The Carnegie Climate Governance Initiative (2016-2023)

Impact and Learning

November 2023

C2G Carnegie Climate Governance Initiative

An initiative of CARNEGIE COUNCIL for Ethics in International Affairs

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Acronyms

AOSIS	Alliance of Small Island States
AR6	6th Assessment Report of the IPCC
CCEIA	Carnegie Council for Ethics in International Affairs
C2G	The Carnegie Climate Governance Initiative
C2G2	The Carnegie Climate Geoengineering Governance Initiative
CBD	Convention on Biological Diversity
CCDA	Climate Change and Development in Africa Conference
CDR	Carbon dioxide removal
CO_2	Carbon dioxide
CSO	Civil society organisation
DAC	Direct air capture
ECLAC	UN Economic Commission for Latin America and the Caribbean
ESCAP	UN Economic and Social Commission for Asia and the Pacific
EU	European Union
EC	European Commission
G77	The Group of 77
Gt	Gigatonnes
GESAMP	Joint Group of Experts on Scientific Aspects of Marine Protection
GESDA	Geneva Science and Diplomacy Anticipator
HLAB	UN High-Level Advisory Board on Effective Multilateralism
IAI	Inter-American Institute for Global Change Research
IATT	UN Inter-Agency Task Team on science, technology, and innovation
IGO	Intergovernmental organisation
IRGC	International Risk Governance Center
IPCC	Intergovernmental Panel on Climate Change
LAC	Latin America and the Caribbean
LDC	Least developed countries
NASEM	US National Academies of Sciences, Engineering, and Medicine
NGO	Non-governmental organisation

NOAA	US National Oceanic and Atmospheric Administration
SAI	Stratospheric aerosol injection
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SDGs	Sustainable Development Goals
SCoPeX	Stratospheric controlled perturbation experiment
SR15	IPCC Special Report on Global Warming of 1.5°C
SRM	Solar radiation modification
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNEA	United Nations Environment Assembly
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNHRC	United Nations Human Rights Council
VKRF	V. Kann Rasmussen Foundation
WCRP	World Climate Research Programme

Foreword by the President

In March 2016, I was contacted by Irene Krarup of the V. Kann Rasmussen Foundation, asking if Carnegie Council might be willing to work together on issues related to the governance of geoengineering – also referred to as climate-altering technologies. Given the low probability of limiting global temperature increase to below the Paris Agreement's two-degree goal, it seemed likely that geoengineering options would move from science fiction speculation to genuine policy consideration.

With relatively little knowledge about geoengineering available and with no system in place to develop governance, it was time for someone to step up to begin a process to establish the principles and legal framework for the global governing of climate engineering.

Carnegie Council proved to be the perfect home for this new venture. For more than 100 years, the Council has worked on issues of global governance, emphasizing the need for international cooperation based on shared values and interests. Independent and non-partisan, the Council has always drawn widely from experts across professional sectors, academic disciplines, and civil society to advance new ideas in the public interest.

From the beginning, the Carnegie Climate Governance Initiative (C2G) was explicit in linking ethics to governance. Our premise was that rules, norms, or standards for the development and potential use of new climate-altering technologies needed to be based on ethical principles. Those principles should be well understood, widely discussed, and generally agreed to as the basis for international cooperation.

As the project concludes, it is gratifying to see developments such as the work of UNESCO's World Commission on the Ethics of Scientific Knowledge and Technology, which addresses the ethics of climate engineering. These efforts are situated within the context of UNESCO's earlier Declaration on Ethical Principles in Relation to Climate Change.

Such work sets the stage for a positive and constructive global dialogue that will ultimately govern the use of climate-altering technologies such as solar radiation modification (SRM) and Carbon Dioxide Removal (CDR) that have been the focus of C2G's work.

In addition to its pioneering efforts in global-scale governance, C2G has set the standard for how Carnegie Council does its work. Goal-driven and results-oriented, C2G delivered on its time-bound campaign to put the governance of climate-altering technologies on the agenda of national

governments, world bodies, and international organizations such as the United Nations.

As you will read in this report, C2G accomplished its ambitious goal by:

- Providing thought leadership resulting in immediate impact on the international agenda.
- Creating a globally diverse community of knowledgeable and engaged participants.
- Publishing impartial and evidence-based educational resources for expert and general audiences.
- Empowering young climate leaders and elevating the voices and views of under-represented and climate-impacted communities.
- Establishing an irreplaceable platform and library for the future.

In short, C2G is an exemplary model for how to make ideas matter in the policy world, how to facilitate dialogue, and how to be patient and persistent in the pursuit of long-term goals.

It is my sincere hope that new initiatives will be created in C2G's image. The world faces numerous global-scale governance crises that would benefit immeasurably from a similar approach.

None of the accomplishments of C2G would have been possible without the extraordinary leadership of Janos Pasztor and the initiative's staff. I would like to offer my personal thanks to all for their tireless efforts, and to the many funders of this effort who supported C2G in its successful conclusion. Their work inspires us all.

Joel H. Rosenthal
President, Carnegie Council for Ethics in International Affairs

Introduction by the Executive Director

As climate change poses ever-growing risks to the future of humanity and ecosystems across the planet, there has never been a more important moment for effective international cooperation and governance. The primary task remains to urgently and deeply cut global greenhouse gas emissions to mitigate the root cause of climate change and avert further catastrophic disruption.

In May 2016, just weeks after the historic Paris Agreement on Climate Change was opened for signature in the UN General Assembly in New York, I was approached by Irene Krarup, the Executive Director of the V. Kann Rasmussen Foundation, with an interesting proposal to set up and then lead an initiative to address the lack of international governance around geoengineering. This took place within the context of global assessments of science and mitigation efforts, which had made it clear that the window to limit temperature raise to 1.5°C was closing fast. The likelihood of temporarily exceeding that goal was dependent on the speed by which the Paris agreement would accelerate existing global efforts on the priority actions of emission reductions and identifying options to remove excess carbon from the atmosphere. By July I was working full time on this new task, and by November 2016 when the Paris Agreement entered into force, a team of three colleagues were in place. The Carnegie Climate Geoengineering Governance (C2G2) initiative was formally launched in New York on 17 February 2017.

I started by recruiting former colleagues from the UN Secretary-General's climate change team, which I had led the previous year as Ban Ki-Moon's Assistant Secretary General for Climate Change. Over time we added others, coming from different backgrounds and with different experiences. With our funders extending to us the flexibility to develop our own work programme, together with this small, dedicated team, we set about our task of catalysing actions by intergovernmental actors, governments and non-state actors to fill the gaps around governance of emerging techniques that could alter the climate, such as large-scale carbon dioxide removal (CDR) and solar radiation modification (SRM).

The task was both intellectually and ethically complex as well as diplomatically challenging. There was generally a lack of understanding about what is meant by governance or geoengineering, and the subject of geoengineering was (and remains today) understandably contentious. We quickly discovered the topic was both polarising and beset with misinformation and disinformation, all requiring careful navigation. Clarifying what we meant by the term 'governance' presented us with a perennial challenge. Some considered it to mean only rules and regulations made by governments.

We drew on the broader definition used by the Intergovernmental Panel on Climate Change (IPCC), to refer to all the structures, processes, and actions through which private and public actors interact to address societal goals. But the challenge posed by the different definitions and interpretations of 'governance' remained with us from start to finish.

Ambiguity and varying perceptions and connotations associated with the term 'geoengineering' led us to change the name of the initiative in 2019 to the Carnegie Climate Governance Initiative (CG2). Being impartial about whether these techniques should or should not be used and supporting our arguments with reliable, high-quality evidence quickly became cornerstones of an approach that would secure the trust of our key interlocutors. Maintaining impartiality on everything we said and wrote in such a context was a challenge.

We pursued a catalytic approach in our work – sometimes engaging publicly, and at other times quietly, behind the scenes, encouraging others to learn about and address these issues themselves, thus ensuring a sustainable outcome. Our public commitment to a time-limited initiative helped us to build greater trust with our interlocutors reassuring them of C2G's purpose and intent.

Based on our decades of experience in global negotiations on challenging topics, a commitment to impartiality and inclusivity also allowed us to create a broader platform encouraging and enabling a wider range of actors with more diverse (and sometimes conflicting) perspectives, to engage.

