



External Geophysics, Climate (Aeronomy and Meteorology)

## Montreal Protocol at 30: The governance structure, the evolution, and the Kigali Amendment



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### ABSTRACT

Scientific discoveries, national regulations, and international agreements impact our lives. If we bring all three together in a solid but flexible governance structure, then we are able to address those impacts and share more evenly their consequences across different nations. This is what the Montreal Protocol has done in its 30 years of life and will continue to do thanks to the recent Kigali Amendment. There are many lessons for diplomacy to be drawn from the recent negotiations, including the critical role of science. The most important lesson in reaching consensus is the injection of optimism, pride, ownership of the process, and building trust among all nations. The solid yet flexible foundation of the Montreal Protocol provided a firm grounding for the Kigali negotiations to experiment with the different negotiating techniques in a forum where countries, industry, non-governmental organizations, and scientists are brought together by the United Nations.

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### 1. Introduction

Anniversaries apart from celebration provide an opportunity to reflect on what worked, what can change and what can be replicated to different settings. Thirty-one years after the Montreal Protocol was adopted, there are many achievements of which nations can be collectively proud. Its significance lies on three main points: first, united action and universal membership of 197 parties to the ozone treaties to achieve results; second, right science and an agreement on finance and technology to reconcile the nations' different needs and act as one on a global challenge; third, patience for thirty years to see the positive results of the concerted actions, a time scale that needs to be factored in, in international negotiations.

The success of this environmental regime is based on the interaction between science, policy, and diplomacy. Scientific discoveries, national regulations, international agreements, they all have an impact on the people's lives. If all three are brought together in a solid but flexible governance structure, then the impacts on people's lives can be shared more evenly across different nations.

This is exactly what the Montreal Protocol has done in its thirty-one years of life and will continue to do in the thirty years ahead thanks to the recent adoption of the Kigali Amendment.

The Secretariat of the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer (Ozone Secretariat) is responsible for servicing the meetings of these two treaties and ensuring the parties have all the necessary information they need to take decisions. The Secretariat is also following up on those decisions and

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supports their implementation. The Secretariat therefore has an important role to play in facilitating the negotiations among the parties to the Montreal Protocol, who now number 197. One of the indicators of success of the Ozone Treaties, and the seriousness with which the parties regard the problem, is the fact that both the Convention and the Protocol have achieved universal ratification, a distinction that is rarely achieved in international agreements.

This article is divided in five sections:

- Benefits today arising from the Montreal Protocol;
- Governance structure of the Montreal Protocol;
- Phasing down HFCs under the Kigali Amendment;
- Reflections on a new diplomacy based on the recent experience of the Kigali Amendment;
- Concluding remarks.

## 2. Benefits to date arising from the Montreal protocol

In terms of the environment, there are now indications that the ‘hole’ in the ozone layer is healing. As a result of the phase-out so far of 99 per cent of the historic baseline levels of production and consumption of controlled ozone-depleting substances globally in the atmosphere, the Antarctic Ozone Hole is no longer getting larger and is expected to return to the 1980 levels by about 2070. The global ozone layer is expected to return to the pre-1980 levels – the time before the occurrence of a significant ozone layer depletion – by around 2050. Without the Montreal Protocol, it is estimated that the Antarctic Ozone Hole would have been about 40% larger in size by 2013.

In terms of the global climate, ozone protection efforts have contributed significantly to the mitigation of climate change by averting an estimated net amount of more than 135 billion tonnes of carbon dioxide equivalent emissions going into the atmosphere from 1990 to 2010, rendering it one of the most effective tools to date in climate change mitigation. The Montreal Protocol’s contribution towards reducing global greenhouse gas emissions has been estimated for 2010 to be about five times larger than the annual emissions reduction target for the first commitment period (2008–2012) of the Kyoto Protocol on climate change.

In terms of the “human face” of the Protocol’s achievements, up to 2 million cases of skin cancer may be prevented each year by 2030; 283 million cases of skin cancer avoided for those born between 1890 and 2100 in the US, 8.3 million being melanoma; 1.6 million deaths from skin cancer prevented; and 46 million cases of cataract prevented according to the United States Environmental Protection Agency.

In terms of green economy, the phase-out of the ozone-depleting substances has brought investment in greener alternatives. It has changed the production and consumption patterns by stimulating more efficient production processes including energy efficiency and by innovative redesigning of products and equipment to use greener chemicals. The phase-out has greened global value chains in the process.

