ninety-six States and eleven international organizations appearing in the Hague.¹² Many of the States present had never before argued at the ICJ. Through moving presentations and rigorous legal arguments that reflected remarkable alignment, representatives of the global majority brought the lived reality of climate change and its existential threat into the courtroom and made the case for climate justice and accountability.

Following these historic proceedings, the Court issued a unanimous advisory opinion in July 2025, concluding that all States have binding duties under multiple sources of law, including customary international law, to prevent, mitigate, and remedy climate harm.¹³ The Court roundly rejected arguments put forward by many of the largest cumulative emitters and fossil fuel producers, who contended that the United Nations (UN) climate treaties (the 1992 UN Framework Convention on Climate Change, the 1997 Kyoto Protocol, and the 2015 Paris Agreement) are the exclusive source of States' climate obligations and largely leave it up to governments to determine their own climate actions. The Court made clear that all States have legal obligations under longstanding customary and treaty-based environmental and human rights law to use all means at their disposal to prevent harm to the climate system and to protect human rights from the impacts of climate change.¹⁴ Those obligations, the Court explained, include reducing GHG emissions and the conduct known to cause them — such as fossil fuel production, consumption, licensing, and subsidies.¹⁵ The Court also rebuffed attempts to disregard the past. It affirmed that States' responsibilities differ based on their historical contributions to the climate crisis, and that States that have breached or are breaching their climate obligations face legal consequences, including the requirement to cease their wrongful conduct and provide full reparation for resulting harm.¹⁶



Arnold Kiel Loughman, Attorney General of the Republic of Vanuatu, speaks at the ICJ in 2024.
© UN Photo/ICJ-CIJ/Frank van Beek

Crucially, the Court made clear that States' obligations to protect the climate system are obligations *erga omnes* — owed to the international community as a whole and enforceable by all States.¹⁷ Climate change is a common concern of humankind, the Court emphasized, and any State can invoke the legal responsibility of another that breaches its climate obligations under customary international law.¹⁸ While only those that have suffered damages due to the other State's breach can seek reparations, any State can seek to compel the offending State to cease its wrongful conduct and guarantee that it will not recur.¹⁹ Practically speaking, that means any State could bring a claim against a major emitter who fails to control emissions or acts to increase pollution.

With these core legal questions now settled, factual questions take center-stage, including a critical one that the Court did not answer: when did States' obligations to prevent climate harm first arise?

The International Court of Justice and the Question of Timing

In its advisory opinion, the ICJ did not pronounce a date when all or some States knew or should have known that fossil fuel emissions are the principal driver of anthropogenic climate change. Nor did it identify a specific date when States should have known that climate change, left unchecked, would cause irreversible damage to people and the planet. The Court did, however, make clear that the question of timing is key to assigning specific responsibility for climate harm. It underscored that a State's legal obligation to take action to prevent climate change was first triggered when that State became aware of the causes of climate change and its foreseeable harms.²⁰ If it can be shown that a State or group of States has known what causes climate change and has been on notice of its foreseeable — indeed, unfolding — consequences, then those States may bear legal responsibility — not just for failing to do all they could to curb climate change since then but for acting in ways that have made climate change worse.

According to the ICJ, the timing of when a State's duties to protect the climate system arose and when their acts or omissions first breached those duties is essential to determining that particular State's responsibility for climate harm.²¹ Clarifying what States knew and when forms a critical bridge that connects the Court's conclusions about State obligations and responsibility to States' specific liability for past and ongoing climate damage.

Longstanding International Law Requires States to Act on Climate Change

The Court's conclusions are based on longstanding international law, according to which a State's knowledge of the risk of significant transboundary environmental harm triggers a duty to take preventive action.²² When a State knows that particular conduct within its jurisdiction or control — such as oil extraction or power plant operation — could foreseeably result in significant harm to the environment beyond its borders, it has an obligation to use all means available to avoid and minimize that harm, including through effective regulation of public and private actors' conduct.²³ According to the ICJ, “States are subject to the duty to prevent significant harm either where no harm has yet been caused but the risk of future significant harm exists, or where some harm has already been caused and there exists a risk of further significant harm.”²⁴

“ According to the ICJ, **“States are subject to the duty to prevent significant harm** either where no harm has yet been caused but the risk of future significant harm exists, or where some harm has already been caused and there exists a risk of further significant harm.”

Governments cannot lawfully allow activities in their territory or subject to their regulation to cause damage to other countries or the global commons. They must act to prevent and mitigate the risk of such harm, including by restricting the conduct that poses the risk. This foundational rule, recognized as part of customary international law, is known as the “no-harm” or transboundary harm principle, and according to the ICJ, it applies to climate change.²⁵

The preventive duty under this principle is closely linked to the obligation under international human rights law that requires States to take all necessary measures to protect human rights from foreseeable violations.²⁶ Where environmental harm jeopardizes human rights, States have a legal obligation to refrain from and to restrict conduct that causes such harm.²⁷

These bodies of law, and the underlying principles, predate the UN climate treaties and continue to apply alongside them, imposing obligations and informing the adequacy of State action in the context of climate change.²⁸

Seal on gate outside the International Court of Justice, the Hague
© Tobias Ahelger - stock.adobe.com

Establishing Climate Risk

As mentioned, States are required to consider how conduct within their control could affect the environment beyond their borders. According to the ICJ, whether a State has a duty to prevent a given activity depends on “both the probability or foreseeability of the occurrence of harm and its severity or magnitude.”²⁹ Such harm may be “caused by the cumulative effect of different acts undertaken by various States and by private actors subject to their respective jurisdiction or control, even if it is difficult in such situations to identify a specific share of responsibility of any particular State.”³⁰ That means that States have a duty not to consider each project, permit, or practice in isolation, but to “assess the possible cumulative effects of their acts and the planned activities under their jurisdiction or control.”³¹ Although such “activities may not be environmentally significant if taken in isolation, ... they may produce significant effects if evaluated in interaction with other activities.”³²

Climate change is the quintessential example of how the cumulative effect of discrete activities in one place can be deadly in another. The consequences of GHG accumulation in the atmosphere are not confined to the locations where those gases are emitted but rather affect the entire global climatic system. Among the great injustices of the climate crisis is that many of the countries and communities with the lowest historic emissions face the highest risk of adverse climate impacts.³³

When a State knows or should know that an activity risks causing significant environmental and human rights harm, and thus is under a duty to prevent and mitigate that risk, that State’s failure “to take all measures which were within its power to prevent the significant harm”³⁴ exposes the State to liability. When it comes to climate change, that means a State may be responsible where — as so many have — it has failed to take “the necessary regulatory and legislative measures to limit the quantity of emissions caused by private actors under its jurisdiction.”³⁵ One need only look at the trajectories of fossil fuel production plans, global emissions, and temperature rise today to know that many States are in flagrant violation of their duties and widely exposed to liability.

Knowledge Triggers Legal Responsibility ... and Denial

Because knowledge of climate risk triggers a duty to prevent it, it is no surprise that high-emitting States seeking to avoid liability for climate damages have a legal interest in asserting that they did not know about climate change until recently. Those governments aiming to deflect, deny, or minimize their legal responsibility have an incentive to downplay their prior knowledge of the risk of climate harm. The later their awareness arose, the shorter the period they have had a duty to act. This misrepresentation of history conveniently reduces States’ exposure to liability for both failing to act to prevent climate change and for worsening GHG accumulation through the continuation or expansion of polluting activities.

Major emitting States made such claims before the ICJ in the climate advisory opinion proceedings, implying their knowledge of climate change lagged behind scientific discoveries. For example, the US, the largest historical emitter of GHGs, wrote in its submission: “It was only in the late 1980s, however, that a general awareness developed among States of the significant global risks that could arise from global warming resulting from increased atmospheric concentrations of GHGs due to human activities.”³⁶ China, the second largest historic emitter, similarly wrote, “The World Meteorological Organization (WMO) convened the first World Climate Conference (WCC) in 1979, which for the first time expressed concern at the global level about anthropogenic climate change and its adverse effects.”³⁷



As laid out in Parts II and III, these statements are misleading. They ignore decades of evidence from scientists that fossil fuels would warm the planet, with potentially devastating consequences, as well as warnings from political advisors. They also ignore the prior international gatherings that elevated climate science and concerns about GHG emissions to global attention.

Anticipating these claims, Small Island Developing States included in their submissions to the ICJ evidence that officials of certain high-emitting countries knew about climate change far earlier. Vanuatu, for example, referred to an expert opinion from Professor Naomi Oreskes, a science historian at Harvard University, which states: “[A]t least from the 1960s, the United States and other States with high cumulative emissions of greenhouse gases (GHGs), including France and the United Kingdom (UK), were aware that (a) the release of greenhouse gases into the Earth’s atmosphere had the potential to alter the climate system, and (b) that such interference, if unmitigated, could have catastrophic effects for humans and the environment.”ⁱⁱ

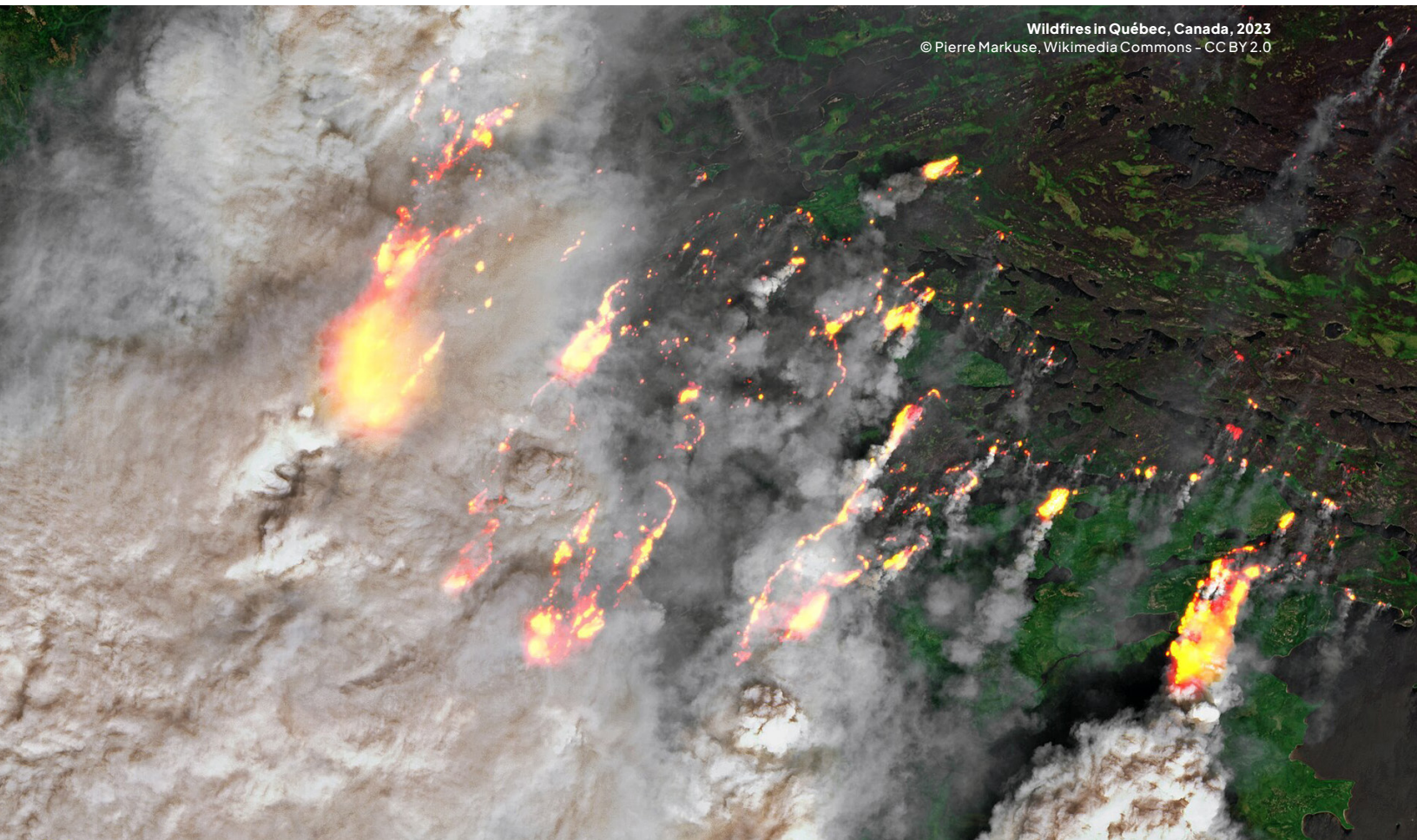
ⁱⁱ Vanuatu, Written Statement of the Republic of Vanuatu to the International Court of Justice, Obligations of States in Respect of Climate Change (Request for an Advisory Opinion), March 21, 2024, paras. 4, 177–192, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240321-wri-06-00-en.pdf>; Vanuatu, Written Comments of the Republic of Vanuatu to the International Court of Justice, Obligations of States in Respect of Climate Change (Request for an Advisory Opinion), August 15, 2024, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240815-wri-11-00-en.pdf>. Vanuatu’s Written Statement includes Naomi Oreskes, Expert Report of Professor Naomi Oreskes on Historical Knowledge and Awareness, in Government Circles, of the Effects of Fossil Fuel Combustion as the Cause of Climate Change, January 29, 2024, in Exhibit D, which is cited in both their Written Statement and later Written Comments.

Connecting the Dots

Part II and Part III lay out evidence that certain States knew about the causes and foreseeable consequences of climate change well before any multilateral agreements on climate change were concluded. These historical facts clarify how long these States have been under a duty to prevent climate harm and bolster a foundation for climate accountability.

Of course, proving the existence of a duty does not, on its own, establish State responsibility. Future claimants may need to show that the duty-bound State in question breached its obligations not only by failing to use all means to reduce the causes of climate harm once they were known, but also, in many cases, by adding to those causes through continued or expanded fossil fuel production and use. There, however, the evidence abounds. Rather than curtail emissions once they knew the danger they posed, the biggest cumulative emitters have continued to authorize, subsidize, and increase reliance on the oil, gas, and coal heating the planet and making us sick. Denial, dismissal, and distortion of climate science have further obstructed climate action, exacerbating rather than alleviating the problem.

Establishing the reparations owed by a given State to those who have suffered the consequences of climate change may require facts that link the State's action and inaction to the damage caused by climate change. Again, however, evidence substantiating major emitters' liability for climate harm is growing stronger by the day. Attribution science — a field that connects GHG emissions to specific weather events or other negative impacts from climate change, such as heatwaves, sea level rise, and ocean acidification — is already robust and constantly improving, putting this final link in the causal chain of climate accountability well within reach.





Climate change protesters march in Paris streets, October 2018
© Jeanne Menjoulet, Wikimedia Commons - CC BY 2.0

Proving a State's knowledge is not necessarily a prerequisite for holding it responsible for its share of climate harm. Under theories of strict liability or allocation of loss in absence of a wrongful act, States may have an obligation to remedy damages resulting from activities under their control whether or not that conduct was lawful at the time it occurred. Therefore, a State's prior conduct is not rendered legally irrelevant simply by identifying when a State's knowledge of climate risk crystallized and when its duty to prevent further GHG emissions arose. Acts and omissions that generated or failed to regulate GHG pollution before its impacts were foreseeable still form part of the cumulative conduct that has caused, is causing, and will cause harm. They thus bear on any assessment of climate-related injury and apportionment of liability among contributing States. Evidence of what States knew and when does, however, also bear on the lawfulness of their conduct and thus may be a prerequisite to establishing wrongfulness and the legal consequences that flow from it.

The ICJ opinion reinforced the legal foundation for climate justice and accountability. The facts summarized below begin to lay out some of the cases that can be built upon it.