Gaining the attention of busy leaders, diplomats, and policymakers to explain the need for comprehensive governance of technologies that don't yet exist, and which are politically contentious, required quite some perseverance and effort. Adding to that the obstacles raised by an unprecedented global pandemic, the Russian war in Ukraine, and with the increasing challenges of (de)globalisation and geostrategic issues, it's a wonder anyone was able to engage with us.

But engage they did. Over the course of our seven years of work, we engaged both in-person and on-line with representatives of over 75 governments, 61 intergovernmental organisations and actors and 250 non-state organisations and actors internationally, we fulfilled our mission of bringing the governance issues related to CDR and SRM to their attention.

Today, CDR, the need for which has been clearly indicated by successive IPCC reports and implicitly recognised in the Paris Agreement, is now attracting substantial interest and growing public and private investment globally, along with increasing international governance activities. These include understanding and dialogue regarding definitions of types of CDR; their roles and purpose in relation to emission reductions; increasing public engagement; improving accounting and transparency; and how international and national rules should take up these issues as part of governance.

In 2017, some doors would not open to talk with us about the need to address gaps in governance around CDR or, even if they did, the conversation could not leave the room. The same applied for SRM. Meanwhile, how to deal with SRM, a largely unknown, or at best fringe idea amongst international policymakers when we started, is now on the international agenda with high profile

calls to build understanding and governance emerging from the UN, Washington, Brussels, Mexico and elsewhere.

How much these developments can be directly or indirectly attributed to C2G's efforts is of course difficult to ever be sure of. An independent evaluation of C2G's work examined this issue (see Delivery insights: Insights from independent evaluation on p. 50). In some cases, the consequences of our work will not have impact for years to come. However, many who have worked with, evaluated, or observed C2G's efforts have remarked on the importance and effectiveness of our work. While discretion prevents us from sharing all the anecdotal evidence of our impact, I think most would agree that things would have turned out quite differently without C2G's work of the past seven years.

This report serves not only as a record of what we did and some insights into what impact that may have catalysed, but also as an opportunity for us to share what we learned along the way. I hope that this knowledge will be useful both now and in the future as others begin to address the governance gaps around these and other emerging technologies of global significance.

The team and I are grateful for the opportunity to have been able to tackle this challenging task and for the farsightedness and trust of our funders who enabled us to undertake this timely and important work. We're also grateful to our many interlocutors in governments, the UN and elsewhere across the world for their willingness to meet, listen, learn, and engage on this challenging topic.

We have worked hard to bring the need for more comprehensive governance around CDR and SRM to the attention of the international community over the past seven years. With both now firmly on international agendas, it's now up to societies and governments to better understand the implications of not collectively delivering transformative mitigation efforts on time, and ultimately to decide whether, when and how such climate-altering techniques should or should not be researched, developed, or used in future. What happens next is now in their hands.

Janos Pasztor
Executive Director, Carnegie Climate Governance Initiative (C2G)

Delivering the initiative

The following section provides an overview of C2G's mission and approach, the funders and delivery team involved, the various stakeholders engaged, and what was delivered when.

1. The mission

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Less than a year after the landmark Paris Agreement on climate change, concern continued to grow that without rapid acceleration in international action, limiting global average temperature rise to 1.5-2°C might not be achieved through greenhouse gas emissions reductions alone.

Once seen as a fringe idea, addressing the problem of overshooting this goal through intentional, large-scale intervention in the climate system – often referred to collectively as "geoengineering" – had begun to attract renewed attention, triggered by concerns about the fast-closing window to limit warming due to inadequate climate action, new research, and emerging civil society campaigning.

The different techniques that were being proposed for so-called “geoengineering” interventions fell into two broad categories, with different aims and different implications for governance. Firstly, carbon dioxide removal (CDR), that aims to remove excess CO_2 from the atmosphere and durably store it, thus reducing the cause of global warming. The science informing the Paris Agreement modalities – the IPCC Fifth Assessment Report – had made it clear that pathways to achieve the Paris temperature goals required CDR to reach net-zero by mid-century and global net removals (net negative emissions) in the second half of century. Secondly, solar radiation modification (SRM), that aims to reduce the amount of solar radiation reaching the earth’s surface, thus reducing the impacts of global warming. This emerging technique had received some attention by the IPCC and some other UN processes but none that was comprehensive.

With increasing attention turning to potential CDR and SRM techniques that might be proposed for large-scale interventions, the lack of comprehensive international governance around either of them began to raise concerns among some observers.

The Carnegie Climate Geoengineering Governance (C2G2) initiative was conceived and subsequently formally launched in February 2017 to address these concerns. Initiated and funded by the V. Kann Rasmussen Foundation (VKRF) and hosted by the New York-based Carnegie Council for Ethics in International Affairs, the C2G2 initiative commenced operation with a mission to catalyse the creation of effective governance for emerging climate-altering technologies.

2. The funders and delivery team

Funders

Team members[1]

- Miranda Böttcher, Research Associate (2017-18)
- Thomas Busch, Resource Development Consultant (2020-23)
- Rebecca Chamblee, Program Associate (2022-23)
- Nigel DeCoopman, Program & Finance Associate (2019-23)
- Nicholas Harrison, Director of Knowledge Management (2019-23), Senior Program Manager (2017-19)
- Alia Hassan, Outreach Officer, Government and Intergovernmental Organizations (2019-23)

1 Team members were not all full-time or engaged for the full duration of the years indicated.

- Tim Kruger, Science Adviser Associate (2017-18)
- Natalie LaVan, Program Manager (2017)
- Dao Nguyen, Lead Adviser, Biodiversity (2017-18)
- Valérie Novarina, Personal Assistant to the Executive Director (2016-23)
- Celine Novenario, Communications Officer (2019-21)
- Anita Nzeh, Knowledge Management and Communications Officer (2022-23), Knowledge Management Officer (2019-22)
- Janos Pasztor, Executive Director (2016-23)
- Paul Rouse, Science Advisor (2019-21)
- Natalia Rubiano, Outreach Officer (2018-19)
- Cynthia Scharf, Senior Strategy Director (2016-23)
- Kai-Uwe Barani Schmidt, Deputy Executive Director, Governmental Affairs (2023), Senior Director of Programs (2016-23)
- Michael Thompson, Senior Outreach Consultant (2021-22), Senior Outreach Manager (2017-21)
- Mark Turner, Senior Communications Consultant (2022-23), Communications Director (2017-22)
- Qi Zheng, Outreach Officer, Government and Intergovernmental Organizations (2018-23)

Advisory Group members

The C2G Advisory Group was constituted from leading international experts covering diverse sectors and countries and selected to provide independent strategic guidance to help ensure the initiative's work was well informed, effective, and high impact. Members participated in an individual, independent capacity and did not represent any specific organisation or institution. The group was not a decision-making body, and so members had no direct or accountable influence over C2G's work.

- Neth Daño (Philippines), Co-Executive Director, ETC Group (2017-19)
- Maria Ivanova (USA/Bulgaria) Associate Professor of Global Governance, John W. McCormack Graduate School of Policy and Global Studies; Director of Center for Governance and Sustainability (2018-23)

- Pan Jiahua (China) Director-General of the Institute for Urban & Environmental Studies, Chinese Academy of Social Sciences (2020-23)
- Ronald Jumeau (Tanzania, Seychelles), Permanent Representative to the United Nations and Ambassador for Climate Change (2017-19)
- David Keith (Canada/USA/UK), Professor of Applied Physics and Professor of Public Policy, Harvard University (2017-23)
- Thelma Krug (Brazil), Vice-Chair, Intergovernmental Panel on Climate Change (2017-23)
- Amy Luers (USA), Global Lead, Sustainability Science, Microsoft (2019-23)
- Alessandra Orofino (Brazil), Executive Director & Co-founder of Meu Rio (2017-18)
- Manuel Pulgar-Vidal (Peru) Global Lead, Climate and Energy, WWF International (2017-23)
- Jairam Ramesh (India), Member of Parliament (2017-23)
- Steve Rayner (UK), James Martin Professor of Science & Civilization, University of Oxford (2017-20) [2]
- Ambuj Sagar (India), Vipula and Mahesh Chaturvedi Professor of Policy Studies, Department of Humanities and Social Sciences; Head, School of Public Policy, Indian Institute of Technology Delhi (2018-23)
- Youba Sokona (Mali), Special Advisor for Sustainable Development, South Centre (2017-23), Vice-Chair, IPCC (2017-23)
- Elizabeth Thompson (Barbados), Ambassador Extraordinary & Plenipotentiary with Responsibility for Climate Change, Small Island Developing States and Law of the Sea (2019-23)

The C2G team would like to thank all members of the Carnegie Council for Ethics in International Affairs team who supported delivery of the initiative.