The Montreal Protocol has also led to technology transfer, with the Multilateral Fund contributing more than US\$ 3.8 billion from 1991 till today to all developing countries. This has helped in the transition worldwide to greener chemicals, both in production and consumption. The parties to the Montreal Protocol have further agreed in 2017 to replenish the Fund with US\$ 540 million for the triennium 2018–2020.

In terms of contribution to the Gross Domestic Product, the global phase-out of CFCs under the Montreal Protocol will result in an estimated US\$ 1.8 trillion in global health benefits, US\$ 1.109 billion for skin cancer only, and almost US\$ 460 billion in avoided damages to agriculture, fisheries, and materials, which would have been caused by the depletion of the ozone layer (cumulative estimates from 1987 to 2060).

## 3. Governance structure of the Montreal Protocol

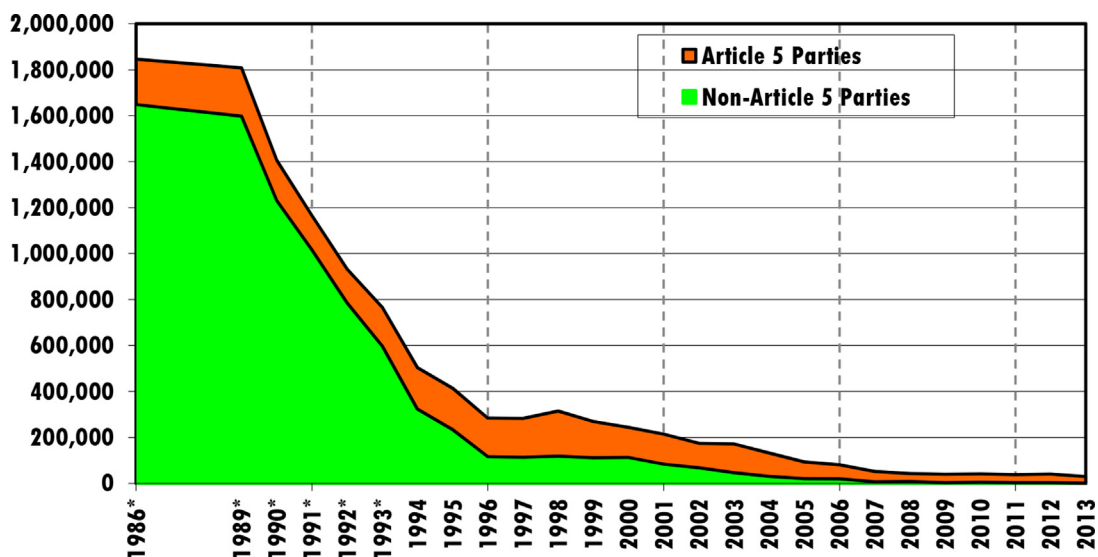
The story of the Montreal Protocol’s effort to rid the world of the chemicals that are destroying the earth’s protective ozone layer starts in 1974, when [Mario Molina](#) and [F. Sherwood Rowland](#) published their ground-breaking research warning that chlorofluorocarbons (CFCs) would destroy the ozone layer. Then, in 1985, Joseph Farman, Brian Gardiner, and Jonathan Shanklin ([Farman et al., 1985](#)) published the evidence of a recurring springtime Antarctic Ozone Hole. The Montreal Protocol was adopted in 1987 with the goal to reduce production and consumption of ozone-depleting substances and their abundance in the atmosphere, thereby protecting the ozone layer.

CFCs and HCFCs (hydrochlorofluorocarbons) were quite pervasive in houses and workplaces. Air conditioning to keep people comfortable, food kept in fridges, usually transported from afar in refrigerated trucks and ships, computers and other electronic equipment and appliances contained parts cleaned with ozone-depleting solvents.

Car dash boards, insulation foams in our houses and office buildings, water boilers and even shoe soles were made using CFCs or HCFCs. Offices, businesses and computer facilities, military bases, airplanes and ships extensively used halons for fire protection. All kinds of sprays such as hair sprays and inhalers used by asthma patients were propelled by CFCs. A lot of the vegetables we eat were fumigated by methyl bromide to kill pests. Ozone-depleting substances have been used in thousands of products across 240 sectors.