Part II

Early Climate Science Milestones

Smoke from the 2023 Québec wildfires spread across eastern North America, causing hazardous air quality in cities including New York.
© Aelthemplaer, Wikimedia Commons - CC BY 4.0

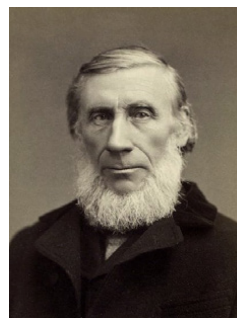
Far from being a novel scientific concept in the 1980s, research on GHGs and climatic change has been ongoing since the nineteenth century. This section presents an illustrative timeline of the major scientific developments and milestones that advanced global understanding of anthropogenic climate change within and outside of scientific circles. While research activities were concentrated in certain countries, the research itself involved scientists who hailed from all over the world.

Early Research Into Greenhouse Gases

Research into carbon dioxide (CO₂)’s warming effect began in the nineteenth century and continued through the beginning of the twentieth century. During this period, scientists quantified the potential warming impact of GHGs in the atmosphere and determined that CO₂ released from fossil fuels was capable of warming the planet. Academics began to write about the potential for humankind to change the environment and spur unintended consequences — a concept that was previously poorly understood.

1859ⁱⁱⁱ

John Tyndall, an Irish physicist, conducted a series of experiments measuring the absorption of heat by gases, including both water vapor and CO₂.³⁸ Tyndall laid out the significance of this research for the global climate in a paper and subsequent 1861 lecture, where he explained that any variation in CO₂ in the atmosphere would produce a change in climate.³⁹



John Tyndall, Irish physicist
© NYPL Archives

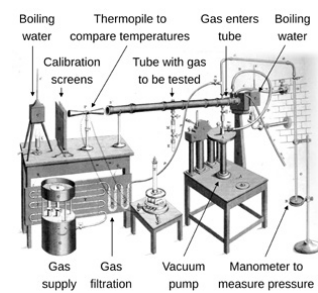


Illustration of Tyndall's sensitive ratio spectrophotometer
© John Tyndall

1896

Building upon Tyndall’s work on CO₂’s warming impact, Swedish physicist Svante Arrhenius performed the first estimate of the warming impact from doubling the levels of CO₂ in the atmosphere. He performed tens of thousands of calculations by hand, finding that doubling the CO₂ in the atmosphere would raise global temperatures by five to six degrees Celsius.⁴⁰ Arrhenius explicitly acknowledged that human industrial activities can be a significant source of CO₂,⁴¹ and in subsequent lectures he explained that the burning of coal could eventually raise global temperatures.⁴²



Svante Arrhenius, Swedish physicist
© Zeitschrift für Physikalische Chemie

ⁱⁱⁱ Eunice Foote, an American scientist, published the first known findings on the warming impact of CO₂ in 1856, but unlike Tyndall, her work did not become well-known and there is no evidence it reached the notice of government officials. See Tess Joosse, “August 1856: Eunice Foote Concludes That Carbon Dioxide Could Warm the Atmosphere, Three Years Before John Tyndall Did,” *Advanced Physics*, July 12, 2023, <https://www.aps.org/apsnews/2023/07/carbon-dioxide-atmosphere-eunice-foote>.

1922

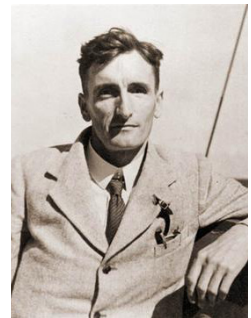
British geologist Robert Lionel Sherlock published a book exploring the ways human activity was interfering with natural processes, including the release of mass amounts of CO₂ into the atmosphere from burning fossil fuels.⁴³ Sherlock's work was among the first to acknowledge the breadth of human impact on the environment, and is often cited today as an early piece of literature supporting the declaration of the Anthropocene Epoch, a geological age marked by human transformation.⁴⁴ While Sherlock's work was not explicitly focused on climate science, his ideas set the foundation for human's understanding of their own potential to impact the global environment.



Robert Lionel Sherlock,
British geologist
© British Geological Survey

1938

British engineer Guy Stewart Callendar compiled temperature measurements and atmospheric CO₂ concentrations, concluding that over the preceding half century, humans had released enough CO₂ that global temperatures had risen.⁴⁵ By the 1950s rising temperatures caused by increased GHGs in the atmosphere had become known as the “Callendar effect.”⁴⁶



Guy Stewart Callendar, British
engineer
© University of East Anglia Archive

Post World–War II Consensus Emerges

After the end of WWII, scientists returned to studying “the carbon dioxide problem,” as anthropogenic climate change was often called at the time. During this period, scientists established that fossil fuel combustion was — as previous scientists had shown theoretically possible — putting more CO₂ into the atmosphere than the earth's natural systems could absorb. By the 1960s, the predominant scientific view was that the earth was warming due to human activity and that continued warming had the potential to cause severe and widespread effects on society.

1955

Chemist Hans Suess determined that the release of fossil fuels had changed the concentrations of different carbon isotopes in the atmosphere and oceans. By measuring the different isotopes, Suess demonstrated the impact that fossil fuel combustion was having on increasing atmospheric CO₂ levels. This phenomenon became known as the “Suess effect.”⁴⁷

1957

Suess and Roger Revelle, an American oceanographer, published models and calculations on ocean-carbon exchange.⁴⁸ They concluded that the levels of CO₂ released by fossil fuel combustion amounted to a “large-scale geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future.”⁴⁹ Revelle and Suess became proponents of adding CO₂ monitoring programs to the International Geophysical Year (IGY), which took place in 1957–1958.⁵⁰

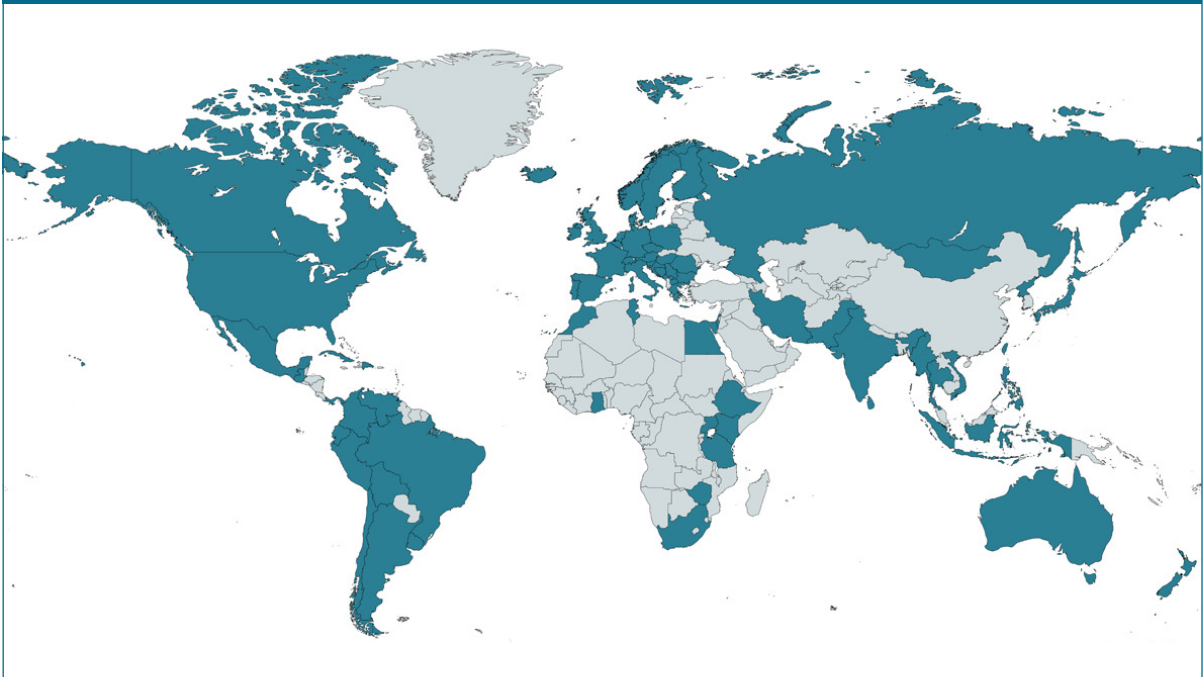


Roger Revelle, Scientist
© UCSD

1957–1958

The IGY was a convening of approximately 60,000 scientists from multiple disciplines and nearly seventy countries.⁵¹ The event was a global effort to conduct experiments, collect data, and compile research that advanced understanding of global systems like the atmosphere, climate, and oceans.⁵² In the US, the Weather Bureau used funds appropriated for the IGY to create a geochemical measurement program meant to track ozone and carbon dioxide levels.⁵³ On May 1, 1957, Revelle presented the initial IGY findings to the US Congress. During his address, he spoke of an increase in fossil fuel use that was elevating carbon dioxide levels and driving global warming.⁵⁴

Figure 1: Countries that Participated in the International Geophysical Year in 1957



This map includes: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, Colombia, Cuba, Czechoslovakia, Denmark, Dominican Republic, East Germany, Ecuador, Egypt, Ethiopia, Finland, France, Ghana, Greece, Guatemala, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Kenya, Malaya, Mexico, Mongolia, Morocco, Myanmar, Netherlands, New Zealand, North Korea, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Romania, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Tanzania, Thailand, Tunisia, West Germany, and Zimbabwe.

1958

Charles Keeling led the IGY-funded CO₂ measurement program from a lab at the Mauna Loa observatory in Hawaii. He began daily measurements of CO₂ levels in the atmosphere starting on March 29, 1958.⁵⁵

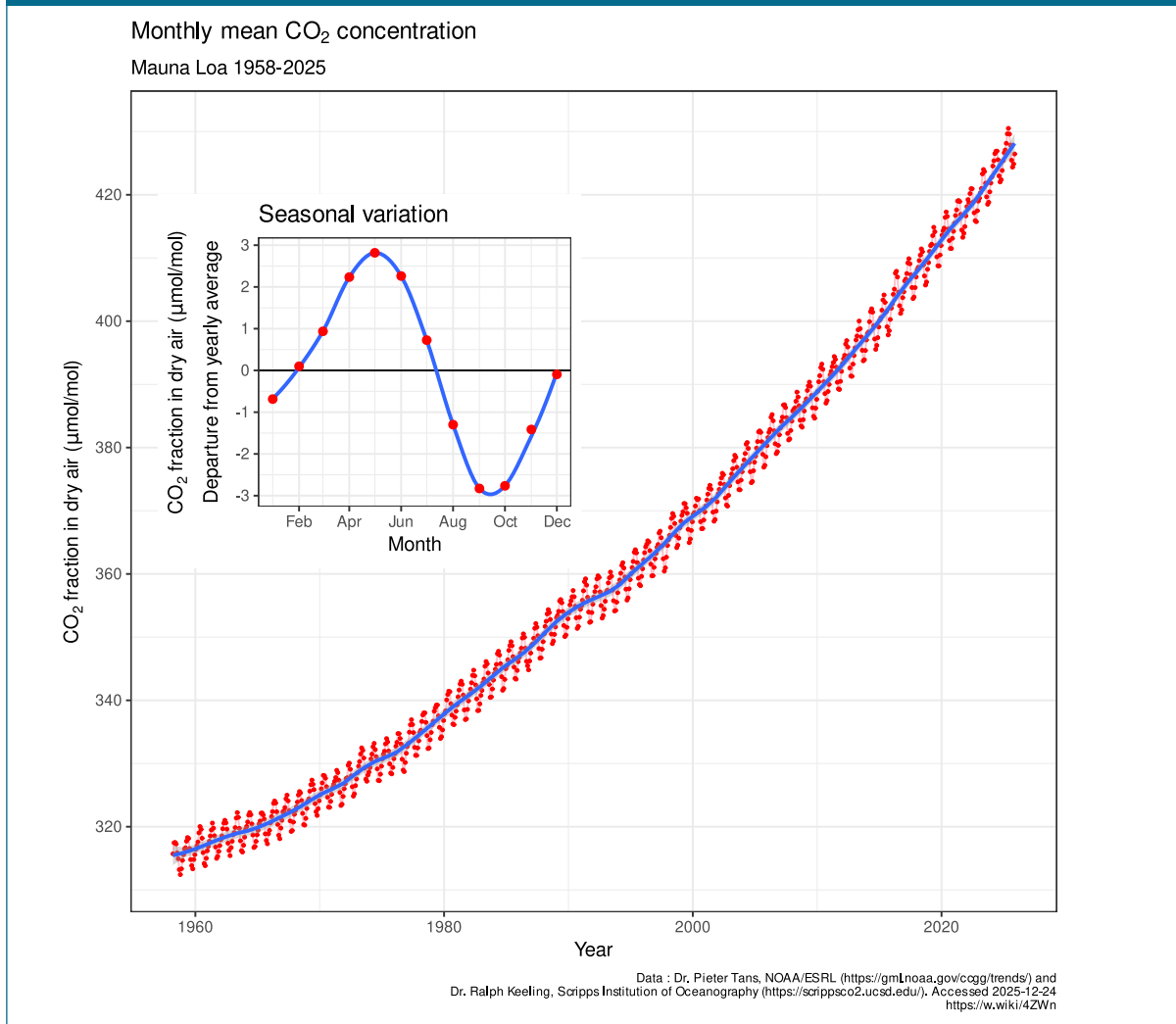


The National Oceanic and Atmospheric Administration's Mauna Loa Observatory
© NOAA

1960

Keeling published the results of the first three years of measurements at Mauna Loa. The article described the seasonal pattern of CO₂ fluctuations and the steadily increasing concentrations of CO₂ year over year. In the paper, Keeling suggested a link between the rising CO₂ levels and the burning of fossil fuels. The graph showing this rise in CO₂ became known as the “Keeling Curve.”⁵⁶

Figure 2: Keeling Curve



©NOAA / Ralph Keeling, Scripps Institution of Oceanography

1960s–1970s

Interviews with Indigenous leaders and projects dedicated to documenting TEK have shown that Indigenous groups, primarily in the Arctic, began noticing changes in temperature and sea ice during the 1960s and 1970s.⁵⁷

1965

The American Association for the Advancement of Science's (AAAS) Air Conservation Commission released a report summarizing the known science around air pollutants and their potential impacts on human health and society.⁵⁸ The report mentions that, although not ordinarily considered a pollutant, CO₂ levels have been rising due to the use of fossil fuels,⁵⁹ and would impact the heat balance of the planet.⁶⁰ Written to “be of value to scientists, public bodies, and the public,”⁶¹ the report was cited in prominent scientific publications and read by top government officials. For example, Senator Edmund Muskie of Maine, who later became Secretary of State, corresponded with scientists regarding articles written about the report.⁶²

1967

Meteorologists Syukuro Manabe and Richard Wetherald developed a basic atmospheric model at the US National Oceanic and Atmospheric Administration. Their paper describing the modeling results indicated that atmospheric CO₂ had a much larger impact on warming than previously understood.⁶³

1973

With more than a decade's worth of observations, Keeling's team calculated how much (about 55 percent) of the CO₂ resulting from fossil fuel combustion was failing to be taken up by the oceans, plants, and soils and was instead remaining in the atmosphere. This lingering CO₂ became known as the “airborne fraction.” The existence of the airborne fraction challenged the beliefs of the largest remaining group of scientists that were uncertain about fossil fuels' influence on global warming. These dissenting scientists had theorized that the earth's natural carbon cycle would absorb the excess CO₂ from fossil fuels, but Keeling's data showed that a large portion of the warming gas remained in the atmosphere.⁶⁴