2 Died in 2020.

3. The delivery approach

The initiative's approach was based on a number of assumptions about the nature of the problem, and these informed our theory of change for addressing that problem.

Prior to the initiative, discussions about emerging techniques that can alter the climate and their governance had existed within the academic community, but only to a limited extent amongst political decision-makers, and comprehensive international governance was either weak or missing. C2G understood that policymakers internationally were largely unaware, and hence poorly-informed, and consequently ill-prepared for the difficult choices they – and society – would face in the future when having to make decisions about these emerging technologies. The team also believed that well-informed, timely and prudent decision-making would be essential for effective governance of such technologies.

C2G's guiding assumptions

- **The time is now:** Given the accelerating risks faced from climate change and the emergence of climate-altering technologies, the best time to discuss the governance of these technologies is now, not later. There is a far greater risk in delaying or not having this discussion, than there is in grappling with the many governance issues raised by these technologies in a thoughtful, well-informed, inclusive and transparent manner.

- **Not one but many:** No one global institution can address all the dimensions governance around these technologies. In a multipolar world, effective governance depends on engaging multiple actors, processes and institutions, from the global to the local. Given the planetary-wide impacts of these technologies, it also is important to engage in intergovernmental processes that have broad international membership.

- **The need to learn more:** The world currently does not know enough about the risks, unintended consequences and potential benefits, as well as the governance challenges and opportunities of many of these techniques to in order to accept or reject them. Well-governed research may help answer these questions. In the meantime, international agreements calling for no deployment of solar radiation modification (SRM) before certain conditions are met would reduce risks and allay concerns about hasty, unilateral, ungoverned action, while allowing essential research to take place.

- **The need to engage all sectors of society:** like for climate action generating political momentum for the governance of these technologies will require a cross-sectoral, top-down and bottom-up approach. On the one hand, engagement of politically influentially governments will be needed to spearhead diplomatic efforts at the global level. At the same time, engagement of a broad range of voices from across society will be necessary to ensure inclusive governance actions.

The strategy

Based on its understanding of the problem and a number of guiding assumptions (see box on C2G's guiding assumptions) the team developed a strategy for addressing the problem. The strategy would seek to:

- **Raise awareness** and support learning – Policymakers and their advisors, and other key actors, learn about new approaches, their implications – both potential risks and benefits, and why they need to be governed.

- **Convene and collaborate** – Diverse actors convene, discuss, and develop shared understanding and collaborative approaches to governance.

- **Catalyse decisions** – Governments – national and in relevant UN and other intergovernmental processes – take decisions to fill critical governance gaps.

The strategy would target policymakers and their advisors in government and non-state organisations, at international, regional, and national levels. Priority would be given to work with catalytic actors who could drive broader societal governance discussions and included intergovernmental organisations and processes, national governments, and other non-state actors.

C2G's delivery principles

- **Impartiality:** C2G is impartial regarding the potential use of climate-altering techniques or interventions, but not on the need for effective governance.
- **The need for governance:** Governance includes interlocutors from across all sectors of society coming together in diverse processes to discuss, learn, share knowledge, and take decisions at multiple levels.
- **Rule of international law:** C2G affirms the need for urgent climate action on many fronts, including the implementation of existing multilateral agreements.
- **A broad risk management approach:** C2G encourages evidence-based discussions, guided by the precautionary principle, about potential benefits, risks, trade-offs, and synergies.
- **Preparedness:** Society needs to make difficult decisions today, to be ready for tomorrow.

Objectives

The approach focussed on delivering three priority objectives:

1. Catalyse international agreements to help prevent the deployment of SRM technologies before (i) the risks and potential benefits are sufficiently understood for decision making, and (ii) international governance frameworks are agreed;

2. Support the development of governance of research, particularly for SRM. This could include codes of conduct; criteria for testing; and public engagement.

3. Encourage discussions about the governance of CDR technologies at the appropriate sub-national, national and global levels.

Activities

In pursuit of these objectives, based on the strategy and principles outlined above, the team sought to deliver four main groups of activities:

- Organise educational briefings, webinars and meetings for multiple, diverse sectors of society, with a special focus on multilateral and government policymakers.
- Create balanced information materials that elucidate the key risks, issues and concerns about the technologies, as well as potential benefits.
- Actively engage with key actors in governments, the UN system, civil society, faith communities, defence and security sectors, and the private sector to support governance-related discussion and activities.
- Trigger and support governance discussions in key multilateral fora, including *inter alia* in the CBD, UN Environment Assembly, the UNFCCC and the UN General Assembly.

Learning and changing approach

While the core approach remained constant throughout the delivery period, C2G (enabled by the flexibility and trust of its funders) adopted an entrepreneurial and adaptive approach, learning from what was and was not working and responding to changes in the delivery environment. Consequently, to optimise delivery towards its mission the team adjusted its approach in a number of ways during the delivery period including, inter alia:

- **Working as a catalyst** – early on in the initiative, it became clear that in order to remain impartial about the technologies and the way they would be governed – and thus maintain trust a credibility in the initiative's intentions – rather than taking a prominent public leadership role on the subject, working more in the background encouraging and supporting other actors to lead and act would be a more effective approach.
- **Changing names and changing language** – following the intense negotiations of a Swiss-led resolution on governance during UNEA-4 which did not lead to consensus nor adoption of the resolution (see Learning story: Catalysing governance at the fourth session of the UN Environment Assembly on p. 63), it became clear that the term "geoengineering" had become confusing on the one hand with no clarity of what the term included or excluded and also somewhat toxic and consequently – by its association – a distraction from the initiative's efforts on the other. C2G therefore transitioned to use language adopted by the IPCC to remain impartial and avoid any unnecessary controversy arising from the use of the more divisive "geoengineering" term. As the word also featured in the initiative's name, the initiative not only changed its approach but also its very name by dropping the word Geoengineering, and thus C2G2 became C2G.