They have been so extensively used that phasing them out required a lot of work in developing the substitute chemicals and alternative technologies, without any compromise in quality and without disruptions to the functioning of the society. Back in the 1980s, technological alternatives to CFCs were either non-existent or considered too costly or unfeasible. The arguments for controlling CFCs rested on scientific theories on the effects of ozone layer depletion to human health and some of the main industries were opposed to any controls.

Convinced of the seriousness of the threat, the United Nations Environment Programme, then led by the Egyptian scientist Dr. Mustafa Tolba, contributed to a diplomatic



\* Missing Production for years prior to entry into force has been estimated at the base year levels

Fig. 1. Progress up to date in phasing out the production of all controlled ozone-depleting substances.

effort to negotiate a treaty to protect the stratospheric ozone layer. The result was the adoption of the Vienna Convention for the Protection of the Ozone Layer in 1985, and its Montreal Protocol two years later. The Montreal Protocol gave the signal to industry to invest in research and technology to pursue alternatives for chemicals that were thought to be indispensable.

The Montreal Protocol started modestly, and it moved quickly in the following years. The parties learned by doing, became more confident, and increased their ambition gradually. With increasing scientific knowledge about ozone depletion, manmade ozone-depleting gases were added through amendments, and phase-out schedules were accelerated through adjustments brought to the Protocol, eventually reaching the phase-out of nearly 100 substances. The result is that 99% of controlled ozone-depleting substances have been phased out to date (Figs. 1 and 2).

The Protocol is an example of how science and diplomacy can interact effectively to address a global threat. Its governance structure has succeeded in delivering tangible results.

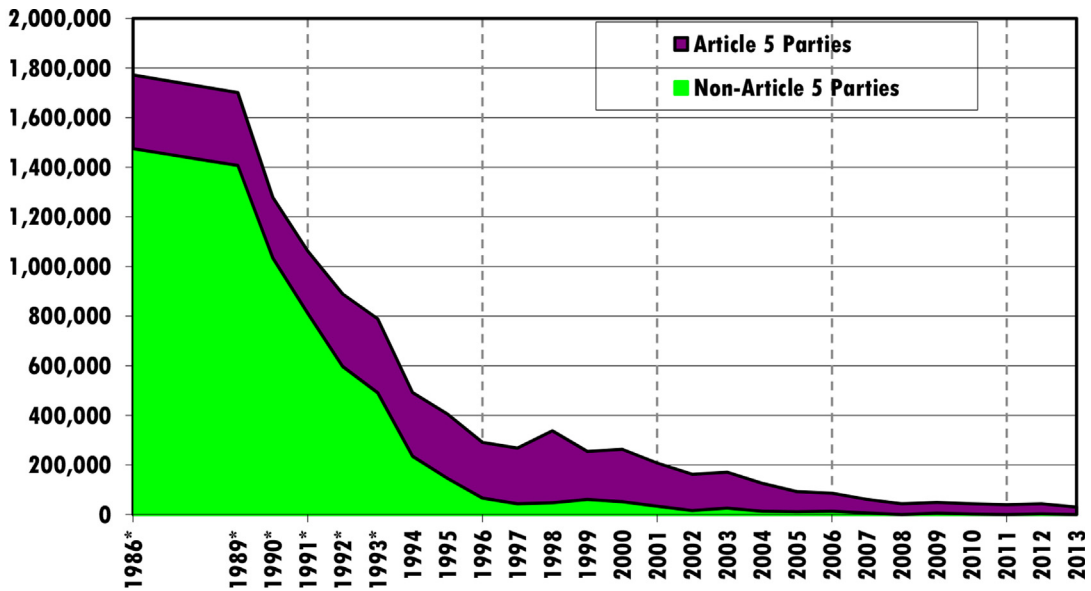
- Scientific assessment panels were established to review scientific evidence and technical, economic, and environmental issues on an ongoing basis. Based on this information, nations were able to strengthen the treaty's provisions.
- Public-private partnerships from big industries to small medium enterprises together with the United Nations Environment Programme, governments and non-governmental organizations, worked together to spread new technologies to eliminate the ozone-depleting substances.