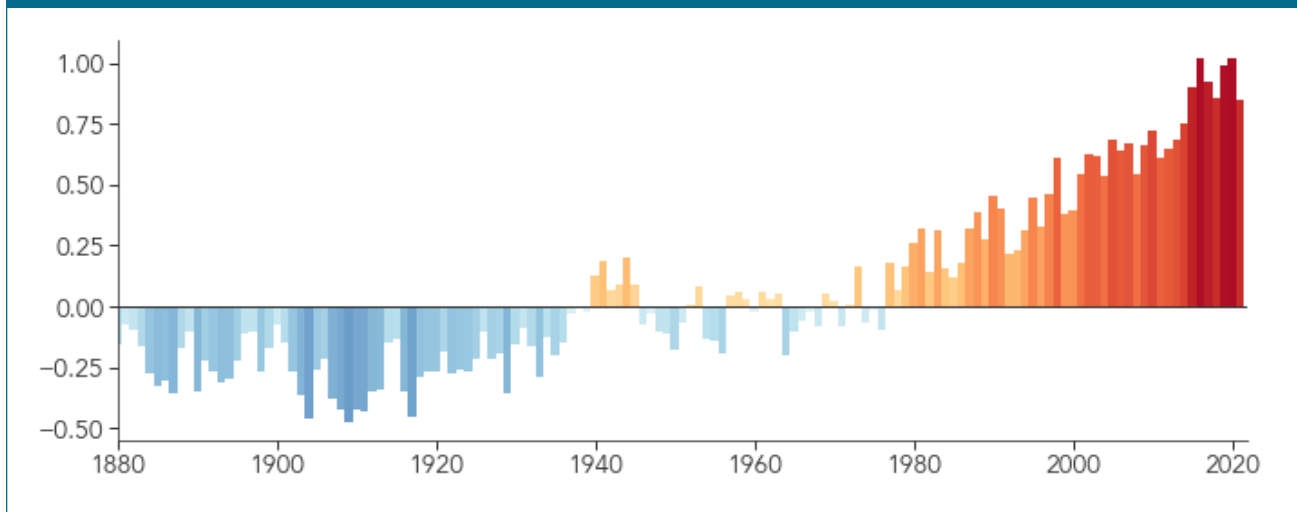
1979

In a paper for *Science*, John Laurmann, an engineer at Stanford, argued that because reducing fossil fuel use would take decades, climate change created an “immediate environmental control problem.”⁶⁵ Laurmann estimated that by beginning that process immediately, the concentration of CO₂ in the atmosphere could be held to a peak of about 403 parts per million (ppm)⁶⁶ (today CO₂ levels are over 420 ppm).⁶⁷ Another paper, published the same year in the *Journal of Geophysical Research*, reached similar conclusions and warned that failure to reduce fossil fuel dependence would lead to catastrophic levels of warming by the end of the twenty-first century.⁶⁸ Throughout the early 1980s, other scientists picked up on this same concept, writing papers that described reducing fossil fuel use as the solution for climate change and emphasizing the importance of early action to keep CO₂ levels down.⁶⁹

Beyond Consensus: Climate Change Moves Through the Political Realm

The climate research in the 1950s and 1960s established the initial foundations for how the earth's systems interact with increases in CO₂ from fossil fuels. While precision in climate science and modeling continued to improve, the fact that the burning of fossil fuels was increasing global temperatures was widely accepted by scientists and many government officials in the 1960s. Despite warnings from scientists, governments — particularly in high-emitting countries — moved slowly in addressing climate change. Most of the major scientific milestones post-1970 were not breakthroughs, but reiterations or more precise confirmations of the ways in which CO₂ was changing the atmosphere. Each subsequent event in the timeline during this period represents a missed opportunity for government action.

Figure 3: Global Temperature Anomaly (°C compared to the 1951–1980 average)



Global average temperatures have risen sharply since the late twentieth century, with recent years among the warmest ever recorded.
© NASA

1970

A concerned group of scientists held a conference in Stockholm on the “Study of Man’s Impact on Climate.” The conference report discussed the potential for human pollutants to influence the climate, potentially melting the polar ice caps and causing global warming of as much as two degrees Celsius.⁷⁰ The main audiences for the report were “peoples and governments of the world who collectively bear the responsibility for assuring that man does not inadvertently destroy his environment in the process of meeting his many and varied needs.”⁷¹ The conference included preeminent scientists from around the world including from the US, France, the USSR/Russia, West Germany, Israel, Japan, Belgium, Canada, Hungary, India, Australia, Italy, and Sweden. Many of these scientists were from government institutions.⁷²

1972

The UN convenes its first ever conference on the Human Environment in Stockholm. While climate change was not the sole focus of the conference, the meeting's final report included recommendations for governments to "be mindful of activities in which there is an appreciable risk of effects on climate," and to create CO₂ monitoring programs.⁷³

1975

Wallace Broecker, an American geochemist,⁷⁴ published an article in *Science* called "Climatic Change: Are We on the Brink of a Pronounced Global Warming?" The article is credited with popularizing the term "global warming," and predicted the start of a period of rapid atmospheric heating.⁷⁵

1977

The US National Academy of Sciences, the official science advisory organization for the US government,⁷⁶ released a report called "Energy and Climate: Studies in Geophysics" with the support of multiple scientific and government agencies. The report warned of consequences that were "adverse, perhaps even catastrophic" if atmospheric CO₂ levels continued to rise.⁷⁷ The report, and its warnings about the use of coal, in particular, were widely covered in domestic and international media.⁷⁸

1978

The International Institute for Applied Systems Analysis, an organization founded during the Cold War to promote East-West scientific cooperation,⁷⁹ held a workshop on "Carbon Dioxide, Climate and Society," co-sponsored by the WMO, UN Environment Programme (UNEP) and Scientific Committee On Problems in the Environment (SCOPE). The conference included representatives from government research institutions from all over the world, including high-emitting countries like the US, West Germany, the USSR, Canada, France, Italy, and the UK.⁸⁰ At the conference, speakers discussed the potential for serious atmospheric consequences resulting from continued reliance on fossil fuels for energy.⁸¹

1979

In February 1979, the UN held the World Climate Conference in Geneva, overseen by the WMO, which brought together experts from around the world to examine climate variability, including global warming, and its implications for human society. The conference resulted in a declaration calling on the world's governments "to foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity."⁸²



1980

Scientists from the World Meteorological Institute, the International Council of Scientific Unions (ICSU), and the UNEP met in Villach, Austria in November for a “joint meeting of experts on the assessment of the role of CO₂ on climate variations and their impact.” The report from the conference concluded that “[t]he probability that potentially serious impacts may be realized is sufficiently great that an international commitment to a programme of co-operation in research is required to illuminate the issues and to reduce uncertainties so that the dimensions and time scale of the problem can be more reliably ascertained.”⁸³

1983

The US National Research Council released another report with largely the same scientific conclusions as the Villach report.⁸⁴

1985

Scientists reconvened in Villach in 1985 for the “Assessment of the Role of Carbon Dioxide and of Other Greenhouse Gases in Climate Variations and Associated Impacts,” where they reviewed a report authored by SCOPE.⁸⁵ The conference paper stated: “[I]n the first half of the next century a rise of global mean temperature could occur which is greater than any in man’s history.”⁸⁶ The conference paper also urged government action, something that had not been done so explicitly before.⁸⁷ The conference was convened by the UNEP, ICSU, and WMO, rather than specific national governments.⁸⁸ Unconstrained by the political pressures in their own countries, scientists spoke freely about the dangers of climate change.⁸⁹

1988

On June 23, NASA scientist James Hansen addressed a US congressional committee declaring that NASA was 99% certain that the recorded increase in warming was not a natural variation. He told legislators, “it is time to stop waffling so much and say that the evidence is pretty strong that the greenhouse effect is here.”⁹⁰

The New York Times front page from June 24, 1988
© New York Times



In its submissions to the ICJ for its advisory opinion on climate change, the US government referred to Hansen’s statements as the first wake up call to governments regarding climate change.⁹¹ This characterization ignores the fact that his words followed decades of research and diligent communication from scientists regarding the threats of human-caused climate change. The congressional hearing occurred on the cusp of important international conferences, which launched the formal international climate negotiations.

1988

On June 27, scientists, government officials, and nongovernmental organizations at the Toronto Conference, issued a global warning on the seriousness of climate change. The statement called for cutting CO₂ emissions to 20 percent below the 1988 levels by 2005 and warned: “Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war.”⁹²

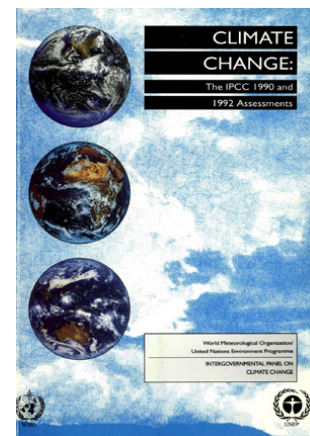
“**Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences could be second only to a global nuclear war.**

excerpt from the 1988 Toronto Conference

1990

The IPCC, established in 1988, released its First Assessment Report to inform policymakers of the current research.⁹³

Scan of IPCC climate change assessment
© WMO / UNEP



1992

The United Nations Framework Convention on Climate Change (UNFCCC), adopted in May 1992 and opened for signature at the UN Earth Summit in Rio de Janeiro in June of that year, commits governments to "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."⁹⁴



UN Photo

Delegates gather at the 1992 United Nations Conference on Environment and Development (Earth Summit) in Rio de Janeiro, where the UN Framework Convention on Climate Change (UNFCCC) was opened for signature.

Box 1: Industry Knowledge of Climate Change

In parallel with government or university-sponsored climate research, prominent fossil fuel companies conducted their own studies. Much has been written about industry knowledge of climate change,⁹⁵ but the following truncated timeline provides insight into how the industry informed scientific and governmental understanding and affirmed key warnings, as well as how the industry responded — not by curtailing its dangerous products but by obstructing climate action. Fossil fuel industry denial, deception, and distortion of climate science continued to derail climate action well beyond the period below — indeed, to the present day.

1957

As scientists were preparing experiments for the IGY, scientists at Humble Oil (now ExxonMobil) published a paper on the work of Guy Callendar, Hans Suess, and others, and explicitly acknowledged a link between burning fossil fuels and rising CO₂ levels.⁹⁶

1958

The American Petroleum Institute (API)'s Smoke and Fumes committee funded a project to measure atmospheric carbon “of fossil origin.”⁹⁷ API members in the US and internationally put the industry on notice about climate change.⁹⁸ The API would go on to lobby against pollution regulations and play up uncertainty around climate change.⁹⁹

1968

The Stanford Research Institute produced a report commissioned by the API that described the causes and impacts of global warming. The report described the potential consequences of climate change and said that fossil fuel combustion was likely the cause of global warming.¹⁰⁰

1978

ExxonMobil scientific advisor James Black gave a presentation to Exxon Corporation that clearly stated that the continued use of fossil fuels would warm the planet. In his presentation Black said, “There is general scientific agreement that the most likely manner in which mankind is influencing the global climate is through carbon dioxide release from the burning of fossil fuels.”¹⁰¹

1998

The API held a meeting on a “Global Climate Science Communications Action Plan,” with explicit goals to emphasize the uncertainties in climate science and discredit those who promote climate action.¹⁰²

Part III

Government and Popular Perceptions of Climate Science

Floodwaters inundate streets in Jakarta, Indonesia, where sea level rise, land subsidence contribute to recurring urban flooding
© GHArtwork- stock.adobe.com

The scientists unraveling the questions around the greenhouse effect and climate change were not conducting their work in obscurity. Many discoveries regarding climate change were covered widely by the media and many more were funded by government agencies. That coverage further substantiates that governments and industry were on notice of the causes and consequences of fossil fuel dependence and the GHG emissions it was driving.

The media examples in this section are not exhaustive and are largely limited to English-language sources. Examples from after 1980 (when coverage of climate change significantly increased) are not included. The examples of government interaction with climate science are limited to public speeches and events, while examples of behind-the-scenes work on climate change by governments are laid out in Part IV with country-specific case studies. As these illustrations make clear, climate change was not a niche issue discussed only within scientific circles. Rather, it was something that policymakers in many major emitting countries would have been aware of at least by the 1950s.

Perceptions of Early Discoveries on Carbon Dioxide

Governments were involved with climate change discoveries from the very beginning, starting with John Tyndall's work in the mid-nineteenth century. Tyndall conducted his work at the Royal Institution in London, an organization founded to teach the public about science and new technologies.¹⁰³ By the time of his 1861 lecture, Tyndall had become a cultural icon, and his lectures were widely attended.¹⁰⁴ Svante Arrhenius, the Swedish physicist who built upon Tyndall's work at the end of the nineteenth century, was also well known. He was a Nobel laureate, was offered work at European universities, and gave lectures at universities in the US.¹⁰⁵

Some governments have acknowledged that Arrhenius's work was well known, but claim they disregarded CO₂ emissions as a problem because Arrhenius believed warming would be slower and could actually benefit society.¹⁰⁶ While it is true that Arrhenius, like Callendar after him, projected lower levels of warming than the world has seen, it was not because he underestimated the effect of CO₂ accumulation on temperature. Rather, he underestimated the pace at which humanity would burn through fossil fuels. Had he used numbers that accurately reflected the rapacious rates of fossil fuel combustion, Arrhenius's calculations would have projected catastrophic warming occurring over a much shorter period of time.¹⁰⁷ While governments in Arrhenius's time might have reasonably thought that fossil fuel use would decline before warming became a problem, scientists — and some government agencies — familiar with Arrhenius's work decades later had access to evidence showing that fossil fuel use was accelerating and that warming was likely occurring more rapidly than he anticipated.

ROYAL INSTITUTION.

On Friday evening Dr. Tyndall delivered a lecture on the effects of different qualities of heat on different gases; his Royal Highness the Prince Consort being in the chair. Dr. Tyndall stated that he had been engaged in a series of experiments to ascertain the correctness of the views of M. Pouillet respecting the effect of aeriform bodies in absorbing the rays of heat, and he had arrived at conclusions which are quite new, and calculated to be of great importance in explaining some of the great phenomena of nature. His experiments had been conducted with the aid of a thermo-electric pile, which is far more sensitive to the effects of heat than the most delicate thermometer, and the results he had arrived at are that the invisible rays of heat are absorbed in passing through most transparent gaseous bodies, but that the luminous heat of the sun is transmitted through them unimpeded. Dr. Tyndall repeated successfully some of these experiments, which require the most careful manipulation. He first showed, by means of a galvanometer connected with the thermo-electric pile, that rock salt transmits the rays from a non-luminous source of heat which are obstructed by glass; and in the construction of his apparatus he accordingly used the former substance. The apparatus consisted of a tube four feet long and three inches diameter, closed at each end with rock salt, and so contrived that it might be exhausted of air, and other gases substituted. Some fusible metal was kept heated at one end of the tube, and at the other was placed a thermo-electric pile, which was connected with a delicate galvanometer. Another sensitive pile was also heated by a non-luminous body and connected with the galvanometer, the indications of which were, by an ingenious arrangement of the electric light, reflected on a screen. The two sources of heat were so regulated as to neutralise each other, and to bring the galvanometer needle to zero, when the tube contained atmospheric air. When the tube was exhausted, and the rays of heat passed through the partial vacuum, a decided deflection of the needle was observed. The difference in the effect was, however, small when compared with the brisk action of the needle when the tube was afterwards filled with coal gas, which absorbed the rays of heat much more than common air. Dr. Tyndall having shown by these experiments — which he said might be repeated with similar effects with all other gases — that the invisible rays of heat are variously absorbed by gaseous bodies, he next employed a source of heat combined with light, resembling that of the sun. For this purpose he used the oxyhydrogen light, the rays of which were passed through the tube when filled with air; when exhausted, and when filled with coal gas, in every instance the effect was the same, for the luminous rays were not absorbed, and the galvanometer needle, after having been brought to zero, remained there. These experiments, Dr. Tyndall observed, have an important bearing on the phenomena of nature, for they seem to explain how the planets most distant from the sun may yet be sufficiently heated by its rays to become habitable. Even the planet Neptune, though so remote from the source of heat, may in the course of time have become heated by continuously receiving luminous rays, the heating portion of which, when not combined with light, may be retained by the absorbing power of the atmosphere. Dr. Tyndall did not attempt to reconcile this hypothesis with the geological theory that this globe has been gradually cooled down from an incandescent state to its present temperature by the radiation of its heat into space.