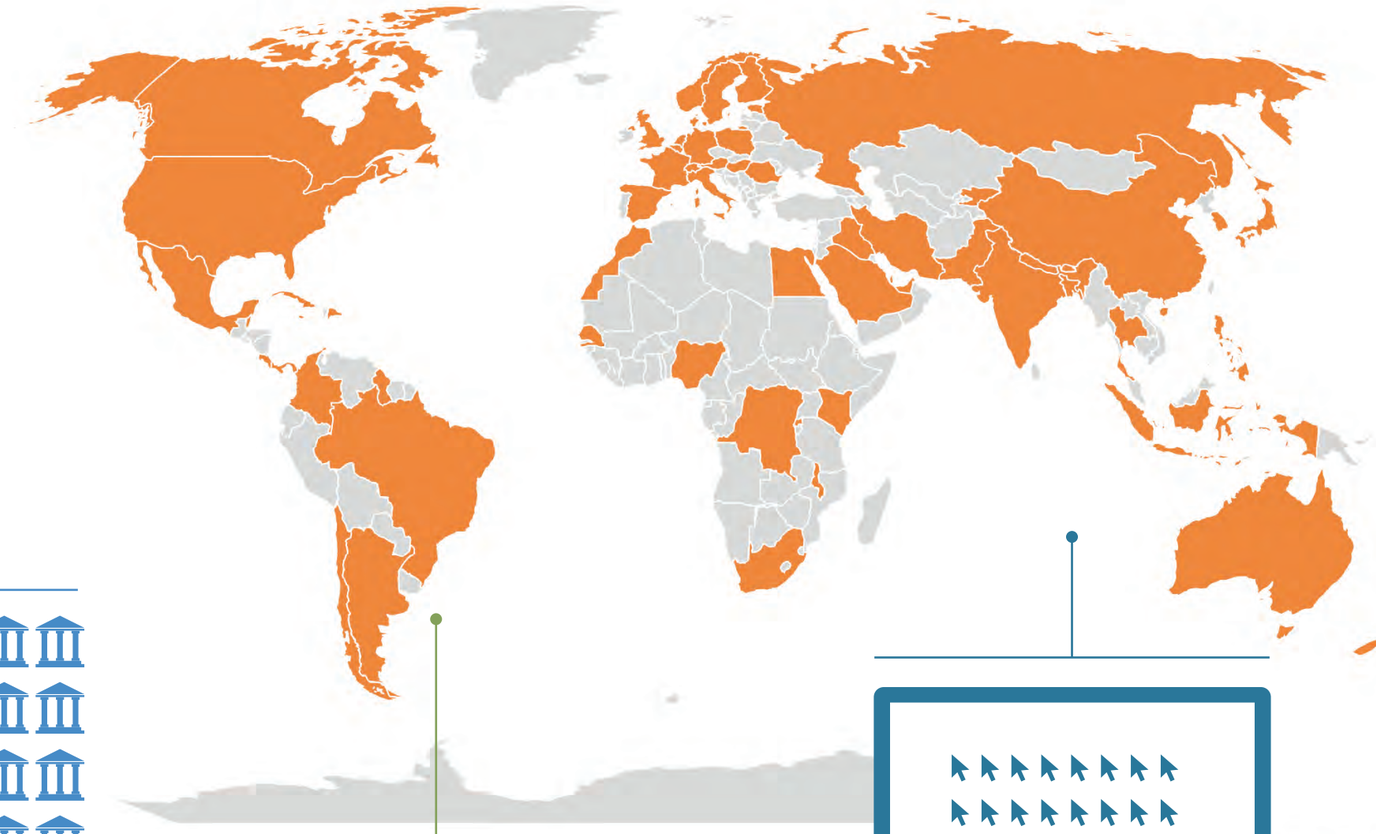
- **Increasing focus on SRM** – following the publication of the IPCC's Special Report on 1.5°C (IPCC SR15) in late 2018, the topic of large-scale CDR, which had previously been downplayed, was given a new prominence. As Parties to the UNFCCC began to announce their long-term commitments to achieving mid-century, net-zero emissions (which is not possible without making use of large-scale CDR) and with more investment and innovation flowing into CDR, the discussion of CDR and its governance began to become more mainstream on international agendas. Recognizing that governments were now aware of CDR and related governance issues, and being conscious that in its role to bring these issues to the attention of governments it could provide no value added, as well as the greater challenges remaining around discussion of SRM and its governance, and the limited time and resources remaining, the team decided to increasingly – and in the last 2 years entirely focus on SRM.

- **Adapting to COVID-19 pandemic restrictions** – while the challenges posed by the COVID pandemic did not affect the day-to-day operations of the initiative as much as others (due to our from the start remote-based virtually connected team), the consequent travel and proximity restrictions that were imposed did present significant new challenges for engaging with stakeholder interlocutors who could now no longer be met in-person. While shifting meetings and events to online-only delivery the initiative also accelerated the development of a comprehensive online learning series including interactive webinars (C2GLearn and C2GDiscuss) and video interviews (C2GTalk) enabling more remote engagement and learning opportunities for our target stakeholders, during this period of pandemic restrictions.

- **Transitioning C2G's work** – cognisant that some of its expertise and resources could be important and useful beyond the planned end of the initiative, during the second half of the initiative's life, an increasing emphasis was placed on transitioning such expertise or resources into appropriate intergovernmental organisations or non-state actors before the end of the initiative.

4. The stakeholders engaged

To deliver its activities, the initiative identified and targeted influential and catalytic actors in intergovernmental organisations and processes, national governments, and other non-state actors.



75
Country governments engaged

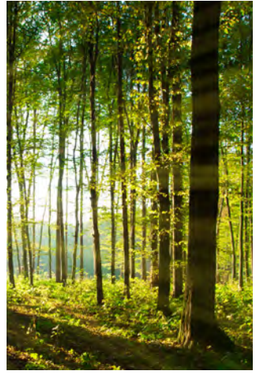
61 Intergovernmental organisations and actors engaged

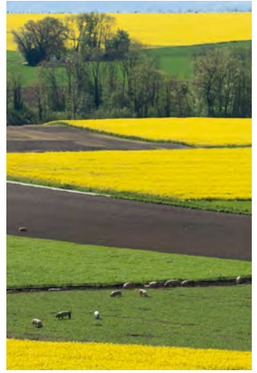
250 Non-state actor organisations engaged

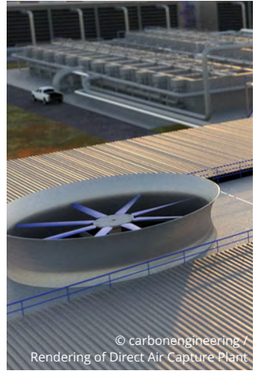
48,000+
Visitors to C2G's website

4,500+
Social media followers

5. Delivery timeline: Carbon dioxide removal (CDR)







© carbonengineering /
Rendering of Direct Air Capture Plant

Before 2017

UNFCCC Convention (1992) and Paris Agreement (2015) address carbon removals.

The Oxford Principles for geoengineering governance published (2013).

IPCC address CDR in its AR5 report (2014).

CBD Parties address CDR in various decisions and guidance (2008, 2010, 2016).

Parties to the London Convention and Protocol address CDR in resolutions and establishment of regulatory mechanism (2008, 2013).

The Carnegie Climate Geoengineering Governance initiative (C2G2) is established to catalyse the creation of effective governance for climate-altering technologies, in particular for solar radiation modification and large-scale carbon dioxide removal.

2017

UNEP Emissions Gap Report features a chapter on CDR for first time.

Worlds first commercial CO2 Direct Air Capture plant launched in Switzerland.

C2G2 and CBD Secretariat co-convenes workshop with SBSTTA representatives to highlight and further identify governance gaps including around CDR.

2018

IPCC publishes the SR15 report noting that "All pathways that limit global warming to 1.5°C with limited or no overshoot project the use of CDR on the order of 100–1,000 $GtCO_2$"

C2G2 publishes report on Carbon Removal and Solar Geoengineering: Potential implications for delivery of the SDGs.

C2G2 publishes technical brief on knowledge gaps on climate-related geoengineering in relation to the CBD.

C2G2 publishes report highlighting CDR governance gaps: Governing large-scale carbon dioxide removal: are we ready?

C2G2 provides input on CDR and its governance to the UNFCCC Talanoa Dialogue Platform

C2G2 begins to encourage and support governments and others to create a forum to exchange practical experience on implementing CDR activities.

2019

First ever resolution on geoengineering (including both CDR and SRM) is negotiated during UNEA-4 without reaching agreement.

Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) produces report reviewing proposed marine geoengineering techniques, including CDR.

C2G2 provides briefing to formal session of UNEA Committee of Permanent Representatives addressing CDR and its governance.

C2G2 changes its name to the Carnegie Climate Governance initiative (C2G).

2020

(Global COVID pandemic)

Microsoft Corporation publicly announces intention to remove its historic carbon emissions by 2050.

C2G commissions and funds discussion paper addressing: Options for supporting carbon dioxide removal.

C2G commissions and funds academic journal paper addressing: Potential implications of carbon dioxide removal for the sustainable development goals.

C2G convenes 26 C2GLearn webinars addressing CDR and its governance.

C2G secures inclusion of key language on CDR governance in the strategy for the UN Decade for Ecosystem Restoration.

C2G continues to catalyse and support a government-led, informal forum to exchange practical experience on CDR activities and their governance together with representatives of relevant private sector, IGOs and CSOs.

2021

IPCC AR6 Working Group I report addresses CDR.

UNHRC adopts resolution 48/14 requesting preparation of a report on the impact of new technologies for climate protection including CDR.

Number of scientific papers being published on CDR grows from a few dozen per year in the 1990s to 4,700+ in 2021 alone.

C2G convenes first dialogue on CDR between the Executive Secretaries of all UN Regional Commissions.

C2G publishes update to its 2018 report highlighting CDR governance gaps: Governing large-scale carbon dioxide removal: are we ready? – an update.