- Clearly defined targets and schedules were established to phase out specific controlled substances.
- A dedicated financial mechanism, the Multilateral Fund, was created to assist developing countries in acquiring new technologies.
- Parties created a mechanism to monitor compliance with their reporting requirements and their phase-out targets, in an approach that facilitated compliance rather than punishing non-compliance.
- Trade restrictions on trade with non-parties to the Protocol in controlled substances were implemented and parties have all established licensing systems to monitor their imports and exports.

The Montreal Protocol's success in phasing out ozone-depleting substances (ODSs) has inspired a new effort to avoid global warming hydrofluorocarbons (HFCs). HFCs are non-ozone-depleting, but are powerful greenhouse gases. They have been used mainly as replacements for ODSs under the phase-out schedules of the Protocol.

After six years of discussions and one year of formal negotiations, in 2016 the parties agreed to amend the Protocol and include under its remit, a list of 19 HFCs as controlled substances to be phased down<sup>1</sup>. Phasing down HFCs may avoid up to 0.5 degrees Celsius of temperature increase by the end of the century (Fig. 3).

<sup>1</sup> The first proposal to amend the Montreal Protocol and include under its remit the HFC phase-down was tabled in 2009 by the governments of the Federated States of Micronesia and Mauritius. Since then, many similar proposals have been submitted by many parties to the Montreal Protocol.



\* Missing Consumption for years prior to entry into force has been estimated at the base year levels

Fig. 2. Progress up to date in phasing out the consumption of all controlled ozone-depleting substances.

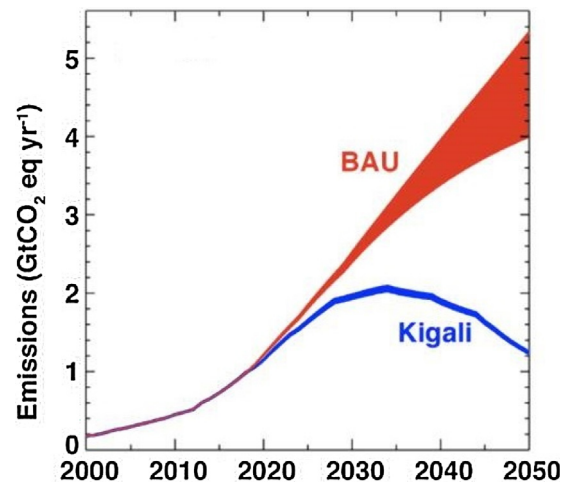
#### 4. Phasing down HFCs under the Kigali Amendment

Table 1 and Fig. 4 show the phase-down schedules of the HFCs under the Kigali Amendment.

In addition to adopting the Amendment, the parties to the Protocol took a separate but related decision dealing with solutions to the challenges of managing HFCs. The challenges that have been discussed for years were related to issues like flexibility to implement national policies for the HFC phase-down, funding and safety issues of the new refrigerants, exemptions, Intellectual Property Rights, synergies with the United Nations Framework Convention on Climate Change (UNFCCC). The main messages from Table 1 are the following:

- HFCs production and consumption are to be phased down gradually by between 80–85 per cent from 2019 to the late 2040s;
- non-Article 5 parties will go first, with most of them starting to phase down from January 2019. A small number of Article 2 countries will start the phasedown from 2020;
- article 5 parties will phase down in two groups. Group 1 has a freeze date of 2024, with the starting point of their phase down to be the average HFC consumption (or production) for 2020 to 2022. Their first reduction will be 10% of their starting point and will start from 2029 onwards;
- group 2 of Article 5 countries have a freeze date of 2028, a starting point for the reduction the average consumption (or production) for 2024 to 2026, and an initial reduction of 10% in 2032.

The Amendment will make use of the tested mechanisms of the Montreal Protocol, including the agreed phasedown targets and schedules and the financial mechanism to assist developing countries to meet their phase-down obligations. Countries are now working on arrangements to ratify and implement the Amendment, which will enter into force on 1 January 2019, provided 20 parties have ratified it by that date. So far 23 parties have ratified it, and therefore the condition for its entry into force has been met.



Source: Guus Velders, RIVM

Fig. 3. Expected impact of the Kigali Amendment on climate.