At the conclusion of the lecture the Prince Consort had some conversation with Dr. Tyndall before he retired.

June 15, 1859: Tyndall's lecture on the greenhouse effect was covered by the *London Morning Post*. Prince Albert (husband to Queen Victoria, then the reigning monarch) attended the lecture.¹⁰⁸

The connection between the burning of fossil fuels (particularly coal) and environmental problems, including warming, was well known to the general public, as well as governments. Warnings about the rising use of coal and Arrhenius's predictions were published in newspapers across the world in the early twentieth century. Here are a few examples:

The Selma Morning Times.

SELMA, ALA., WEDNESDAY, OCTOBER 15, 1902

Hint to Coal Consumers.

A Swedish professor, Svend Arrhenius, has evolved a new theory of the extinction of the human race. He holds that the combustion of coal by civilized man is gradually warming the atmosphere so that in the course of a few cycles of 10,000 years the earth will be baked in a temperature close to the boiling point. He bases his theory on the accumulation of carbonic acid in the atmosphere, which acts as a glass in concentrating and refracting the heat of the sun.

The furnaces of the world are now burning about 2,000,000,000 tons of coal a year. When this is burned, uniting with oxygen, it adds about 7,000,000,000 tons of carbon dioxide to the atmosphere yearly. This tends to make the air a more effective blanket for the earth and to raise its temperature. The effect may be considerable in a few centuries.

1912: Excerpt that appeared in *The Rodney and Otamatea Times* in New Zealand and in *Popular Mechanics* in the US¹¹⁰

1902: Excerpt from *The Selma Morning Times*, Alabama, US¹⁰⁹

Twentieth Century Alarm Bells

Both World Wars captured much of the scientific and media attention in the early twentieth century, but by the 1950s, interest in “the carbon dioxide problem” — as anthropogenic climate change was then referred to — roared back and the public warnings became more dire.

In May 1953, a physicist named Gilbert Plass delivered a stark warning about climate change during a presentation at the American Geophysical Union in Washington. “The large increase in industrial activity during the present century is discharging so much carbon dioxide into the atmosphere that the average temperature is rising at the rate of 1.5 degrees per century,” he said. Plass’s remarks, which occurred as Roger Revelle and Hans Suess were refining the science behind the earth’s natural climate absorption capabilities, were widely covered in the mainstream news media all over the world, including, *The New York Times*, *Time*, *Newsweek* and *The Sydney Morning Herald*.¹¹¹

In 1958, climate change was a well-known enough issue that it appeared on the *Bell Telephone Science Hour*^{iv} with the host declaring that, “man may be unwittingly changing the world’s climate through the waste products of his civilization.”¹¹² After its television run, the *Bell Telephone Science Hour* was released on videotape and shown to an estimated 200 million students.¹¹³

iv The Bell Telephone Science Hour was a popular television program that explained popular scientific topics. It garnered tens of millions of viewers per episode. The TV show was serialized, released on video, and disseminated to schools. Some estimate that hundreds of millions of school children saw the series. See Scott Curtis, “Between Education and Entertainment: Animation, Science Communication and the Bell System Science Series,” *The British Journal for the History of Science*, August 22, 2025, <https://doi.org/doi:10.1017/S0007087425101118>.

By the 1960s, climate change was a semi-regular fixture in newspapers.¹¹⁴ President Lyndon Johnson mentioned climate change in an address to Congress in 1965, saying, “This generation has altered the composition of the atmosphere on a global scale through radioactive materials and a steady increase in carbon dioxide from the burning of fossil fuels.”¹¹⁵

In January 1972, *The Ecologist*, a magazine in the UK, published “A Blueprint for Survival,” which included discussion of CO₂ emissions from the burning of fossil fuels and projections of future climate change.¹¹⁶ The issue sold over 750,000 copies and shot the magazine to fame.¹¹⁷

In the same year, a global issues group known as “The Club of Rome” released *Limits to Growth*, which used computer simulations to show that production and consumption could not increase indefinitely. While the book discussed a wide array of environmental problems, it mentioned thermal pollution from CO₂ and cited the most up-to-date research on climate change.¹¹⁸ The book sold more than thirty million copies in thirty languages.¹¹⁹

“ This generation has altered the composition of the atmosphere on a global scale through radioactive materials and a steady increase in carbon dioxide from the burning of fossil fuels.

President Lyndon Johnson during an address to Congress in 1965

Lyndon Johnson's scientific advisory committee warned of climate change in 1965
© James Vaughan, Flickr - CC BY-NC-SA 2.0



Air pollution shrouds the Paris skyline, illustrating the continued public health impacts of fossil fuel combustion
© Delphotostock - stock.adobe.com

Part IV



The preceding sections of this report demonstrate that the science behind climate change was well established by the 1960s and was widely known outside of the scientific community. This section looks at some of the world's high emitting countries and lays out specific examples of their governments' knowledge of climate change. Where relevant, the country section includes contrasting excerpts from the government's written statements to the ICJ during the 2024 proceedings on its climate advisory opinion.

The evidence below is not exhaustive. The absence of information for specific countries below, or the omission of certain countries from this section, does not indicate an absence of government knowledge of climate change in those States. Rather it may reflect how well such knowledge has been documented, publicized, and investigated by other institutions, and what information was readily available for remote, online research in English.



United States

The US is the world's largest historic emitter of CO₂ with an estimated 420 gigatons (Gt) released from fossil fuel use between 1850 and 2021.¹²⁰ In its written statement to the ICJ the US asserted: "It was only in the late 1980s, however, that a general awareness developed among States of the significant global risks that could arise from global warming resulting from increased atmospheric concentrations of GHGs due to human activities."¹²¹

Despite this contention, most documentation about State knowledge of climate change prior to the 1980s stems from US government documents. By the mid-twentieth century, the US was home to the most groundbreaking climate research, much of it through government-funded institutions. The private and public sectors indisputably knew as much as, and arguably more than, their counterparts in other countries. There are numerous papers and books that fully explore the US government's knowledge of climate change well before the late 1980s.^v Below is a brief summary of some of the most significant evidence.

^v For a detailed look at US climate knowledge before 1970, see Naomi Oreskes et al., "Climate Change and the Clean Air Act of 1970 Part I: The Scientific Basis," *Ecology Law Quarterly* 50, no. 811 (2024), <https://doi.org/10.15779/Z38DV1CP99>.

1951

The US Air Force, which conducted climate research at the Geophysics Research Division of the Airforce Cambridge Research Center, published a *Compendium of Meteorology*, which discussed CO₂ and climate change.¹²²

1956–1957

Roger Revelle, an oceanographer, twice addressed the US House of Representatives' Committee of Appropriations regarding the IGY,¹²³ explaining that fossil fuel combustion adds CO₂ to the atmosphere, causing global warming.¹²⁴

1961

Former Senator Clinton Anderson warned President John F. Kennedy about the ability of humans to modify the weather.¹²⁵

1963

Charles Keeling and Erik Eriksson of the Swedish International Meteorological Institute were among several prominent scientists invited to a conference held by the private Conservation Foundation called the “Implications of Rising Carbon Dioxide Content of the Atmosphere.” The event’s report warned that the burning of fossil fuels was leading to an increase in atmospheric CO₂, which would warm global temperatures.¹²⁶ The publication noted that temperature increases had already changed the abundance and range of several commercially important fish species, and noted that continued use of fossil fuels could cause temperature increases that would melt the polar ice caps, and that “many life forms would be annihilated.”¹²⁷ The conference organizers distributed 700 free copies of the report to university and government libraries throughout the country, indicating that they were read by policymakers and others within the US government.¹²⁸



1965

In its report, President Lyndon B. Johnson's Science Advisory Committee featured a full twenty-one-page section on atmospheric CO₂, which detailed Keeling's results among other recent scientific developments, and warned of large temperature increases by the year 2000.¹²⁹ The White House published the report on official letterhead, which likely meant it was delivered to the president.¹³⁰

The report directly warned of disastrous effects of climate change, such as sea level rise: "It has sometimes been suggested that atmospheric warming due to an increase in the CO₂ content of the atmosphere may result in a catastrophically rapid melting of the Antarctic ice cap, with an accompanying rise in sea level.The melting of the Antarctic ice cap would raise sea level by 400 feet. If 1,000 years were required to melt the ice cap, the sea level would rise by about 4 feet every 10 years, 40 feet per century. This is a hundred times greater than present worldwide rates of sea level change."^{131vi}

The committee also clearly tied the increasing CO₂ levels in the atmosphere to humanity's burning of fossil fuels: "We can conclude with fair assurance that at the present time, fossil fuels are the only source of CO₂ being added other than the ocean-atmosphere-biosphere system. ... We may conclude that the total CO₂ addition from fossil fuel combustion will be a little over 3 times the atmospheric content, and that, if present partitions between reservoirs are maintained, the CO₂ in the atmosphere could increase by nearly 170%."^{132vii}

1966

At the Third National Conference on Air Pollution, multiple speakers addressed the greenhouse effect from CO₂ emitted by fossil fuel combustion. Government officials attended and spoke at the event, including representatives from the National Center for Air Pollution Control (later rolled into the Environmental Protection Agency),¹³³ a member of Congress, a senator, a mayor, and a governor.¹³⁴

1967

The US Department of Commerce convened the “Panel on Electrically Powered Vehicles, The Automobile and Air Pollution: A Program for Progress.” In the preliminary report, a sub-section on “weather modification” resulting from the combustion of fossil fuels described the greenhouse effect and its potential impacts on society. The report was sent to government officials including cabinet members (e.g., the Defense Secretary, the Interior Secretary, and the Transportation Secretary), as well as the Chairmen of the Atomic Energy Commission and Federal Power Commission, and the Postmaster General.¹³⁵

1968

The Conservation Foundation published an article called “Is Mankind Playing a Game of Environmental Russian Roulette?” The article warned that CO₂ pollution and climate change were serious threats. Staff from the office of Senator Muskie saved the article, demonstrating that he likely read it. On February 28, Senator Henry Jackson put the article into the Congressional Record and urged members of several Senate standing committees to read it.¹³⁶

1969

A memo between Daniel Moynihan and John Ehrlichman, advisors to US President Richard Nixon, recirculated the 1965 report from President Johnson’s Science Advisory Committee.¹³⁷ In the memo, which appears on White House letterhead, Moynihan urges action on “the carbon dioxide problem,” including involving the North Atlantic Treaty Organization (NATO).¹³⁸ In August 1970, Moynihan proposed a draft memo to Erlichman, written from the president to the secretary of state, encouraging environmental leadership on the world stage, including NATO and the UN.¹³⁹ It is unclear whether this draft memo was ever sent.

MEMORANDUM

THE WHITE HOUSE
WASHINGTON



September 17, 1969

FOR JOHN EHRLICHMAN

As with so many of the more interesting environmental questions, we really don't have very satisfactory measurements of the carbon dioxide problem. On the other hand, this very clearly is a problem, and, perhaps most particularly, is one that can seize the imagination of persons normally indifferent to projects of apocalyptic change.

The process is a simple one. Carbon dioxide in the atmosphere has the effect of a pane of glass in a greenhouse. The CO₂ content is normally in a stable cycle, but recently man has begun to introduce instability through the burning of fossil fuels. At the turn of the century several persons raised the question whether this would change the temperature of the atmosphere. Over the years the hypothesis has been refined, and more evidence has come along to support it. It is now pretty clearly agreed that the CO₂ content will rise 25% by 2000. This could increase the average temperature near the earth's surface by 7 degrees Fahrenheit. This in turn could raise the level of the sea by 10 feet. Goodbye New York. Goodbye Washington, for that matter. We have no data on Seattle.

It is entirely possible that there will be countervailing effects. For example, an increase of dust in the atmosphere would tend to lower temperatures, and might offset the CO₂ effect. Similarly, it is possible to conceive fairly mammoth man-made efforts to countervail the CO₂ rise. (E.g., stop burning fossil fuels.)

In any event, I would think this is a subject that the Administration ought to get involved with. It is a natural for NATO. Perhaps the first order of business is to begin a worldwide monitoring system. At present, I believe only the United States is doing any serious monitoring, and we have only one or two stations.

Hugh Heffner knows a great deal about this, as does also the estimable Bob White, head of the U.S. Weather Bureau. (Teddy White's brother.)

The Environmental Pollution Panel of the President's Science Advisory Committee reported at length on the subject in 1965. I attach their conclusions.

Daniel P. Moynihan

Attachment - xerox of "Conclusions and Findings" -- Restoring the Quality of Our Environment", Nov. 1965

cc: Dr. Heffner, OST

DPM/crm

(Copy to: Chris Miller)

Content File

Robert White, Dept of Commerce

1969

Following a devastating hurricane, Nixon and his staff wrote a letter to Congress urging the lawmakers to launch a research program into air pollution, including pollutants' effect on weather and climate.¹⁴⁰

1969

In October, the National Air Pollution Control Administration (formerly NCAPC) co-sponsored a symposium at which the agency's director, John Middleton, delivered the keynote speech. In the speech, he acknowledged that there were still unknowns regarding CO₂ emissions and climate, but that the impacts of rising emissions were potentially drastic.¹⁴¹ "The point is, that when man alters the balance of Nature, it is like tossing a pebble into a pond: the resulting ripples spread out concentrically from the entry point until they touch every point on the shore. Continued small alterations of our environment may have drastic effects later, effects we cannot foresee now," he said.¹⁴²

1977

In July, President Jimmy Carter received a memo from the Office of Science and Technology Policy warning of the "release of fossil CO₂ and the possibility of a catastrophic climate change."¹⁴³

1979

The JASONs, a group of elite scientists, released a stark report for the Department of Energy called, "The Long-Term Impact of Atmospheric Carbon Dioxide on the Planet." The report described that global warming of two to three degrees by the mid-twenty-first century would threaten agriculture and the availability of drinking water, and would lead to sea-level rise.¹⁴⁴ The report described dire impacts from high levels of global warming, including the melting of Antarctic sea ice, which could cause 5 meters of sea level rise with "consequent major disruptions for the world's coastal regions."¹⁴⁵ The JASONs disseminated their report widely to various scientists, government agencies and industry groups.¹⁴⁶

1979

In July, President Carter's Office of Science and Technology Policy commissioned top scientists to report on CO₂-induced warming. The commission, headed by meteorologist Jule Charney, released its findings in "Carbon Dioxide and Climate: A Scientific Assessment," which became known as "The Charney Report."¹⁴⁷ The report definitively stated that, "we now have incontrovertible evidence that the atmosphere is indeed changing and that we ourselves contribute to that change."¹⁴⁸ It also urged action from policymakers: "A wait and see policy may mean waiting until it is too late."¹⁴⁹



Australia

Australia is estimated to be the world's thirteenth largest historic emitter with 18.9 Gt of CO₂ released from fossil fuel use between 1850 and 2021. As atmospheric and climate science developed, Australia emerged as a scientific leader for monitoring in the southern hemisphere.¹⁵⁰

1971

Australian meteorologist, Sean Twomey, from the Commonwealth Scientific and Industrial Research Organization (CSIRO) attended the 1971 conference on the Study of Man's Impact on Climate.¹⁵¹

1974

Australian meteorologist W.J. Gibbs served as the first vice president of the World Meteorological Organization (1967–1975) and as Director of the Australian Bureau of Meteorology.¹⁵² Gibbs chaired a panel on climate change that examined the possibility of the onset of a new ice age. Gibbs' panel found that while that possibility was unlikely, the potential for GHG-induced global warming was high. This finding spurred the convening of the 1979 World Climate Conference.¹⁵³

1975

The Australian Branch of the Royal Meteorological Society convened the Australasian Conference on Climate and Climatic Change at Monash University. Conference attendees expressed urgency in studying the climate of the Southern hemisphere, as much of the world's research focused on the north.¹⁵⁴

1976

Monitoring began at a newly established WMO station in Tasmania, selected in 1974 as the first monitoring site in the Southern Hemisphere.¹⁵⁵ The CO₂ measurements (overseen by the CSIRO) recorded gradual CO₂ increases in the atmosphere, confirming Keeling's observations from 1960.¹⁵⁶

1980

The Australian Academy of Science sponsored a conference in Canberra on CO₂ and climate, where scientists attempted to create the first climate model for Australia.¹⁵⁷

Larger and more intense wildfires threaten ecosystems around the world.
© Delphotostock - stock.adobe.com





Canada

Canada is the tenth largest historic emitter of CO₂ with an estimated 34.2 Gt released from fossil fuel use between 1850 and 2021.¹⁵⁸ In its statements to the ICJ, Canada implied that climate change was not considered a serious problem until the late 1980s: “While the general issue of climate change has been known and discussed in scientific circles since the end of the 19th century, it was not until the 1980s that the world began to seriously consider the development of an international regime to address the problem.”¹⁵⁹

While true that the IPCC was not established until 1988 and the global climate treaties followed thereafter, the international community, including several prominent Canadians, recognized the threat of climate change much earlier than the 1980s. The Canadian government itself supported climate research since at least the early 1970s.