C2G edits first special issue of the academic journal Global Policy: Governing Climate-altering approaches, including 8 papers addressing CDR and its governance.

C2G and ECLAC collaborate to commission and publish a report and tool: Current understanding of the potential impact of CDR approaches on SDGs in selected countries in Latin America and the Caribbean.

C2G authors e-learning pages on CDR and its governance for ESCAP online SDG Helpdesk platform.

2022

IPCC AR6 Working Group II and III reports address CDR.

Parties to the London Convention and Protocol adopt a statement identifying the need to evaluate marine geoengineering techniques including CDR.

C2G and UNECA collaborate to commission a tool on CDR in Africa: Nature-based Climate Change Mitigation in Africa.

C2G convenes 3 C2GLearn webinars exploring how CDR and its governance is addressed in the AR6.

C2G authored content on CDR published in ESCAP report: 2022 Review of Climate Ambition in Asia and the Pacific: Raising NDC targets with enhanced nature-based solutions.

2023

IPCC AR6 Synthesis report addresses CDR.

UNFCCC addresses CDR under Article-6 of the Paris Agreement.

First 'State of CDR' report published.

Occidental Petroleum buys CO_2 direct air capture company Carbon Engineering for $1.1bn

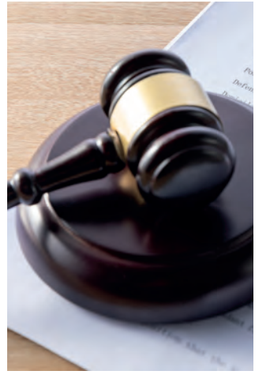
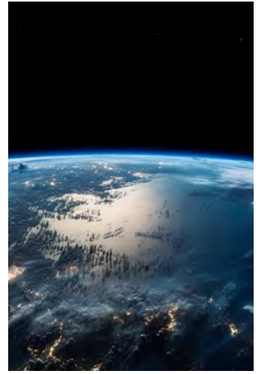
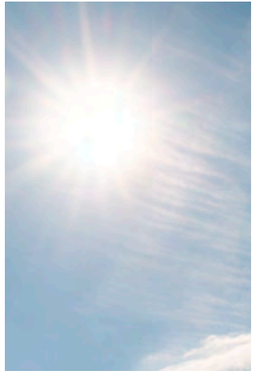
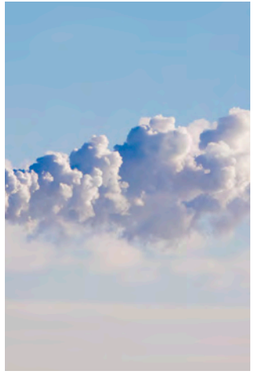
UNEP Executive Director invites UNEA Member States to consider establishing an Ad Hoc Expert Group (AHEG)-type approach to strengthen understanding of the science, risks and environmental impacts of climate-altering technologies and measures, including CDR.

C2G authored content on CDR published in ECLAC report: Nature-based solutions and carbon dioxide removal.

- Selected global CDR governance-related developments[3]
- Selected key C2G CDR governance-related delivery

3 This list is not comprehensive and is intended as an indicative selection of notable developments only.

6. Delivery timeline: Solar radiation modification (SRM)

Before 2017

IPCC convenes an expert meeting and publish a meeting report addressing SRM (2012).

UNESCO convenes a workshop (2010) and publishes a policy brief (2011) addressing SRM.

The Oxford Principles for geoengineering governance published (2013).

CBD Parties address SRM in various decisions and guidance (2008, 2010, 2016).

Parties to the London Convention and Protocol address SRM in resolutions and establishment of regulatory mechanism (2008, 2013).

UNFCCC Paris Agreement (2015) provides context for consideration of SRM.

The Carnegie Climate Geoengineering Governance initiative (C2G2) is established to catalyse the creation of effective governance for climate-altering technologies, in particular for solar radiation modification and large-scale carbon dioxide removal.

2017

C2G2 and CBD Secretariat co-convene workshop for representatives to the SBSTTA to highlight and further identify governance gaps including around SRM.

2018

IPCC publishes the SR15 report addressing SRM.

Scientific assessment prepared for the Parties to the Montreal Protocol addresses SRM (2018).

UN Secretary-General highlights gaps in environmental law relating to geoengineering in report to the UN General Assembly.

C2G2 publishes report on Carbon Removal and Solar Geoengineering: Potential implications for delivery of the SDGs.

C2G2 publishes technical brief on knowledge gaps on climate-related geoengineering in relation to the CBD.

2019

First-ever resolution on "geoengineering" (including both CDR and SRM) is negotiated during UNEA-4 without reaching agreement.

GESAMP publishes report reviewing proposed marine geoengineering techniques, including SRM.

C2G2 provides briefing to formal session of UNEA Committee of Permanent Representatives addressing SRM and its governance.

C2G2 changes its name to the Carnegie Climate Governance initiative (C2G).

2020

(Global COVID pandemic)

C2G convenes 17 C2GLearn webinars addressing SRM and its governance.

2021

IPCC AR6 Working Group I report addresses SRM.

UNGA adopts resolution 76/112 on the Protection of the atmosphere including legal guidelines relating SRM.

WCRP establishes a task team addressing SRM research.

UNHRC adopts resolution 48/14 requesting preparation of a report on the impact of new technologies for climate protection including SRM.

US National Academies of Science report recommends a five-year SRM research programme for USD100-200m.

Swedish Space Agency halt planned in-situ experiments in the stratosphere by Harvard University SCoPEx project following objections by indigenous people and environmental NGOs.

US National Intelligence Estimate notes the risk of unilateral geoengineering is increasing.

C2G edits first special issue of the academic journal Global Policy: Governing Climate-altering approaches, including 6 papers addressing SRM and its governance.

C2G authors e-learning pages on SRM and its governance for ESCAP online SDG Helpdesk platform.

2022

IPCC AR6 Working Group II and III reports address SRM.

Parties to the London Convention and Protocol adopt statement identifying the need to evaluate marine geoengineering techniques including SRM.

Scientific assessment prepared for the Parties to the Montreal Protocol includes chapter addressing SRM.

A group of academics launches the Solar Geoengineering Non-Use Agreement initiative calling for governments to ban funding for SRM experiments and development.

World Economic Forum Global Risks report highlights the potential risks associated with ungoverned SRM.

Papers catalysed by C2G cited in the IPCC AR6 report.

C2G convenes 3 C2GLearn webinars exploring how SRM and its governance is addressed in the AR6.

C2G catalyses GESDA to hold a panel discussion on SRM, and to include the topic in the 2022 GESDA report.

2023

IPCC AR6 Synthesis Report addresses SRM.

UNEP publishes 'One Atmosphere: An independent expert review on SRM research and deployment'.

UN HLAB publishes report recommending establishment of a forum on the governance of technologies, including SRM.

UNHRC Advisory Committee publishes report on the impact of new technologies for climate protection, including SRM.

UNESCO prepares a report on the ethics of climate engineering, including recommendations relating to SRM governance.

WCRP task team presents recommendations to its Joint Scientific Committee addressing SRM research.

UNEP Executive Director invites UNEA Member States to consider establishing an Ad Hoc Expert Group (AHEG)-type approach to strengthen understanding of the science, risks and environmental impacts of climate-altering technologies and measures, including SRM.

The European Commission announces its support for international efforts to assess the risks and uncertainties of SRM and discussions on a potential international framework for its governance.

At the request of the US Congress, the White House publishes a report on what an SRM research programme might look like, including research on governance framework.

A small US start-up company begins launching balloons for the purpose of stratospheric aerosol injection SRM and selling 'cooling credits'.

US NOAA begins stratospheric research flights over the Arctic to help assess the impacts of deliberate climate interventions such as SRM.

Two more groups of academics publish letters supporting more SRM research and more balanced, insight-based deliberation, research, and assessment of SRM.

Papers catalysed by C2G cited in IPCC AR6.

Papers catalysed by C2G cited in UNEP Independent Expert Review of SRM.