**Table 1**  
Agreed phase-down schedule for HFCs.

Baseline formula	Article 5 parties <sup>a</sup> group 1		Article 5 parties group 2		Non-Article 5 parties	
	Average HFC consumption for 2020–2022 plus 65% of HCFC baseline		Average HFC consumption for 2024–2026 plus 65% of HCFC baseline		Average HFC consumption for 2011–2013 plus 15% of HCFC baseline <sup>b</sup>	
Freeze year	2024		2028			
	Year	Reduction in %	Year	Reduction in %	Year	Reduction in %
1 <sup>st</sup> step	2029	10	2032	10	2019	10
2 <sup>nd</sup> step	2035	30	2037	20	2024	40
3 <sup>rd</sup> step	2040	50	2042	30	2029	70
4 <sup>th</sup> step	–	–	–	–	2034	80
Plateau	2045	80	2047	85	2036	85

<sup>a</sup> Article 5 and non-Article 5 parties are defined within the Montreal Protocol based on their annual calculated level of consumption of any controlled substance per capita. Those that exceed this level of annual calculated consumption are classified as non-Article 5 and those that do not exceed it as Article 5 parties.

<sup>b</sup> For Belarus, Russian Federation, Kazakhstan, Tajikistan, Uzbekistan, 25% HCFC component of baseline and different initial two steps (1) 5% reduction in 2020 and (2) 35% reduction in 2025

### 5. Reflections on a new diplomacy based on the recent experience of the Kigali Amendment

Governments, experts, scientists, industries, non-governmental organizations, all brought together under the United Nations had their own role to play in negotiating the Kigali Amendment.

It is amazing to see that the governance structure of the Protocol has remained unchanged in its 30 years of life so far. Despite the rather confined mandate, the exposure to the various stakeholders is bigger than in any other convention. The recent incorporation of the HFCs has definitely broadened the Protocol’s mandate, but it is confined in the same sectors of the ozone-depleting substances without challenging its institutions and its governance structure. The lessons drawn from the recent negotiations that led to amending the Montreal Protocol also provide with a response as to what has kept this Protocol alive, successful, and relevant after thirty-one years.

#### 5.1. Science had a critical role to play

The recent negotiations relied on scientific projections for climate change mitigation from the HFC phase-down.

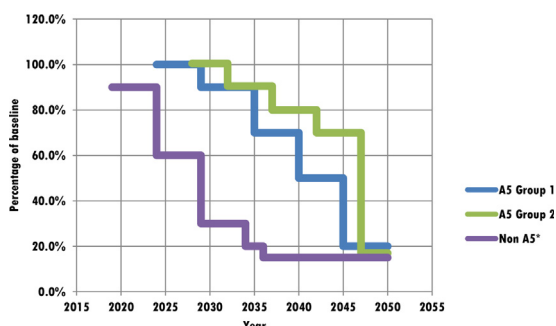


Fig. 4. Agreed phase-down schedule for HFC.

#### 5.2. Setting realistic and tangible objectives led up, like stepping stones, to the overall objective of amending the Protocol

Planning and setting realistic and tangible objectives for every meeting that would lead up, like stepping stones, to the overall objective, which was the amendment of the Protocol to include HFCs was a prerequisite for any meeting that took place.

#### 5.3. Reframing the discussion to first resolve the technical issues before the beginning the negotiations on the language of the amendment assisted the parties to reach an acceptable outcome for all

The parties themselves have agreed to reframe the discussion, first, by seeking to resolve the issues, and then, negotiating language for the amendment. Challenges were broken down into specific issues that could more easily be addressed. The challenges and issues to be resolved initially yielded a very long list that was reduced to a shorter list, after the issues were grouped. In every meeting, it was important to take stock of the discussions and bring into the open the contentious and thorny issues that remained unresolved.

#### 5.4. Informal discussions alongside the formal ones offered a forum for different approaches, ideas, and positions to be clearly and freely expressed, unhindered by country positions

Alongside the formal meetings of the parties, workshops were organized to address challenges and resolve issues. Workshops were also moderated by professional facilitators drawn from the mediation field. Informal briefing notes containing brief, factual, and technology-neutral information were produced, to address the most contentious challenges of the negotiations. Workshops offered a forum for different approaches, ideas, and positions to be freely expressed, unhindered by country positions. This assisted in crisply defining the issues that needed to be further addressed and generated possible

options for bridging different perspectives and points of view for subsequent discussions.