1959

Canadian oil sands company Sun Oil (later Suncor)¹⁶⁰ was on notice about climate change since at least 1959, when Robert Dunlop, the president of the company and director of the API, sat through a lecture on climate change from physicist Edward Teller. Dunlop was also the head of the API during the 1960s when the institute received internal warnings about climate change.¹⁶¹ In 1981, the Ontario government purchased a 25 percent stake in Suncor, which it maintained before divesting in 1993.¹⁶²



1960s–1980s

Frederick Kenneth Hare was a climatologist who spent much of his career at Canadian universities (McGill, the University of British Columbia, and the University of Toronto).¹⁶³ Hare was involved in CO₂ research beginning in the late 1960s, publishing on it through the 1970s and 1980s.¹⁶⁴ Hare was a contributor to the SCOPE report presented at the 1985 Villach conference.¹⁶⁵

1971

Two members of Canada's Environment Department attended the 1971 conference on the Study of Man's Impact on Climate.¹⁶⁶

1972

The governmental Atmospheric Environmental Service (AES) of Canada supported climate research as early as 1971 when a member of the agency produced a paper on “man's impact on climate” for the 1972 UNEP conference in Stockholm.¹⁶⁷



Delegates confer during the 1972 United Nations Conference on the Human Environment in Stockholm
© UN Photo/Yutaka Nagata

1972

Maurice Strong, a Canadian oil and mineral businessman, became the Secretary General of the 1972 UN Conference on the Human Environment and convened the first international panel of experts on climate change.¹⁶⁸

1979

AES's employee newspaper archives show research and discussion on CO₂ and climate change throughout the 1970s and 1980s,¹⁶⁹ including the formation of the Canadian Climate Planning Board in 1979.¹⁷⁰ The board opened the Canadian Climate Centre (within AES) and hosted a subsequent workshop on “the carbon dioxide problem” in order to begin creating a national climate plan.¹⁷¹



France

France is the twelfth largest historic emitter of CO₂ with an estimated 38.5 Gt released from fossil fuel use between 1850 and 2021.¹⁷²

1960s

The French government was a minority owner of Total (now TotalEnergies) from its founding in 1924 until 1992 when it sold a large portion to private shareholders.¹⁷³ Total was a member of the API in the 1960s and could have had access to API's information on climate change from that period.¹⁷⁴

TotalEnergies gas station
© UN Photo/Yutaka Nagata



1968

In 1968, an interministerial symposium on Spatial Planning and Advanced Technologies brought together top scientists and policymakers to discuss, among other issues, the pollution impacts of fossil fuels and the imperative to move toward electrification and other energy sources, including nuclear power.¹⁷⁵

1971

Total executives knew about climate change no later than 1971, when the company published an article in its own magazine, *Total Information*, titled “Atmospheric Pollution and Climate.” The article described the “enormous quantities” of CO₂ released from the burning of fossil fuels and warned that the resultant increase in the concentration of CO₂ in the atmosphere is “quite worrying,” due to the potential of CO₂ to increase atmospheric temperatures.¹⁷⁶



Germany

Germany is the sixth largest historic emitter of CO₂, the largest in Europe, with an estimated 93.1 Gt released from fossil fuel-use between 1850 and 2021.¹⁷⁷ In its written and oral statements before the ICJ, Germany claimed that scientific knowledge about climate change was only established with the reports issued by the IPCC and that no customary legal duty to prevent it could have applied before then:

With respect to anthropogenic greenhouse gas emissions, such State practice and *opinio iuris* only conceivably have emerged after scientific knowledge about the adverse effects of greenhouse gas emissions had become established. The reports of the Intergovernmental Panel on Climate Change (IPCC) might constitute a sound basis for the determination of that scientific knowledge and thus indicate the earliest point of time in which norms of customary international law may gradually have started to develop. Not only do these reports reflect the global consensus of the scientific community at the time but also the state of knowledge of the international community, as these reports are also endorsed by the respective IPCC members' governments. Therefore, any potential customary international law concerning greenhouse gas emissions can only conceivably have emerged in the 1990s at the earliest.¹⁷⁸

Prior sections of this report evince widespread shared understanding of climate change in the 1960s, well before the formation of the IPCC. Within Germany there were also several prominent scientists who worked on climate change prior to the 1980s.

1941

Hermann Flohn, a government scientist, published Germany's first paper on climate change, "Die Tätigkeit des menschen als klimafaktor" (Human Activity as a Climate Factor), in 1941. Though Flohn's climate research was limited under the Nazi regime, Flohn picked up climate change research following the war and published warnings about climate change in well-circulated news outlets throughout the 1970s and 1980s.¹⁷⁹

1971

Flohn and several other German scientists attended the 1971 conference on the Study of Man's Impact on Climate.¹⁸⁰

1976–1977

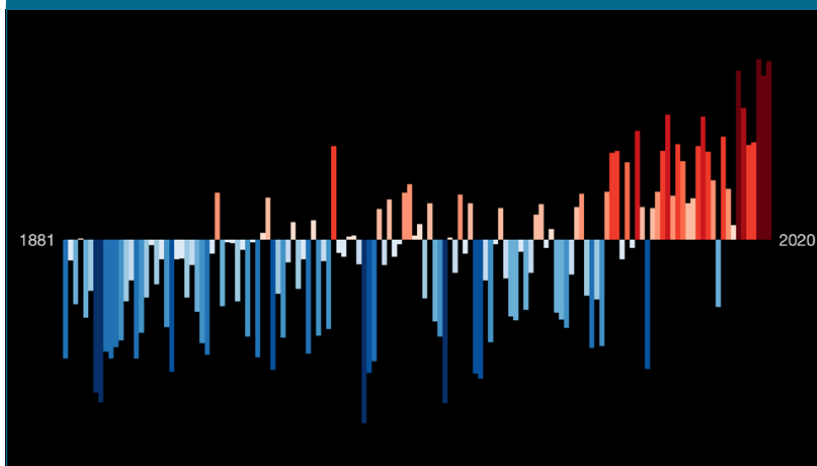
Germany held several prominent conferences on climate change in the 1970s including the 1976 Dahlem Conference on Global Chemical Cycles and Their Alterations by Man and a 1977 meeting of the Scientific Committee on Problems of the Environment about the global carbon cycle.¹⁸¹ While many elements of the carbon cycle and climate change were debated at the conference, the role of fossil fuels in changing CO₂ concentrations was treated as an established fact. Fossil fuels were one of the main topics, according to the meeting summary, which says, “Burning of fossil fuel obviously constitutes a particularly relevant human influence on the environment. Of serious concern is man’s alteration of the natural CO₂ cycle and the resulting progressive increase of the CO₂ concentration in the atmosphere, because it can lead to climatic changes which, in turn, could trigger profound effects on human society.”¹⁸² The *Dahlem Konferenzen*, the governing body of the workshop, was founded and funded by the German government through the German Research Foundation.¹⁸³

1978

In a 1978 address to the West German Parliament, a senior government official explicitly cited the “responsibility” of industrialized countries to move to new, environmentally friendly forms of energy.¹⁸⁴

“ Burning of fossil fuel obviously constitutes a particularly relevant human influence on the environment. Of serious concern is man’s alteration of the natural CO₂ cycle and the resulting progressive increase of the CO₂ concentration in the atmosphere, because it can lead to climatic changes which, in turn, **could trigger profound effects on human society.**

Figure 4: Temperature Change in Germany



Temperature change in Germany, 1881–2020
© Ed Hawkins, Wikimedia Commons – CC BY 4.0



Italy

Italy is the nineteenth largest historic emitter of CO₂ with an estimated 25 Gt released from fossil fuel use between 1850 and 2021.¹⁸⁵ Evidence of the Italian government's knowledge of climate change stems from research done by oil major Eni. Eni, founded in 1953, was originally entirely state-owned, but was largely privatized in the 1990s. The Italian government still owns a controlling share in the company.¹⁸⁶



Eni gas station

© Ank Kumar, Wikimedia Commons – CC BY SA 4.0

1969

The *Istituto per li Studi sullo Sviluppo Economico e il Progresso Tecnico* (ISVET; the Institute for Studies on Economic Development and Technical Progress), an Eni study arm, began a technical-economic survey on pollution control. The results were presented at a meeting in Rome on June 18, 1970: "... the carbon dioxide in the atmosphere ... due to the increased use of mineral fuel oils has increased over the last century by an average of 10 per cent world-wide...; towards the year 2000 this increase could reach 25 per cent, with 'catastrophic' consequences for the climate."¹⁸⁷

1970s

Throughout the 1970s, TECNECO, an Eni corporation meant to work on pollution clean up, released numerous reports on CO₂ and fuel use tied to climate change.¹⁸⁸



Norway

Though Norway is not among the top historic CO₂ emitters, in recent years it has become one of the world's largest oil and gas producers, ranking thirteenth and eighth for oil and gas respectively.¹⁸⁹ The Norwegian government is also the majority shareholder (67 percent) in Equinor, a multinational company.¹⁹⁰ Equinor, known until 2018 as Statoil,¹⁹¹ was wholly owned by the Norwegian State from its founding in 1972 until 2001.¹⁹² Equinor is listed among the top fifty entities responsible for the most carbon emissions between 1854 and 2023.¹⁹³



1980

Finn Lied, chair of the Statoil board and a former government minister, gave a seminar in which he acknowledged the 'CO₂ problem' and its potential social costs. He expressed concern that this could upend the petroleum industry in the future.¹⁹⁴

1989–1991

The Norwegian government identified climate change as a foreign policy priority in the 1990s, establishing a CO₂ stabilization target in 1989 and a carbon tax in 1991.¹⁹⁵ Norway was one of the first countries to take these measures, but that same decade, Statoil, then wholly owned by the Norwegian government, expanded operations outside of Norway.¹⁹⁶



United Kingdom

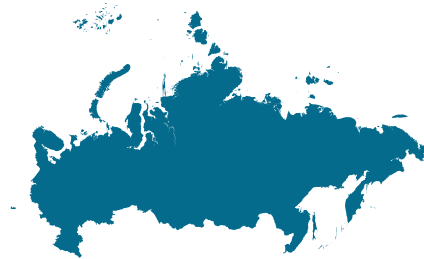
The UK is the eighth largest historic emitter of CO₂, with an estimated 74.9 Gt released from fossil fuel use between 1850 and 2021.¹⁹⁷

1950s

The UK government owned a 31.5 percent stake in BP before 1987.¹⁹⁸ As a member of the API, BP likely knew about climate change since the 1950s when API received internal warnings about climate change.¹⁹⁹

1969

The greenhouse effect was raised in the British Parliament in 1969 by Viscount St. Davids in a debate about the use of welded rails for trains.²⁰⁰



USSR/Russia

The USSR/Russia is the third largest historic emitter of CO₂, with an estimated 117.3 Gt released from fossil fuel use between 1850 and 2021.²⁰¹ Despite knowledge of climate change both internationally and within Russia since at least the 1960s and 1970s, Russia claimed in both its written and oral statements to the ICJ that mankind did not know about the impact of carbon emissions until the 1990s.

Written Statement:

When it comes to the customary legal obligation to prevent significant harm to the environment, it is necessary to bear in mind that humankind learnt about the impact of anthropogenic emissions of greenhouse gases on the climate with a sufficient degree of certainty only in the 1990s. Consequently, in as much as greenhouse gas emissions are covered by that obligation, no State may be held responsible for such emissions produced in the preceding period.²⁰²

Oral Hearings:

Regarding the customary obligation to prevent significant environmental harm, it should be noted that humanity became sufficiently aware of the impact of anthropogenic greenhouse gas emissions on climate only in the 1990s. Thus, to the extent that anthropogenic emissions fall under this obligation, a State cannot be held responsible for emissions that occurred before this period.²⁰³

1958

Soviet geophysicist E.K. Fedorov published “Human Impact on Meteorological Processes,” examining the wide range of human activities that impact the global environmental system from land-use change to human-caused shifts in atmospheric chemistry.²⁰⁴

1961

Fedorov, along with Mikhail Budyko, the director of the Main Geophysical Observatory in Leningrad (now St. Petersburg), held a meeting focused on anthropogenic climate change.²⁰⁵

1960s–1970s

Budyko followed this 1961 meeting with several papers throughout the 1960s and 1970s that discussed the role of humankind in adding CO₂ to the atmosphere and warming the world.²⁰⁶ Budyko’s work in the Main Geophysical Observatory was funded and managed by Soviet government institutions.²⁰⁷

1971

Budyko attended the 1971 conference on the Study of Man’s Impact on Climate, where he presented several papers about climate change.²⁰⁸

Conclusion

By no later than the beginning of the twentieth century, scientists had established that burning fossil fuels could potentially warm the atmosphere. In the ensuing years, research shed increasing light on the adverse impacts such warming could cause. By the 1960s, policymakers in several of the highest emitting countries were on notice that continued fossil fuel emissions were likely to alter the global climate in ways that could cause grave harm to people and the environment. Even as uncertainties regarding the exact impacts of climate change persisted, by the start of the 1970s scientists publishing in both academic journals and the popular press cautioned State leaders that action was needed to curb planetary warming given its potentially devastating consequences.

This timeline, as laid out in this report, contradicts the assertions of major emitters that their governments were unaware of the risks of climate change until the late 1980s or early 1990s.

Legally, the history of government knowledge about the fossil fuel drivers and foreseeable consequences of climate change matters. Evidence that many countries responsible for large portions of global emissions — and therefore a large portion of global climate change — knew for decades that their conduct would cause harm to the world, yet took no meaningful steps to address it and instead continued to make it worse, reveals a knowing disregard for the legal duties to prevent and minimize such harm. It makes clear that the largest polluters are not just factually responsible for their respective shares of climate damages (corresponding to their cumulative emissions since the start of the industrial era), they are also legally culpable for knowingly continuing and even increasing those emissions after the consequences of doing so were foretold and the obligation to act had arisen.

Even after the late 1980s, when virtually all States admit that governments were aware of the threats presented by climate change and that fossil fuels were its chief cause, most high-emitting countries continued to authorize, subsidize, and expand fossil fuel production and use, further driving up global emissions.^{viii} In some cases, these States (or companies within their borders) also took steps to actively stymie action on climate change — something this report only touches on. Despite governments' assertions that they have been diligently working towards curbing climate change since the 1980s, CO₂ emissions continue to rise. Emissions hit an all-time high in 2024, and then again in 2025 — three decades past when States claim they began collective efforts to prevent climate change, and more than half a century beyond when the largest polluting States were well aware that their fossil fuel combustion had the potential to damage the entire planetary system.

^{viii} Data on fossil fuel production and use from the International Energy Agency since 1990 shows that every country singled out in this report as well as India, China, and Japan have all increased either their production or use of fossil fuels since 1990. Data before 1990 is not readily available for each country.