- Selected global SRM governance-related developments[4]
- Key selected C2G SRM governance-related delivery

4 This list is not comprehensive and is intended as an indicative selection of notable developments only.

7. Delivery in numbers

200+
News articles and letters to the editor published
C2G and its work presented in news articles globally

43 — **C2GLearn**
Webinars providing the latest information and research about emerging climate-altering approaches and their governance, from varying perspectives.

C2GDiscuss
Webinars presenting in-depth conversations between diverse experts on some of the governance challenges facing decision-makers, now and in the future.

33 — **C2GTalks**
Interviews with influential practitioners and thought leaders, exploring the governance challenges raised by climate-altering approaches

2000+
Social media posts

30+
Contributions and workshop or conference reports

7
Reports published

19 Infographics
89 Videos

30+
Events convened

1350+
meetings attended

84
Months of operation

21
Newsletters

78
Blogs

7
Op-eds published
in high-profile publications including Foreign Policy, Le Monde, Politico and Science

26
Contributions to other publications

940+
Interlocutors

10
Meetings of the C2G Advisory Group

13
Academic papers published
Papers published in academic journals that were catalysed by C2G

30+ Policy Briefs
7 Evidence Briefs

$14.318m
Funding
Total funding of C2G's work

7 Funders
Funders of C2G's work

20
Team members
Number of team members over the course of the initiative

Delivery insights

The following section outlines some key insights into C2G's delivery activities and what was learned from delivering them. Insights are presented across eight thematic areas:

- Catalysing more inclusive engagement
- Catalysing knowledge development
- Facilitating impartial learning on a contentious topic
- Engaging with governments
- Engaging with intergovernmental processes
- Engaging in regions of the world
- Facilitating online learning
- Insights from independent evaluation

8. Delivery insights: Catalysing more inclusive engagement

From the start of the initiative, it became clear that a variety of groups were, or would be likely to be, under-represented in discussions about governance of CDR and SRM, including *inter alia*, women, young people, indigenous people and those from the Global South. Mindful of power-differentials between different stakeholder groups and a desire to catalyse inclusive engagement of different actors (in particular those historically under-represented), the initiative made specific efforts to catalyse more inclusive engagement of such actors.

What we delivered

The initiative sought to catalyse more inclusive engagement in a number of ways, including:

- **Supporting Global South representation in events** – for example, catalysing and funding Global South actors to participate and present in international events, to ensure greater inclusion of Global South perspectives and to help the individuals to build their international networks.

- **Outreach in Global South countries** – by constantly reviewing countries targeted for engagement, the team ensured that Global South countries were well engaged throughout (see The stakeholders engaged on p. 22).

- **Partnering with Global South organisations** – the initiative partnered with a variety of Global South organisations to deliver events and workshops.

- **Ensuring strong Global South inclusion in knowledge content production** – when commissioning knowledge products, the initiative made it a requirement to ensure strong Global South and balanced gender representation in authorship.

- **Producing tailored briefings** - C2G produced tailored briefing products, providing specific focus and detail relevant for or of interest to, the target audience for example, when engaging groups from the Global South such as the G77 and China, LDC and AOSIS.

- **Ensuring diverse socio-demographic representation in event panels** ¬– when selecting and inviting panellists and speakers for C2G events, strong efforts were made to ensure a diverse socio-demographic representation.

- **Ensuring diverse socio-demographic representation in knowledge products** – the initiative worked to ensure that knowledge products including its online learning series C2GLearn, C2GDiscuss and C2GTalk and its blog featured broad representation of views.

- **Building the capacity of young people to engage** – to strengthen representation of young people, C2G actively engaged with youth networks, convened youth focussed briefings and workshops, involved young people in knowledge product development including its online learning series such as C2GTalk. Between 2022 and 2023 C2G also designed and delivered a dedicated youth project 'Youth Voices for Emerging Climate governance'.

- **Diverse representation in the Team and Advisory Group** – the initiative actively recruited to ensure stronger socio-demographic representation in its team members and Advisory Group members to ensure that broader perspectives were represented in the delivery of the initiative.

- **Diverse views on CDR and SRM included** – the initiative actively engaged speakers with diverse perspectives to join event panels and contribute to online learning resources C2GLearn, C2GDiscuss and C2GTalk and the C2G blog.

What we learned

- **Systemic challenges** – Historic and ongoing systemic biases in cultural, societal, and political systems make it challenging to achieve full diversity in practice. These challenges can only be addressed up to a point in initiatives such as the C2G and also require addressing at their root (e.g. within the institutions, processes and systems themselves). Being aware of these biases and challenges provides an important starting point for addressing them. In C2G's work for example, additional effort was made to identify diverse participation on expert panels in events and in contributors to knowledge and learning products.

- **Inclusion requires investment** – Enabling diversity is challenging and requires additional dedicated time and resources but yields benefits. For example, early in the initiative, C2G learned that there were significantly fewer experts on SRM from the Global South (with the majority of research investment in Global North institutions). Enabling diversity of expert participation in international meetings required focussed effort by C2G to identify and support the engagement of Global South actors who may not otherwise have been involved. Similar efforts were required to enable greater engagement from youth actors. As a consequence, C2G's work enabled the development of a diverse network of actors that could be drawn upon both in its own work and to support more diverse participation in the work of other organisations and processes.

Young people were all but absent from early-stage conversations about SRM, even though they are the ones with the most to gain or lose from any decisions made about SRM in the next few years. Read more about how C2G sought to address this through its Youth Climate Voices project, in Learning story: Catalysing youth voices on p. 70.

9. Delivery insights: Catalysing knowledge development

Central to the initiative's work was to develop and catalyse impartial, high-quality, accessible, and reliable knowledge to help build awareness and understanding and inform decision-making around governance of climate-altering approaches. Mindful of the risks of misinformation and disinformation around the topics of CDR, and SRM in particular, C2G devoted significant resources and time to knowledge development activities. Activities were informed by developments in scientific and public understanding and feedback from interlocutors that ensured timeliness and a strategic focus critical for catalysing the initiative's core audiences. To allow for broad use and global uptake, many products were produced in four languages.

What we delivered

The initiative sought to catalyse knowledge development and understanding in a number of ways, including:

- **Authoring content for C2G knowledge products** – C2G authored and published a range of knowledge products that aimed to inform target audiences about the current status of knowledge to enable learning and to build understanding of both the science and varying perspectives of different stakeholders. Products were tailored for different audiences. Short Policy Briefs on specific topics and Briefing Notes tailored to specific audiences were produced for a high-level overview, accompanied by more detailed Evidence Briefs and Technical Briefs providing more depth and signposting key sources of evidence. A series of online learning products C2GLearn, C2GDiscuss, and C2GTalk together with regular blog postings were produced to provide more in-depth insights from external experts and stakeholders (see section below on facilitating online learning). A range of Infographics were also produced, summarising complex issues in a single engaging graphic.

- **Contributing content to external knowledge products** – Once C2G's reputation was established, the initiative received regular requests to provide input to (or review of) external organisations products. For example, at the invitation of UN ESCAP, the initiative provided online resource pages on CDR and SRM to the Commissions' SDG Helpdesk platform, and content inputs on CDR to its 2022 Regional review of climate action ambition. C2G also contributed a paper on SRM and the SDGs to a report by the UN Inter-Agency Task Team (IATT) on science, technology, and innovation (STI) published as an input to the UN STI Forum in 2021. At the request of the

International Risk Governance Center (IRGC) C2G authored a short paper presenting a risk-risk framework for SRM, which inspired the commissioning of a C2G report. The authors of that report went on to introduce the concept into an expert review they co-authored for UNEP in 2023. C2G also commissioned and provided input to publications tailored to specific global regions (see Delivery Insight: Engaging in regions of the world on p. 46).

- **Authoring and commissioning content to address knowledge gaps** – Drawing on insights from its engagements with scientists and policymakers, the C2G team identified a number of areas where gaps in knowledge might inhibit the development of effective governance around CDR and SRM. The initiative consequently conceptualised and commissioned a number of reports to address these gaps. Report authors were commissioned on the basis of expertise and reputation but also to ensure – as much as practicable – a balance in authorship (e.g. by gender and geography). The reports addressed topics including: *Carbon Removal and Solar Geoengineering: Potential implications for delivery of the SDGs* (2018); *Governing Large-scale Carbon Dioxide Removal: Are we ready?* (2018) and an update (2021); *Geoengineering: The need for governance* (2019); *Options for Supporting Carbon Dioxide Removal* (2020); *Solar Radiation Modification: Governance gaps and challenges* (2021); and *Solar Radiation Modification: A risk-risk analysis* (2021).