*5.5. Engaging all stakeholders through parallel discussions—governments with governments and industries with industries from the developed and the developing world—assisted identifying problems and finding solutions*

There was a lot of cooperation and discussion among industries in parallel with the discussions among governments, to help share investments and market risks. The negotiation of the Amendment was of great concern to related industries in the global marketplace.

*5.6. Perhaps the most important parameter in reaching consensus was the re-injection of a sense of optimism, pride, ownership of the process, and building trust among the parties*

This is one of the unspoken attributes of the Montreal Protocol, its cultural and social side. The Kigali Amendment was also achieved due to a process that involved a lot of time devoted to injecting optimism during the discussions and understanding the real and different concerns of parties. This was a process built on engagement and ownership, and it resulted in rebuilding trust in cases where it was lost and enhancing it where it was weak.

*5.7. New skills in a digital era*

Digital technologies have also changed the way parties discussed and negotiated. Digital technologies allowed parties to coordinate easily by using instant messaging before and during the meetings. This real-time informal engagement allowed parties to quickly discuss smoothing the way for quicker progress towards an overall agreement.

*5.8. Finally, the Montreal Protocol itself enabled the parties to reach a fair outcome*

International agreements like the Montreal Protocol commit countries to joint action while giving clear signals for investment and innovation. The negotiation of the Kigali Amendment was firmly grounded in the principles underlying the Montreal Protocol, ensuring that developing countries are empowered to comply with their legal obligations, including through the assistance of the Multilateral Fund.

International regulations can also mobilise public and private funds and encourage private donors to offer assistance in aspects not directly related to the negotiations at hand. A recent example was an announcement from 19 philanthropic institutions, a week before the Kigali Amendment was adopted, that they would give US\$ 53 million to projects related to energy efficiency. This initiative has resulted in the Kigali Cooling Efficiency Programme.

The above eight lessons emanate from the robust governance structure of the Protocol. It is a credit to all those who have built it and who allowed for flexibility in tightening existing controls and building in new measures.

The Protocol's governance structure and the ongoing commitment of its parties over three decades have fostered the passion and community interaction that have been critical to the Protocol's success, including the agreement to adopt the Kigali Amendment. It remains to be seen whether the governance structure of the Protocol can be used in areas that go beyond the ozone layer protection and even areas that are beyond the environmental sphere.

## 6. Concluding remarks

Scientific discoveries continue to be made and will continue to be made in perpetuity. As far as the environment is concerned, precaution is better than cure. No matter how imperfect the scientific knowledge of today may be, it will keep improving as long as nations, stakeholders, organizations are guided by a sincere desire to protect the environment, as long as they adhere to the principle of precaution, and as long as the collective consciousness urges them to continue to act. When improvements in scientific knowledge are brought to the attention of global decision-makers through fora such as the United Nations, effective global action can be taken to protect the environment, the people, and the planet.

The Montreal Protocol is firmly built on this understanding. The parties, in 1987, adopted an approach based on the knowledge available at the time recognizing the ongoing developments in the underlying science. Rather than locking themselves into a rigid framework, they built in flexibility so that as scientific knowledge expanded, the Protocol could be adjusted and amended accordingly. The Montreal Protocol is one agreement where the reliance on constantly updated scientific information has been a key driver of success. The results speak for themselves.

The Montreal Protocol is also firmly built on the commitment and engagement of the parties in resolving a significant global problem. Their commitment and engagement are a function of how they engage both with the issues and with each other. Allowing space for parties to have frank and open informal discussions within the framework of established ground rules enhances the parties' engagement with each other and with the technical issues and fosters better understanding. Understanding is a key step to building trust towards other parties, towards the process, and ultimately towards the outcome.

The Montreal Protocol experience proves that the United Nations can successfully take on the role of the honest broker that facilitates the process by which decision-makers can be informed, get to grips with the problem, identify policy options and their implications and then come to an agreement on an appropriate course of action. The Kigali Amendment proves that this can be done in an inclusive manner that addresses not only the underlying science, but also the realities, concerns and capacities of different countries and stakeholders. When that is achieved, the outcome will reflect the complexity and urgency of the real-world problems that science seeks to explain and will ensure that no-one is left behind.



The next step is perhaps to provide the scientific evidence that will be needed at the national level, to make science accessible and relevant to the realities and concerns of all people around the globe. Public opinion can generate pressure for action, but it has to be well-informed to generate effective pressure for environmental action.

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## Further reading