The amount of harm that could have been avoided had States acted when they first learned of climate risk is staggering. But the impending future harm that can still be averted through decisive action to phase out fossil fuels today is even greater. The toll of climate change is only mounting, and the costs of mitigation and adaptation, rising, particularly for those States that have contributed the least to the planetary crisis.

“ The amount of harm that could have been avoided had States acted when they first learned of climate risk is **staggering**. But the **impending future harm** that can still be averted through decisive action to phase out fossil fuels today is even greater.

Fairness dictates that those who cause harm bear responsibility for damage done or at least share it with those on whom the harm falls. Law dictates, however, that those who knowingly cause harm when they could have avoided or lessened it must provide full remedy and reparation to those harmed, including guarantees that the harm will not recur. In the context of climate change, this means the countries that have contributed most to emissions over centuries should shoulder most of the costs of the damages and required responses. However, countries that knowingly disregarded the risk of harm bear another kind of responsibility — one that reflects the wrongfulness of their conduct and carries not only greater moral weight, but stronger legal consequences, too.

In the face of deepening climate injustice, climate accountability is now as urgent as climate action. Major emitters must be held legally responsible for their decades of failure to prevent climate change and perpetuation of its causes. Facts like those laid out in this report make it more possible to build such a case, and to root policy demands for climate action, finance, and repair in legal obligation.



Endnotes

- 1 James E. Hansen, "Statement of Dr. James E. Hansen, Director, NASA Goddard Institute for Space Studies," in *Greenhouse Effect and Global Climate Change: Hearings Before the Committee on Energy and Natural Resources, 100th Cong., 1st sess., June 23, 1988* (Washington, DC: Government Printing Office, 1988), 39. <https://babel.hathitrust.org/cgi/pt?id=ucl.b5127807&view=lup&seq=45>.
- 2 United States of America, Written Statement of the United States of America, in *Obligations of States in Respect of Climate Change* (Request for Advisory Opinion), March 22, 2024. See chapter 2, para. 12 and footnote 55, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240322-wri-06-00-en.pdf>.
- 3 "World Court Says Countries Are Legally Obligated to Curb Emissions, Protect Climate," UN News, July 23, 2025, <https://news.un.org/en/story/2025/07/1165475>.
- 4 International Court of Justice (ICJ), Advisory Opinion (AO), *Obligations of States in Respect of Climate Change*, July 23, 2025, paras 80, 148–151, 421, 42, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20250723-adv-01-00-en.pdf>.
- 5 ICJ AO, paras 421, 429–432, 437–438; ICJ AO paras 405–455. See generally question (b) of the United Nations General Assembly resolution requesting an advisory opinion on climate change from the ICJ.
- 6 ICJ AO, pp. 421–443.
- 7 Friederike E.L. Otto, "Attribution of Extreme Events to Climate Change," *Annual Review of Environment and Resources* 48 (2023): 813–828, <https://doi.org/10.1146/annurev-environ-112621-083538>; NYU Climate Litigation Accelerator and the Union of Concerned Scientists, *The Role of Attribution Science in Legal Action on Loss and Damage* (2025), <https://clxtoolkit.com/wp-content/uploads/2025/05/How-Attribution-Science-Can-Inform-Legal-Action-Report-Photos-Revised.pdf>.
- 8 UN General Assembly (UNGA) Resolution, Request for an Advisory Opinion of the International Court of Justice on the Obligations of States in Respect of Climate Change, A/RES/77/276 (March 29, 2023), <https://docs.un.org/en/A/RES/77/276>.
- 9 United Nations General Assembly, "General Assembly Adopts Resolution Requesting International Court of Justice Provide Advisory Opinion on States' Obligations Concerning Climate Change," Meetings Coverage and Press Releases, GA/12497, March 29, 2023, <https://press.un.org/en/2023/ga12497.doc.htm>.
- 10 ICJ, "Obligations of States in respect of Climate Change (Request for Advisory Opinion), Filing of Written Statements, press release, April 12, 2024, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240412-pre-01-00-en.pdf>.
- 11 ICJ, "Obligations of States in Respect of Climate Change (Request for Advisory Opinion) Filing of Written Comments," press release, August 16, 2024, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240816-pre-01-00-en.pdf>.
- 12 International Court of Justice, "Obligations of States in Respect of Climate Change (Request for Advisory Opinion), Conclusion of the Public Hearings Held from 2 to 13 December 2024, press release, December 13, 2024), <https://www.icj-cij.org/sites/default/files/case-related/187/187-20241213-pre-01-00-en.pdf>
- 13 ICJ AO.
- 14 ICJ AO, paras. 172, 457.
- 15 ICJ AO, para. 427.
- 16 ICJ AO, paras. 148, 179, 429, 445.
- 17 ICJ AO, para. 440.
- 18 ICJ AO, paras. 441–443.
- 19 ICJ AO, para. 443.
- 20 ICJ AO, paras. 97, 423–424.
- 21 ICJ AO, para 423. This paragraph explains that the temporal scope of climate obligations and their breach is part of an "in concreto" assessment, specific to a State or group of States, "which is beyond the scope of [the Court's] Advisory Opinion."
- 22 ICJ AO, para 272.
- 23 ICJ AO, para 282.
- 24 ICJ AO, para 274.
- 25 ICJ AO, paras. 134, 139, 273.
- 26 Inter-American Court of Human Rights, Advisory Opinion AO-32/25 on the Climate Emergency and Human Rights, Advisory Opinion, May 29, 2025, para 276, https://www.corteidh.or.cr/docs/opiniones/seriea_32_en.pdf; ICJ AO, para. 404.
- 27 ICJ AO, para. 403.
- 28 ICJ AO, para. 171. This paragraph rejects the notion that the climate change treaties are the only relevant law applicable to climate change.
- 29 ICJ AO, para 275.
- 30 ICJ AO, para 276.
- 31 ICJ AO, para 276.
- 32 ICJ AO, para 276. This paragraph cites the International Law of the Sea (ITLOS), *Request for an Advisory Opinion Submitted by the Commission of Small Island States on Climate Change and International Law*, Advisory Opinion, May 21, 2024, 123, para 365, https://www.itlos.org/fileadmin/itlos/documents/cases/31/Advisory_Opinion/C31_Adv_Op_21.05.2024_orig.pdf.

- 33 Glen Althor et al., “Global Mismatch Between Greenhouse Gas Emissions and the Burden of Climate Change,” *Scientific Reports* 6 (2016), <https://doi.org/10.1038/srep20281>.
- 34 ICJ AO, para 409.
- 35 ICJ AO, para 428. For a fuller discussion of these legal arguments concerning State obligations and the legal consequences for their breach, as well as the sources underlying them, see: CIEL, Written Statement to the International Court of Justice, Obligations of States in Respect of Climate Change (Request for an Advisory Opinion), March 20, 2024, <https://www.ciel.org/wp-content/uploads/2024/02/Amicus-Brief-ICJ-Defining-States-Climate-Obligations.pdf>.
- 36 United States, Written Statement of the United States of America to the International Court of Justice, Obligations of States in Respect of Climate Change (Request for an Advisory Opinion), March 22, 2024, para. 2.12, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240322-wri-06-00-en.pdf>.
- 37 China, Written Statement, People's Republic of China, to the International Court of Justice, Obligations of States in Respect of Climate Change (Request for an Advisory Opinion), March 22, 2024, 6, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240322-wri-19-00-en.pdf>.
- 38 Sir Roland Jackson, “Who Discovered the Greenhouse Effect?,” *The Royal Institution blog*, May 17, 2019, <https://www.rigb.org/explore-science/explore/blog/who-discovered-greenhouse-effect>.
- 39 John Tyndall, “The Bakerian Lecture: On the Absorption and Radiation of Heat by Gases and Vapours, and on the Physical Connexion of Radiation, Absorption and Conduction,” *Philosophical Transactions of the Royal Society of London* 151 (1861), <https://www.jstor.org/stable/108724?origin=JSTOR-pdf>.
- 40 Clive Thompson, “How 19th Century Scientists Predicted Global Warming,” *JSTOR Daily*, December 17, 2019, <https://daily.jstor.org/how-19th-century-scientists-predicted-global-warming/>.
- 41 Svante Arrhenius, “On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground,” *Philosophical Magazine and Journal of Science Serie 5* 41, no. 251 (1896): 270, <https://www.tandfonline.com/doi/abs/10.1080/14786449608620846>.
- 42 Elisabeth Crawford, “Arrhenius’ 1896 Model of the Greenhouse Effect in Context,” *Ambio, Arrhenius and the Greenhouse Gases* 26, no. 1 (1997): 11, <https://courses.seas.harvard.edu/climate/eli/Courses/EPS281r/Sources/Greenhouse-effect/Arrhenius/3-optional-Crawford-1997.pdf>.
- 43 Robert Lionel Sherlock, *Man as a Geological Agent: An Account of His Action on Inanimate Nature* (London: H.F. & G. Witherby, 1922), 304, https://books.google.com/books?id=rMIOAQAAMAAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false.
- 44 David R. Butler, “From the Archives: Man as a Geological Agent: An Account of His Actions on Inanimate Nature, by Robert Lionel Sherlock, 1922,” *Progress in Physical Geography Earth and Environment* 42 (2018): 530–34, https://www.researchgate.net/publication/327226416_Man_as_a_Geological_Agent; Merriam-Webster, s.v. “anthropocene,” accessed January 23, 2026, <https://www.merriam-webster.com/dictionary/Anthropocene>.
- 45 GS Callendar, “The Artificial Production of Carbon Dioxide and Its Influence on Temperature,” *Quarterly Journal of the Royal Meteorological Society* 64, no. 275 (1938): 223, <https://doi.org/10.1002/qj.49706427503>.
- 46 James Rodger Fleming, *The Callendar Effect: The Life and Work of Guy Stewart Callendar (1898–1964)* (American Meteorological Society, 2007), xiii, <https://download.e-bookshelf.de/download/0003/9400/94/L-G-0003940094-0013325959.pdf>.
- 47 Lauren Shoemaker, “Isotopes: The Basics,” National Oceanic and Atmospheric Administration, August 2010, <https://gml.noaa.gov/education/isotopes/mixing.html>; Hans Suess, “Radiocarbon Concentration in Modern Wood,” *Science* 122, no. 3166 (1955): 3166, <https://www.science.org/doi/abs/10.1126/science.122.3166.415.b>.
- 48 Roger Revelle and Hans Suess, “Carbon Dioxide Exchange Between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO₂ during the Past Decades,” *Tellus* 9, no. 1 (1957): 1–144, <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.2153-3490.1957.tb01849.x>.
- 49 Revelle and Suess, *Carbon Dioxide Exchange*, 19.
- 50 Revelle and Suess, *Carbon Dioxide Exchange*, 18; Christy Collis and Klaus Dodds, *Assault on the Unknown: The Historical and Political Geographies of the International Geophysical Year (1957–8)*, *Journal of Historical Geography* 34 (2008), <https://drive.google.com/file/d/1CMOlMVQC0Dx4gpBNMx1ZSSNBNCx9YipQ/view>.
- 51 Christy Collis and Klaus Dodds, *Assault on the Unknown: The Historical and Political Geographies of the International Geophysical Year (1957–8)*, *Journal of Historical Geography* (2008), <https://drive.google.com/file/d/1CMOlMVQC0Dx4gpBNMx1ZSSNBNCx9YipQ/view>.
- 52 Christy Collis and Klaus Dodds, *Assault on the Unknown*.
- 53 Charles Keeling, “Rewards and Penalties of Monitoring the Earth,” *Annual Review of Energy and the Environment* 23 (1998): 36, https://scrippsco2.ucsd.edu/assets/publications/keeling_autobiography.pdf.
- 54 National Science Foundation, 85th Congress, First Session, Report on International Geophysical Year (Washington D.C., May 1, 1957): 106, <https://static1.squarespace.com/static/571d109b04426270152febe0t/60ff1d5aaee59b13a40cfa09/1627331940605/NSF.Report+on+International+Geophysical+Year.1957.pdf>.

- 55 “The Keeling Curve: Carbon Dioxide Measurements at Mauna Loa,” American Chemical Society, accessed May 18, 2026, <https://www.acs.org/education/whatischemistry/landmarks/keeling-curve.html#establishing-the-keeling-curve-at-mauna-loa>.
- 56 American Chemical Society, *The Keeling Curve*; Charles Keeling; “The Concentration and Isotopic Abundances of Carbon Dioxide in the Atmosphere,” *Tellus* 12, no. 2 (1960), <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.2153-3490.1960.tb01300.x>.
- 57 Nicole Herman-Mercer et al., “Indigenous Observations of Climate Change in the Lower Yukon River Basin, Alaska,” *Human Organization* 70, no. 30 (2011), 250, https://jukebox.uaf.edu/sites/default/files/documents/climate_change_yukon_river_article.pdf; Tero Mustonen, *Stories of the Raven -- Snowchange 2005 Conference Report* (Snowchange Cooperative, 2005), https://www.snowchange.org/pages/wp-content/uploads/2011/04/StoriesOfTheRaven_06NF.pdf, 15, 18; Patricia Longley Cochran and Allyson Geller, “The Melting Ice Cellar,” *American Journal of Public Health*, September 2002, 1404–9, <https://pmc.ncbi.nlm.nih.gov/articles/PMC3222289>.
- 58 The Air Conservation Commission, *Air Conservation* (AAAS, 1965), https://www.google.com/books/edition/Air_Conservation/pA8zAAAAMAA-J?hl=en.
- 59 The Air Conservation Commission, *Air Conservation*, 78.
- 60 The Air Conservation Commission, 79.
- 61 The Air Conservation Commission, X.
- 62 Naomi Oreskes et al., “Climate Change and the Clean Air Act of 1970 Part I: The Scientific Basis,” *Ecology Law Quarterly* 50, no. 811 (2024), 843, <https://doi.org/10.15779/Z38DV1CP99>.
- 63 Otto H. Muller, “Greenhouse Effect Is First Predicted,” in EBSCO, 2023, <https://www.ebsco.com/research-starters/environmental-sciences/greenhouse-effect-first-predicted>; Syukuro Manabe and Richard Wetherald, “Thermal Equilibrium of the Atmosphere with a Given Distribution of Relative Humidity,” *Journal of the Atmospheric Sciences* 24, no. 3 (1967): 241–59, [https://doi.org/10.1175/1520-0469\(1967\)024<0241:TEOTAW>2.0.CO;2](https://doi.org/10.1175/1520-0469(1967)024<0241:TEOTAW>2.0.CO;2).
- 64 American Chemical Society, “The Keeling Curve.”
- 65 Benjamin Franta, “How the Most Important Fact of Global Warming Has Been Obscured,” in *Ignorance Unmasked* (Stanford University Press, 2025), <https://www.sup.org/how-most-important-fact-global-warming-has-been-obscured>; J.A. Laurmann, *Market Penetration Characteristics for Energy Production and Atmospheric Carbon Dioxide Growth* 205, no. 4409 (1979): 896–98, <https://www.science.org/doi/10.1126/science.205.4409.896>.
- 66 Benjamin Franta, “How the Most Important Fact of Global Warming.”
- 67 NOAA, *Recent Global CO₂ Trend*, n.d., accessed February 19, 2026, http://gml.noaa.gov/ccgg/trends/gl_trend.html.
- 68 Franta, *Important Fact about Global Warming Obscured*; F. Niehaus and J. Williams, “Studies of Different Energy Strategies in Terms of Their Effects on the Atmospheric CO₂ Concentration,” *Journal of Geophysical Research* 84, no. C6 (1979): 3123–29, <https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/JC084iC06p03123>.
- 69 Franta, *Important Fact about Global Warming Obscured*.
- 70 Inadvertent Climate Modification: Report of the Study of Man’s Impact on Climate, (Massachusetts Institute of Technology, Royal Swedish Academy of Sciences, 1971), 17, 18, 239.
- 71 Inadvertent Climate Modification, 3.
- 72 Inadvertent Climate Modification, xix-xxi.
- 73 United Nations. Report of the United Nations Conference on the Human Environment, in *Proceedings of the United Nations Conference on the Human Environment*, Stockholm, Sweden, June 5–16, 1972, <https://docs.un.org/en/A/CONF.48/14/Rev.1>; United Nations, *United Nations Conference on the Human Environment*, 5–16 June 1972, Stockholm, <https://www.un.org/en/conferences/environment/stockholm1972>.
- 74 Kevin Krajick, “Wallace Broecker, Prophet of Climate Change,” *Lamont-Doherty Earth Observatory*, Columbia University, February 19, 2019, <https://lamont.columbia.edu/news/wallace-broecker-prophet-climate-change>.
- 75 Wallace Broecker, “Climatic Change: Are We on the Brink of a Pronounced Global Warming?,” *Science* 189, no. 4201 (August 8, 1975): 460–63, <https://doi.org/10.1126/science.189.4201.460>; <https://inters.org/files/broecker1975.pdf>; <https://www.wdbj7.com/content/news/Scientist-who-popularized-term-global-warming-dies-at-87-50601191.html>.
- 76 “Purpose,” *National Academies of Sciences Engineering and Medicine*, accessed December 11, 2025, <https://www.nationalacademies.org/purpose>.
- 77 National Research Council, *Energy and Climate: Studies in Geophysics*, (The National Academies Press, 1977), 11, <https://doi.org/10.17226/12024>.
- 78 For example, Walter Sullivan, “Scientists Fear Heavy Use of Coal May Bring Adverse Shift in Climate,” *The New York Times*, July 25, 1977, <https://www.nytimes.com/1977/07/25/archives/scientists-fear-heavy-use-of-coal-may-bring-adverse-shift-in.html>.
- 79 International Institute for Applied Systems Analysis (IIASA), “History,” accessed May 3, 2025, <https://iiasa.ac.at/about-iiasa/institute/history>.
- 80 “Carbon Dioxide, Climate and Society,” *IIASA Proceedings Series* (IIASA, 1978), 321–332, <https://pure.iiasa.ac.at/id/eprint/821/1/XB-78-502.pdf>.
- 81 “Carbon Dioxide, Climate, Society,” 13, 219, 271.
- 82 World Meteorological Organization (WMO), *Declaration of the World Climate Conference* (World Meteorological Organization, 1979), 1, https://dgvn.de/fileadmin/user_upload/DOKUMENTE/WCC-3/Declaration_WCC1.pdf.