- **Commissioning academic papers** – aware that knowledge presented in academic papers provides the level of quality assurance required by some governments and intergovernmental processes such as the IPCC assessment, C2G also supported the publication of a range of papers published in high-quality academic journals. These included two papers looking at the implications of CDR and SRM respectively, for SDG implementation and ten papers in a C2G Special Issue of the journal *Global Policy*. Many of these papers were subsequently cited in reports and assessments such as the IPCC sixth assessment report.

What we learned

Knowledge products are more effective when they are:

- **Purpose driven** – content and knowledge products are developed with a clear purpose and target audience in mind. Some of the most useful and popular of C2G's knowledge resources were developed in direct response to requests from interlocutors engaged through the initiative's outreach work.

- **Evidence-based** – content is based on transparent, high-quality, up-to-date evidence from credible and reliable sources that withstand scrutiny. This requires additional investment (e.g. external review processes; a dedicated science adviser).

- **Balanced and impartial** – ensure content is (as far as practically possible) based on a balanced and impartial range of sources and types of knowledge. This can be strengthened by engaging a diversity of authors or content contributors.

- **Need for dedicated science advice** – C2G maintained dedicated science advisers throughout the initiative, that could be drawn upon as authors, technical advisers and researchers to ensure C2G's content was reliable and high quality.

- **Review processes** – implementing rigorous internal (and in some cases also external) review processes are essential to ensure high-quality, reliable content.

- **C2G resources used by others** – infographics worked as catalytic tools and were picked up and used by influential stakeholders (not directly associated to C2G) when presenting on the subject in events. Consequently, we published content under Creative Commons licence and designed infographics with discrete logos to enable their wider use externally.

- **C2G's stakeholder survey** - 80% of respondents to C2G's stakeholder survey told us that they thought C2G provided credible and reliable information on both CDR and SRM.[5]

One of C2G's main functions was to provide impartial, high-quality, accessible and reputable information to inform decision-making around governance of these climate-altering techniques. Read more about how C2G addressed knowledge gaps in Learning story: Catalysing learning through knowledge products on p. 54.

5 The C2G General Stakeholder Survey was co-delivered with C2G's Independent evaluator Ian. C. Davies Conseil Inc. The survey was open to submissions for 10 weeks from November 2020–January 2021 and administered via an online survey platform. The General Survey questionnaire was emailed primarily to individuals who have in some way engaged with C2G, its products or activities, and who were listed in C2G's mailing list. Participation in the survey was also promoted via C2G's social media accounts. Responses were analysed and reported on by Ian. C. Davies Conseil Inc.

10. Delivery insights: Facilitating impartial learning on a contentious topic

Mindful of the high level of uncertainty, knowledge gaps, and contentious discourse around CDR and SRM, and an awareness of the power of unconscious bias, facilitating learning that could be considered both impartial and reliable, became cornerstones of C2G's approach. It was hoped that through a strong commitment to impartiality and inclusivity, the initiative could not only provide its audience with trusted and transparent information, but in so doing, also create a broader platform encouraging and enabling a wider range of actors with more diverse perspectives, to engage.

What we delivered

The initiative sought to facilitate impartial learning in a number of ways, including:

- **Promoting impartial language and terminology** – early in the initiative's development it became clear that the choice of language and terminology used in public statements and knowledge products was an essential element of promoting impartiality. For example, use of phrases such as *"...to discuss if SRM should be deployed"* could easily be misinterpreted to imply an unstated bias towards deployment and consequently the team increased its sensitivity towards the semiotics or underlying implications of how and what it said, rephrasing such language to *"...to discuss if SRM should or should not be deployed"*. The team increasingly learned that terms such as "geoengineering" could also result in confusion over impartiality and so the team adjusted its language accordingly.

- **Promoting impartiality in knowledge products** – C2G utilised three main methods to promote impartiality in its own (and others') knowledge products. Firstly, sources of evidence were always transparently referenced, where possible defaulting to high quality assessments (such as the IPCC) and representation of a balanced range of perspectives (for example, signposting evidence sources from both those pro- and anti- the technology). Secondly, in commissioning authors to produce knowledge products, C2G actively assessed and selected to ensure a broad representation of perspectives (e.g., gender, geography/culture, view on the technology). For example, this approach required authors from the Global South and North to engage and work together, thus improving the diversity and quality of the output. Thirdly, the process of reviewing and editing products was a critical stage to ensure use of impartial language. The team developed a sensitivity to this issue over time and in addition to internal review the team also engaged external experts in a double-blind review process for its evidence briefs. This not only ensured the quality of the final products but also enabled screening for language and content that was (or could be perceived as) not impartial.

- **Promoting diverse voices** – Another process C2G put in place to promote impartiality through its learning activities and products, was to ensure that contributors reflected a diverse range of perspectives. In practice this required screening the selection of event speakers and panellists, experts for webinars, interviewees for podcasts, and authors for guest blogs or papers, to promote a diverse range of voices (see also Delivery insights: Facilitating online learning on p. 48). For example by encouraging strong gender balance in author teams for the papers selected for C2G's Special Issue of the Journal *Global Policy* the team managed to achieve a 50:50 balance of male:female lead authors. To promote diversity of gender, geographic, cultural and age perspectives among such voices, as well as a range of views on the technology itself, required considerable additional time investment. The team also frequently reviewed its content output, adjusting future delivery where needed to ensure that over time the initiative provided a platform promoting a diverse range of voices.

What we learned

- **Language and terminology protocols** – to help avoid misunderstandings about C2G's intentions resulting from the language and terminology it used, the team developed an internal protocol, internal review processes and an online Glossary to help ensure consistency and impartiality in all its language output.

- **Tailored communications** – to raise awareness and build understanding around these contentious topics across a broad range of actors, C2G dedicated considerable time and energy considering how best to approach discussions with its interlocutors in different organisations and contexts. By understanding their interests or mandate, C2G could better tailor its communications and products to ensure relevance for their agenda and thus more effectively catalyse learning.

- **Promoting author diversity** – by requiring author teams of knowledge products commissioned by C2G ensure diversity (e.g., gender, geographic, cultural background), we learned two valuable lessons. One that there really is a shortage of Global South based experts on this topic and secondly, that by matchmaking diverse teams, we were able to build and strengthen relationships between diverse authors that will hopefully continue into future collaboration and mutual benefit to their work.

- **Reviewing content** – internal reviewing not always enough. In the case of evolving science – where no reliable assessment had yet been produced or only one perspective existed, the team considered it important to have external expert reviewers to help ensure, as far as possible, that diverse scientific perspectives were reflected.

- **C2G's stakeholder survey** - 67% of respondents to C2G's stakeholder survey reported they thought C2G provided impartial information on both CDR and SRM.

11. Delivery insights: Engaging with governments

As the foundational institutions for international governance – and those who determine the international agenda - governments were a primary audience that the initiative sought to engage through its work. To most efficiently and effectively invest the initiative's limited time and resources, the team assessed and prioritised key target governments to engage based on criteria including their geopolitical role and vulnerability to climate impacts. The team initially pursued an opportunistic approach, focussing on counties where there was initial openness to engage and then systematically and strategically approaching others over time. Many governments were engaged repeatedly, both online and in-person, in national capitals, around international meetings and around geopolitical centres such as the UN in New York, Geneva, and Nairobi.

What we delivered

The initiative sought to catalyse learning by and discussion among governments in a number of ways, including:

- **Meeting bilaterally** – building on existing relationships and establishing many new ones over time, the team spent considerable efforts meeting with governments bilaterally. Meetings were often primed and followed up with relevant reading materials authored or signposted by C2G.

- **Convening events** – numerous briefing events, workshops, and other events where convened or co-convened, often on an invitation-only basis, involving respected experts to provide authoritative information to participating governments. Events were often primed and followed up with relevant reading materials authored or signposted by C2G. In addition to various such briefing events in New York for government representatives to the UN, C2G also partnered with intergovernmental actors including UNEP and the CBD Secretariat to provide dedicated briefings for representatives and their advisers. C2G was also increasingly invited to provide such briefings and events for governments or groups of government representatives such as the African Group of Negotiators, the G77 and China Group in Geneva and in New York.