- 83 WMO et al., Joint Meeting of Experts on the Assessment of the Role of CO₂ on Climate Variations and Their Impact, (WMO, United Nations Environment Programme (UNEP), International Council of Scientific Unions (ICSU), 1980), <https://library.wmo.int/records/item/28238-joint-wmo-icsu-unep-meeting-of-experts-on-the-assessment-of-the-role-of-co2-on-climate-variations-and-their-impact?offset=7>.
- 84 Board on Atmospheric Sciences and Climate, Changing Climate: Report of the Carbon Dioxide Assessment Committee (National Research Council, 1983), <https://nap.nationalacademies.org/catalog/18714/changing-climate-report-of-the-carbon-dioxide-assessment-committee>; Wendy Franz, “The Development of an International Agenda for Climate Change: Connecting Science to Policy” (Laxenburg, Austria: International Institute for Applied Systems Analysis, September 1997), <https://pure.iiasa.ac.at/id/eprint/5257/7/IR-97-034.pdf>, 9.
- 85 Franz, The Development of an International Agenda, 6.
- 86 Climate Impact Assessment: Studies of the Interaction of Climate and Society (ICSU/SCOPE, 1985), xx, <https://www.rwkaates.org/pdfs/b1985.01.pdf>.
- 87 Spencer Weart, The Discovery of Global Warming (Harvard University Press, 2003), 151.
- 88 Climate Impact Assessment: Studies of the Interaction of Climate and Society, xv.
- 89 Franz, The Development of an International Agenda, 14.
- 90 Philip Shabecoff, “Global Warming Has Begun, Expert Tells Senate,” The New York Times, June 24, 1988, <https://www.nytimes.com/1988/06/24/us/global-warming-has-begun-expert-tells-senate.html>.
- 91 United States of America, Written Statement, see page 13, footnote 55.
- 92 Canadian Meteorological and Oceanographic Society, “Toronto Conference On the Changing Atmosphere: Implications for Global Security,” Conference Statement, Toronto, Canada, June 27–30 1988, 292, <https://cmosarchives.ca/History/ChangingAtmosphere1988e.pdf>.
- 93 Intergovernmental Panel on Climate Change (IPCC), Climate Change: The IPCC Scientific Assessment, (Cambridge University Press, 1990), https://archive.ipcc.ch/publications_and_data/publications_ipcc_first_assessment_1990_wg1.shtml.
- 94 UN Framework Convention on Climate Change (UNFCCC), United Nations Framework Convention on Climate Change, Rio de Janeiro, FCC/INFOMAL/84/Rev.1, (1992) United Nations Framework Convention on Climate Change, https://unfccc.int/sites/default/files/convention_text_with_annexes_english_for_posting.pdf, 3.
- 95 Some examples include: Neela Banerjee et al., “Exxon: The Road Not Taken,” Inside Climate News, 2015, <https://insideclimatenews.org/project/exxon-the-road-not-taken/>; Carroll Muffett and Steven Feit, Smoke and Fumes: The Legal Evidentiary Basis for Holding Big Oil Accountable for the Climate Crisis (CIEL, 2017), <https://www.ciel.org/reports/smoke-and-fumes/>; Union of Concerned Scientists (UCS), The Climate Deception Dossiers: Internal Fossil Fuel Industry Memos Reveal Decades of Corporate Disinformation (UCS, 2015), <https://www.ucs.org/resources/climate-deception-dossiers>, and UCS, Decades of Deceit: The Case Against Major Fossil Fuel Companies for Climate Fraud and Damages (UCS, 2025), <https://www.ucs.org/resources/decades-deceit>.
- 96 H.R. Brannon et al., “Radiocarbon Evidence on the Dilution of Atmospheric and Oceanic Carbon by Carbon from Fossil Fuels,” Transactions American Geophysical Union 38, no. 5 (1957), <https://www.smokeandfumes.org/documents/7>.
- 97 Charles Jones, A Review of the Air Pollution Research Program of the Smoke and Fumes Committee of the American Petroleum Institute (American Petroleum Institute (API), 1958), 270, <https://www.tandfonline.com/doi/pdf/10.1080/00966665.1958.10467854>.
- 98 Stephan Hauser et al., “Early Knowledge but Delays in Climate Actions: An Ecocide Case Against Both Transnational Oil Corporations and National Governments,” Environmental & Science Policy 161 (2024), <https://doi.org/10.1016/j.envsci.2024.103880>.
- 99 Benjamin Franta, “Early Oil Industry Disinformation on Global Warming,” Environmental Politics 30, no. 4 (2021): 663–68, <https://www.tandfonline.com/doi/full/10.1080/09644016.2020.1863703>; Neela Banerjee, “How Big Oil Lost Control of Its Climate Misinformation Machine,” Inside Climate News, December 22, 2017, <https://insideclimatenews.org/news/22122017/big-oil-heart-land-climate-science-misinformation-campaign-koch-api-trump-infographic>.
- 100 E. Robinson and R.C. Robbins, Sources, Abundance, and Fate of Gaseous Atmospheric Pollutants (Stanford Research Institute/API, 1968), 3, 5 (of excerpts), <https://www.smokeandfumes.org/documents/document16>.
- 101 James F. Black, “The Greenhouse Effect,” transcript of talk delivered before the PERCC Meeting with Exxon Research and Engineering Company, May 18, 1978, 10, <https://insideclimatenews.org/wp-content/uploads/2015/09/James-Black-1977-Presentation.pdf>.
- 102 Joe Walker, “Global Climate Science Communications Plan,” American Petroleum Institute, April 3, 1998, <https://www.documentcloud.org/documents/2840903-1998-API-Global-Climate-Science-Communications>.

- 103 “John Tyndall’s Radiant Heat Apparatus,” The Royal Institution, accessed December 12, 2025, <https://www.rigb.org/explore-science/explore/collection/john-tyndalls-radiant-heat-apparatus>; “Our History,” The Royal Institution, accessed December 12, 2025, <https://www.rigb.org/about-us/our-history>.
- 104 Jill Howard, “‘Physics and Fashion’: John Tyndall and His Audiences in Mid-Victorian Britain,” *Studies in History and Philosophy of Science Part A* 35, no. 4 (2004): 729–58, <https://www.sciencedirect.com/science/article/abs/pii/S0039368104000846>.
- 105 Science History Institute, Svante August Arrhenius, accessed December 12, 2025, <https://www.science-history.org/education/scientific-biographies/svante-august-arrhenius>.
- 106 Switzerland, Oral Statement on Obligations of States in Respect of Climate Change (Request for Advisory Opinion), December 11, 2024, verbatim record, 51, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20241211-ora-02-00-bi.pdf>. CIEL translation.
- 107 Clive Thompson, “How 19th Century Scientists Predicted.”
- 108 “Royal Institution,” *London Morning Post*, June 15, 1859, 2, <https://www.britishnewspaperarchive.co.uk>; “Prince Albert,” The Official Website of the Royal Family, accessed January 5, 2026, <https://www.royal.uk/prince-albert>.
- 109 “Hint to Coal Consumers,” *The Selma Times*, October 15, 1902, 4, <https://www.newspapers.com/newspage/570090173/>.
- 110 Rodney and Otamatea Times, Waitemata and Kaipara Gazette, August 14, 1912, 7, <https://paperspast.natlib.govt.nz/newspapers/ROT-WKGI9120814.2.56.5>. The same text ran as a caption in a *Popular Mechanics* March 1912 issue. Hearst Magazines, *Popular Mechanics*, March 1912, 341, <https://books.google.com/books?id=Tt4DAAAAMBAJ&lpg=PA341&dq&pg=341>.
- 111 Marc Hudson, “Climate Change First ‘Went Viral’ Exactly 70 Years Ago,” *The Conversation*, May 12, 2023, <https://theconversation.com/climate-change-first-went-viral-exactly-70-years-ago-205508>.
- 112 “The Unchained Goddess,” *The Bell Telephone Science Hour*, February 12, 1958, 0:51, <https://www.youtube.com/watch?v=m-AXBbuDxRY>.
- 113 Eric Niderost, *Sonnets & Sunspots: “Dr. Research” Baxter and the Bell Science Films* (Albany, Georgia: BearManor Media, 2014).
- 114 Marc Hudson, “Climate Change First ‘Went Viral’
- 115 Lyndon B. Johnson, “Special Message to the Congress on Conservation and Restoration of Natural Beauty,” address to congress, Washington D.C., February 8, 1965, <https://www.presidency.ucsb.edu/documents/special-message-the-congress-conservation-and-restoration-natural-beauty>.
- 116 Edward Goldsmith et al., “A Blueprint for Survival,” *The Ecologist*, January 1972.
- 117 “About the Ecologist,” *The Ecologist*, June 12, 2009, <https://theecologist.org/2009/jun/12/about-ecologist>.
- 118 Donella Meadows et al., *The Limits to Growth* (Potomac Associates, 1972), 73–78, <https://www.donellameadows.org/wp-content/userfiles/Limits-to-Growth-digital-scan-version.pdf>.
- 119 Jørgen Stig Nørgard, “The History of The Limits to Growth,” *The Solutions Journal*, February 22, 2016, <https://thesolutionsjournal.com/the-history-of-the-limits-to-growth/>.
- 120 Simon Evans, “Analysis: Which Countries Are Historically Responsible for Climate Change?,” *Carbon Brief*, May 10, 2021, <https://www.carbonbrief.org/analysis-which-countries-are-historically-responsible-for-climate-change>.
- 121 US, Written Comments of the United States of America to the International Court of Justice, Obligations of States in Respect of Climate Change (Request for an Advisory Opinion), August 15, 2024, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240815-wri-09-00-en.pdf>. See chapter 2, para. 12; US, Written Replies of the United States of America, Obligations of States in Respect of Climate Change, December 20, 2024, 1, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20241220-oth-66-00-en.pdf>. See the response to the questions put by Judges Cleveland, Tladi and Aurescu at the end of the hearing held on 13 December 2024.
- 122 Naomi Oreskes et al., “Climate Change and the Clean Air Act of 1970 Part I: The Scientific Basis,” *Ecology Law Quarterly* 50, no. 811 (2024), <https://doi.org/10.15779/Z38DV1CP99>, 827.
- 123 National Science Foundation, 85th Congress, First Session, Report on International Geophysical Year, 106; US Congress, House, Committee on Appropriations, “Report on International Geophysical Year” during the Second Supplemental Appropriation Bill, 1956: Hearings before Subcommittees of the Committee on Appropriations, 84th Cong., 2d sess., 1956, 471–474, <https://babel.hathitrust.org/cgi/pt?id=um3.31951d00742016t&view=lup&seq=477>.
- 124 National Science Foundation, 85th Congress, First Session, Report on International Geophysical Year, 106.
- 125 Benjamin Hulac, “Every President since JFK Was Warned of Climate Change,” *E&E News*, November 6, 2018, <https://www.eenews.net/articles/every-president-since-jfk-was-warned-about-climate-change/>.
- 126 The Conservation Foundation, “Implications of Rising Carbon Dioxide Content of the Atmosphere” (The Conservation Foundation, 1963), ii, <https://babel.hathitrust.org/cgi/pt?id=mdp.39015004619030&seq=14>.
- 127 The Conservation Foundation, *Implications of Rising Carbon*, 6.

- 128 Rebecca John, “1963 Conference Put Carbon Dioxide and Climate Change in the Spotlight,” DeSmog, January 30, 2024, <https://www.desmog.com/2024/01/30/conservation-foundation-conference-1963-big-oil-CO2-climate-change/>.
- 129 Roger Revelle, *Restoring the Quality of Our Environment* (President’s Science Advisory Committee, 1965), 127, <https://nsarchive.gwu.edu/document/31937-document-2-white-house-report-restoring-quality-our-environment-report-environmental>.
- 130 Revelle, *Restoring the Quality of Our Environment*, 111–133.
- 131 Revelle, 123.
- 132 Revelle, 119.
- 133 US Environmental Protection Agency, EPA at Research Triangle Park: Twenty Five Years of Environmental Protection (University of North Carolina, EPA, 1995), 5, <https://nepis.epa.gov/Exe/ZyPDF.cgi/20017YD1.PDF?Dockey=20017YD1.PDF>.
- 134 Oreskes et al., “Climate Clean Air Act,” 851–852.
- 135 Oreskes et al., “Climate Clean Air Act,” 855.
- 136 Oreskes et al., 837.
- 137 Daniel Moynihan, “Memorandum for John Ehrlichman,” memo, September 17, 1969, <https://nsarchive.gwu.edu/document/31936-document-1-memorandum-daniel-p-moynihan-john-ehrichman-september-17-1969-folder-e>; Science Advisory Committee, “Restoring the Quality of Our Environment,” November 1, 1965, <https://nsarchive.gwu.edu/document/31937-document-2-white-house-report-restoring-quality-our-environment-report-environmental>, 111; See also, National Security Archive, “The ‘Carbon Dioxide Problem:’ Nixon’s Inner Circle Debates the Climate Crisis,” April 26, 2024, https://nsarchive.gwu.edu/briefing-book/climate-change-transparency-project/2024-04-26/carbon-dioxide-problem-nixons-inner#_edn1.
- 138 Daniel Moynihan, “Memorandum for John Ehrlichman.”
- 139 Daniel Moynihan to John Ehrlichman, “Draft Memo for Secretary of State,” memo, August 13, 1970, <https://nsarchive.gwu.edu/document/31940-document-5-memorandum-daniel-p-moynihan-john-d-ehrichman-august-13-1970-folder>.
- 140 Oreskes et al., *Climate Clean Air Act*, 862–863.
- 141 Oreskes et al., *Climate Clean Air Act*, 857–858; John T. Middleton, “Diffusion Modeling for Air Pollution Abatement and Control,” in *Proceedings of Symposium on Multiple-Source Urban Diffusion Models* (US EPA, 1972), 1–1, 1–2, <https://babel.hathitrust.org/cgi/pt?id=ucl.b4131956&seq=16>.
- 142 Middleton, “Diffusion Modeling,” 1–2.
- 143 Frank Press, “Release of Fossil CO₂ and the Possibility of a Catastrophic Climate Change,” memorandum, July 7, 1977, Executive Office of the President, https://uploads.guim.co.uk/2022/06/02/SSO_148878_031_07.pdf.
- 144 JASON, *The Long Term Impact of Atmospheric Carbon Dioxide on Climate* (US Department of Energy, April 1979), iii, 2, 24, 26, 27, <https://irp.fas.org/agency/dod/jason/co2.pdf>.
- 145 JASON, 26.
- 146 Nathaniel Rich, “Losing Earth: The Decade We Almost Stopped Climate Change,” *The New York Times*, August 1, 2018, <https://www.nytimes.com/interactive/2018/08/01/magazine/climate-change-losing-earth.html>.
- 147 Nathaniel Rich, “Losing Earth.”
- 148 Ad Hoc Study Group on Carbon Dioxide and Climate, *Carbon Dioxide and Climate: A Scientific Assessment* (Woods Hole, Massachusetts, 1979), vii, https://geosci.uchicago.edu/~archer/warming_papers/charney.1979.report.pdf.
- 149 Ad Hoc Study Group, *Carbon Dioxide and Climate*, viii.
- 150 Simon Evans, “Analysis: Which Countries.”
- 151 Inadvertent Climate Modification, xx; “Homepage,” Commonwealth Scientific and Industrial Research Organisation (CSIRO), accessed January 23, 2026, <https://www.csiro.au/en/>.
- 152 Encyclopedia of Australian Science and Innovation, “Gibbs, William James (Bill),” last updated December 7, 2023, <https://www.eoas.info/biogs/P003253b.htm>.
- 153 John W. Zillman, “Australian Participation in the Intergovernmental Panel on Climate Change,” *Energy & Environment* 19, no. 1 (2008): 21–42, https://www.jstor.org/stable/44397360?read-now=1&seq=1#page_scan_tab_contents.
- 154 Ruth A. Morgan, “Southern Skies: Australian Atmospheric Research and Global Climate Change,” *Disaster Prevention and Management* (2020), 47, <https://dspace-prod.anu.edu.au/server/api/core/bitstreams/61b27f7e-87ac-48b4-8a09-439179fa40d1/content>.
- 155 Morgan, *Southern Skies*, 51.
- 156 Morgan, *Southern Skies*, 52.
- 157 Barrie Pittock, “Climate Change: An Australian Guide to the Science and Potential Impacts” (Australian Greenhouse Office, 2003), https://www.researchgate.net/profile/Vincent-Lyne/publication/344665286_Climate_Change_An_Australian_Guide_to_the_Science_and_Potential_Impacts_Edited_by_Barrie_Pittock/links/5f87f31fa6fdccfd7b626cb9/Climate-Change-An-Australian-Guide-to-the-Science-and-Potential-Impacts-Edited-by-Barrie-Pittock.pdf.
- 158 Evans, “Analysis: Which Countries.”
- 159 Canada, *Written Comments of Canada to the International Court of Justice, Obligations of States in Respect of Climate Change* (Request for an Advisory Opinion), March 20, 2024, para. 12, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240320-wri-03-00-en.pdf>.

- 160 “Our History,” Suncor, accessed January 13, 2026, <https://www.suncor.com/en-ca/who-we-are/history>.
- 161 Benjamin Franta, “On Its 100th Birthday in 1959, Edward Teller Warned the Oil Industry about Global Warming,” *The Guardian*, January 1, 2018, <https://www.theguardian.com/environment/climate-consensus-97-per-cent/2018/jan/01/on-its-hundredth-birthday-in-1959-edward-teller-warned-the-oil-industry-about-global-warming>.
- 162 Agis Salpukas, “Sun to Sell 25% of Unit to Ontario,” *The New York Times*, October 14, 1981, <https://www.nytimes.com/1981/10/14/business/sun-to-sell-25-of-unit-to-ontario.html>; “Who We Are 1990–2010,” Suncor, May 19, 2026, <https://www.suncor.com/en-ca/who-we-are/history/a-sustainable-energy-company>.
- 163 *The Canadian Encyclopedia*, “F. Kenneth Hare,” last updated December 3, 2024, <https://www.thecanadianencyclopedia.ca/en/article/frederick-kenneth-hare>.
- 164 For example, F. Kenneth Hare, “Climate: The Neglected Factor?,” *International Journal* 36, no. 2 (1981), 371–87.
- 165 Climate Impact Assessment: Studies of the Interaction of Climate and Society, 2.
- 166 Inadvertent Climate Modification, xix–xx. See photographs.
- 167 Canadian Meteorological Service, Monthly Report of the Canadian Meteorological Service (1971), 14, https://cmosarchives.ca/Zephyr/1971/MR_Apr1971.pdf.
- 168 Sam Roberts, “Maurice Strong, Environmental Champion, Dies at 86,” *The New York Times*, December 1, 2015, <https://www.nytimes.com/2015/12/02/world/americas/maurice-strong-environmental-champion-dies-at-86.html>.
- 169 Archives available at <https://cmosarchives.ca/Zephyr/chrono.html>. For example “Climatic Aspects of Conservation,” *Zephyr*, April 1971, 14, https://cmosarchives.ca/Zephyr/1971/MR_Apr1971.pdf; “Influence de L’Homme Sur le Climat,” 15, <https://cmosarchives.ca/Zephyr/1973/Sep1973.pdf>; “The Decade Ahead and What it Holds for AES,” 8, https://cmosarchives.ca/Zephyr/1980/Jan_Feb1980.pdf.
- 170 A.E. Collin, “The Year in Review,” *Zephyr*, December 1979, 3, https://cmosarchives.ca/Zephyr/1979/Nov_Dec1979.pdf.
- 171 Collin, “Year in Review,” 3.
- 172 Evans, “Analysis: Which Countries.”
- 173 Jean-Francois Polo and Francoise Fressoz, “L’Etat Réduit de 34 à 15 % La Participation Publique Dans Total [The State Reduces Public Participation in Total from 34% to 15%],” *Les Echos*, May 18, 1992, <https://www.lesechos.fr/1992/05/letat-reduit-de-34-a-15-la-participation-publique-dans-total-926286>; Christophe Bonneuil et al., “Early Warnings and Emerging Accountability: Total’s Responses to Global Warming, 1971–2021,” *Global Environmental Change* 71 (2021), 8, https://www.sciencedirect.com/science/article/pii/S0959378021001655?ref=pdf_download&fr=RR-2&rr=88c72037fa861f46.
- 174 Bonneuil et al., Total’s Responses to Global Warming, 2.
- 175 Collège des techniques avancées, “L’aménagement Du Territoire et Les Techniques Avancées [Land-Use Planning and Advanced Technologies],” Terrestres, 1968, available at: <https://www.terrestres.org/2021/10/26/total-face-au-rechauffement-climatique-1968-2021>. Also cited in Bonneuil, et al., Total’s Responses to Global Warming, 3.
- 176 F. Durand-Dastes, “La pollution atmosphérique et le climat [Air Pollution and Climate],” *Total Information*, December 23, 1971, 18. Cited in Bonneuil et al., Total’s Responses to Global Warming, 2.
- 177 Evans, “Analysis: Which Countries.”
- 178 Germany, Written Comments of Germany to the International Court of Justice, Obligations of States in Respect of Climate Change (Request for an Advisory Opinion), para. 40, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240326-wri-01-00-en.pdf>; ICJ, Public Sitting on the Obligations of States in Respect of Climate Change (Request for an Advisory Opinion submitted by the General Assembly of the United Nations), December 2, 2024, 10:00am, Verbatim Record, p. 146, paras. 35–37, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20241202-ora-01-00-bi.pdf>.
- 179 Jeannine Cavender and Jill Jager, “The History of Germany’s Response to Climate Change,” *International Environmental Affairs* 5, no. 1 (1993): 3–18, https://www.researchgate.net/profile/Jeanine-Cavender-Bares/publication/315810813_Developing_a_precautionary_approach_global_environmental_risk_management_in_Germany/links/5918e7bb4585152e19a24533/Developing-a-precautionary-approach-global-environmental-risk-management-in-Germany.pdf.
- 180 Inadvertent Climate Modification, xix–xx.
- 181 Cavender and Jager, “The History of Germany’s Response to Climate Change,” 6.
- 182 Werner Stumm, “Global Chemical Cycles and Their Alterations by Man,” Dahlem Workshop, Berlin, 1976, 15, <https://archive.org/details/global-chemicalcy0000dahl/page/n7/mode/2up>.

- 183 Stumm, “Global Chemical Cycles,” n1; “What Is the DFG?,” Deutsche Forschungsgemeinschaft, accessed January 16, 2026, <https://www.dfg.de/en/about-us/about-the-dfg/what-is-the-dfg>.
- 184 German Bundestag, Plenary Protocol 8/162 of the 162 Session, 22 June 1979, Annex 65, p. 12964. As referenced in ICJ, Public Sitting on the Obligations of States in Respect of Climate Change (Request for an Advisory Opinion submitted by the General Assembly of the United Nations), December 2, 2024, 3:00pm, Verbatim Record.
- 185 Evans, “Analysis: Which Countries.”
- 186 “A History on the Cutting Edge, from the Post-War Period to Today’s Challenges,” Eni, accessed May 2, 2025, <https://www.eni.com/en-IT/company/our-history.html>; “Shareholders,” Eni, accessed May 2, 2025, <https://www.eni.com/en-IT/governance/shareholding-structure.html>.
- 187 “L’intervento pubblico contro l’inquinamento; valutazione dei costi e dei benefici economici connessi a un progetto di eliminazione delle principali forme di inquinamento atmosferico ed idrico in Italia [Public Intervention Against Pollution; Evaluation of the Economic Costs and Benefits Associated with a Project for the Elimination of the Main Forms of Air and Water Pollution in Italy, CIEL translation],” ISVET, 1971, 24. Cited in, Greenpeace and ReCommon, Eni Knew (GreenPeace, ReCommon, 2023), 3, https://www.greenpeace.org/static/planet4-italy-stateless/2023/09/1771a200-eni-knew_ok.pdf.
- 188 Greenpeace and ReCommon, Eni Knew, 2.
- 189 Data on Total Energy Production 2024, US Energy Information Administration, accessed May 2, 2025, <https://www.eia.gov/international/rankings/world?pa=12&u=0&f=A&v=none&y=01%2F01%2F2023>. Data on oil and gas is available by navigating to the data tab and selecting “natural gas,” or “petroleum and other liquids.”
- 190 “The Norwegian State as Shareholder,” Equinor, accessed May 2, 2025, <https://www.equinor.com/about-us/the-norwegian-state-as-shareholder>.
- 191 “Statoil to change name to Equinor,” Equinor, March 15, 2018, <https://www.equinor.com/news/archive/15mar2018-statoil>.
- 192 “The Norwegian State as Shareholder,” Equinor; “Our History in Brief,” Equinor, accessed May 2, 2025, <https://www.equinor.com/about-us/our-history>.
- 193 “Carbon Majors 2023 Data Update,” Carbon Majors, March 2025, <https://carbonmajors.org/briefing/The-Carbon-Majors-Database-2023-Update-31397>.
- 194 Lied, “Den globale energisituasjonen [The Global Energy Situation],” *Ingeniørnytt* no. 24 (1980); cited in: Ada Nissen, “A Greener Shade of Black? Statoil, the Norwegian Government and Climate Change, 1990–2005,” *Scandinavian Journal of History* 46, no. 3 (2021): 408–29, <https://doi.org/10.1080/03468755.2021.1876757>.
- 195 Ada Nissen, “An Oil Company as a Force for Good? How Statoil Put Norway’s Identity as a ‘Champion of Ideals’ to the Test,” *Culture Unbound* 13, no. 1 (2021): 16–40, <https://doi.org/10.3384/cu.3366>.
- 196 “Our History in Brief,” Equinor, accessed May 2, 2025, <https://www.equinor.com/about-us/our-history>.
- 197 Evans, “Analysis: Which Countries.”
- 198 “Thatcher Government to Sell 31.5% BP Stake in Biggest-Ever Stock Offer,” *LA Times Archives*, August 21, 1987, <https://www.latimes.com/archives/la-xpm-1987-08-21-fi-2366-story.html>.
- 199 Stephan Hauser et al., “Early Knowledge But Delays in Climate Actions: An Ecocide Case against Both Transnational Oil Corporations and National Governments,” *Environmental & Science Policy* 161 (2024), 5, 6 <https://doi.org/10.1016/j.envsci.2024.103880>.
- 200 “Railways: Use of Continuous Welded Rail,” House of Lords Debate 5, November 1969, vol 305, col 335 and 338, <https://api.parliament.uk/historic-hansard/lords/1969/nov/05/railways-use-of-continuous-welded-rail>.
- 201 Evans, “Analysis: Which Countries.”
- 202 Russia, Written Statement of Russia to the International Court of Justice, Obligations of States in Respect of Climate Change (Request for an Advisory Opinion), March 21, 2024, 16, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240321-wri-12-00-en.pdf>.
- 203 Russia, Public Sitting on the Obligations of States in Respect of Climate Change (Request for an Advisory Opinion submitted by the General Assembly of the United Nations), Verbatim Record, December 4, 2024, 3:00pm, para 64, <https://www.icj-cij.org/sites/default/files/case-related/187/187-20240412-ora-02-00-en.pdf>.
- 204 E.K. Fedorov, *Vozdeistvie cheloveka na meteorologicheskie protsessy, Voprosy Filosofii* 4 (1958) 138, 144. Cited in: Jonathan D. Oldfield, “Imagining Climates Past, Present and Future: Soviet Contributions to the Science of Anthropogenic Climate Change, 1953–1991,” *Journal of Historical Geography* 60 (2018): 41–51, 45, <https://www.sciencedirect.com/science/article/pii/S0305748817301998#fn39>.
- 205 A.P. Gal’tsov, “Soveshchanie po probleme preobrazovaniya klimata,” *Izvestiya Akademii Nauk SSSR: Seriya Geograficheskaya* 5 (1961) 128e133. Cited in: Jonathan D. Oldfield, “Imagining Climates Past, Present and Future,” 45.
- 206 M.I. Budyko, “Izmenenie klimata i puti ego preobrazovaniya,” *Vestnik AN SSSR* 7 (1962) 35e36; M.I. Budyko, *Atmospheric Carbon Dioxide and Climate*, NASA Technical Translation, Washington D.C., 1974, 49; M.I. Budyko, *Vliyanie Chelovek na Klimat*, Gidrometeoizdat, Leningrad, 1972, 3; Cited in Jonathan D. Oldfield, “Imagining Climates Past, Present and Future,” 41–5, 1 <https://www.sciencedirect.com/science/article/pii/S0305748817301998#fn39>, 45.
- 207 Katja Doose, “Modelling the Future: Climate Change Research in Russia during the Late Cold War and beyond, 1970s–2000,” *Climatic Change* 171 (2022), 6 <https://link.springer.com/article/10.1007/s10584-022-03315-0>.
- 208 Inadvertent Climate Modification, xix–xx.

Early Warnings: Government Knowledge of Climate Change and Legal Responsibility for Climate Harm

ciel.org

X
@ciel_tweets

Instagram
@ciel_org

BlueSky
@ciel.org

Linkedin
linkedin.com/ciel.org



CENTER for INTERNATIONAL
ENVIRONMENTAL LAW