- **Tailoring knowledge products** – in addition to C2G's general knowledge products, often at the request of governments or groups of governments, and sometimes in collaboration with regional IGOs, C2G produced tailored briefing products, providing specific focus and detail relevant for or of interest to, the target audience.

What we learned

- **Building trust** – engaging governments on such a contentious – and little known – issue required building trust in C2G as an honest broker. The existing reputation of C2G's senior team (from working in the UN and CSOs) together with existing rapport with some interlocutors provided a good basis for this. In addition, stating and demonstrating C2G's impartial stance through its use of language and in its products and activities, and providing support without seeking institutional visibility or credit, also helped provide reassurance. The team also invested considerable time in face-to-face meetings with interlocutors, enabling stronger trust and relationship building that enhanced the credibility of C2G's voice and message.

- **Being a good facilitator** – the initiative focussed on providing a facilitatory role in most briefings and invited trusted experts to provide input. This generally turned out to be an effective way to engage audiences and build trust.

- **Locations and interlocutors** – engaging with interlocutors in both country capitals and with their diplomat representatives to UN processes (e.g. in New York, Geneva or Nairobi) helped enable consistent and tailored communication through diverse channels strengthening governments understanding of and 'buy-in' to the importance of the issues raised by C2G. Maintaining a

sufficient and diverse team to enable engagement with interlocutors at different levels of seniority and with some linguistic and cultural alignment, also enabled effective engagement.

- **Targeting content** - by targeting and tailoring such events to either high-level political actors (covering headline messages and policy dimensions) or technical advisors (covering the latest science or governance dimensions), learning could be facilitated more comprehensively with broader government engagement.

- **Pitch and deliver at the right level** – the team early discovered that levels of understanding varied quite considerably between government interlocutors. Basic technical and policy understanding around CDR and SRM was in many cases at a very low level. Confusions such as what exactly SRM was (something to do with solar power or weather modification?), or CDR (carbon capture and storage, or just planting trees?) meant that the team had to be sensitive to the level of understanding and pitch talking points and supporting information accordingly to engage some governments interlocutors.

- **Opening the door with CDR** – many governments were either averse to engaging with the team on the topic of SRM or found it too far-fetched or theoretical to be of relevance for immediate consideration. In such cases, the team then first engaged on the (less controversial and more policy prominent) issues of CDR and its governance, not only to deal with this as a topic in itself but also to build relationships with governments that could later be used to raise awareness of the governance challenges around SRM.

- **Learning in groups** – convening multiple actors in group dialogues framed as briefings or learning events, enabled governments to avoid any perception that they had a particular policy position and also enable them to gauge the views of, and engage in discussion with other governments on these topics.

- **Patience and persistence** – some governments could not at first easily engage with the contentious topics C2G was addressing and concerns around political risk and moral hazard made some interlocutors wary. Sensitivity to these concerns, employing discretion in how and when to engage and taking a longer-term approach to engagement enabled interlocutors to engage and learn at a pace they were comfortable with. Being patient and persistent generally paid off as over time most interlocutors became more able to engage.

To catalyse discussion among governments about the need to strengthen governance around climate-altering technologies, a key aim of C2G's work was to put the issue on the agenda of relevant intergovernmental bodies. Read more about how C2G catalysed discussion in the UN Environment Assembly in the Learning story: Catalysing governance at the fourth session of the UN Environment Assembly on p. 63.

12. Delivery insights: Engaging with intergovernmental processes

As key fora for international governance discussions and decision-making, intergovernmental organisations and processes were another key route of engagement for the initiative. To most efficiently and effectively invest the initiative's limited time and resources, the team assessed and prioritised key target IGOs and processes to engage. Many IGOs and processes were engaged proactively in a similar way to governments (see previous section) while others were engaged reactively at the request of, or through opportunities provided by the IGOs or processes themselves.

What we delivered

The initiative sought to catalyse learning and engagement in a number of ways, including:

- **Contributing content to official consultations and processes** – the initiative provided comprehensive inputs to numerous consultation and review processes, many of which resulted in the inclusion of key evidence or issues that may otherwise been missed out. For example, C2G

provided inputs to the consultation on the strategy for the UN Decade of Ecosystem Restoration, highlighting key evidence from recent IPCC reports relating to CDR governance. The issue was subsequently included in the strategy. In 2018, the initiative provided written input to the Talanoa Dialogue, and in 2020 a multimedia poster input to the 12th Research Dialogue under the UNFCCC highlighting CDR governance challenges. In 2022 C2G provided inputs to a report being prepared for the Human Rights Council and inputs to a report being prepared by the UN Secretary-General's High Level Advisory Board on Multilateralism (HLAB) which consequently included recommendations relating to SRM governance.

- **Collaborating with IGOs** – the initiative engaged directly with a number of IGOs to build knowledge and understanding around CDR and SRM governance. For example, in 2017/18 together with the Secretariat of the Convention on Biological Diversity (CBD), C2G convened a two-day workshop with government Advisers on the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to help address an issue highlighted in recent CBD decisions. The workshop was well attended and as well as providing SBSTTA with insights from international experts on recent developments, a workshop output included a list of knowledge and governance gaps to be addressed – providing a future research agenda for strengthening governance. Later in 2018, C2G worked with UNEP to provide a dedicated briefing to Committee of Permanent Representatives to the UN Environment Assembly (UNEA) in Nairobi which provided timely background information to inform discussion of a resolution on geoengineering governance months later during the UNEA-4 meeting.

What we learned

- **Collaborating with trusted actors** – working together with intergovernmental organisations and secretariats of intergovernmental processes proved to be an effective route to building understanding and stimulating consideration of C2G's issues by governments engaging in those processes.

- **Knowledge alone isn't always enough** – the workshop, co-hosted with the CBD Secretariat, convened CBD SBSTTA representatives and its outputs (identifying knowledge and governance gaps) was thorough, informative, and welcomed by SBSTTA representatives and the Secretariat as helping further develop knowledge and understanding. However, despite promotion of these outputs among Parties, with so many other pressing challenges to the biodiversity agenda, it was not possible to gain sufficient attention from Parties to catalyse further action beyond this.

To catalyse discussion among governments about the need to strengthen governance around climate-altering technologies, a key aim of C2G's work was to catalyse governments to put the issue on the agenda of relevant intergovernmental bodies. Read more about how C2G engaged the UN Environment Programme in the Learning story: Working with the UN Environment Programme on p. 61.

13. Delivery insights: Engaging in regions of the world

In addition to engaging individual governments and the intergovernmental organisations and processes they work in internationally, C2G also engaged regional actors as a gateway to engaging with governments and other actors in the region. Establishing and developing productive relationships with regional fora such as the UN regional commissions proved fruitful and C2G cultivated these relationships to catalyse learning and dialogue on CDR and SRM governance at the regional level.

What we delivered

The initiative sought to catalyse learning and engagement in regions in a number of ways, including:

- **Co-organising events** – collaborating with UN regional commissions, and CSOs, to deliver events both in the regions and internationally. For example, in 2021 as part of the UN High-Level Dialogue on Energy, C2G brought together the Executive Secretaries of all five regional commissions for the first high-level dialogue addressing the role of CDR. This collaboration resulted in a joint statement by the five Executive Secretaries, calling for enhanced regional cooperation to develop CDR. In 2022, C2G collaborated with the Inter-American Institute for Global Change Research (IAI) based in the LAC region to convene an event hosted by the Government of Jamaica and the University of West Indies promoting learning on SRM science and governance. The event resulted in a notable shift in participants' perspectives of the importance of SRM research for the LAC region. In Africa, C2G began collaborating in 2018 with the African Union Commission and the UN Economic Commission on awareness-raising and learning events including the annual meetings of the Climate Change and Development in Africa Conference (CCDA) that resulted in increased awareness and consideration of the issue in various African ministerial fora.

- **Co-commissioning knowledge products** – other collaborations with UN regional commissions include the co-commissioning of reports looking at CDR and SRM in the LAC region that were later turned into publications by ECLAC and catalysing both ECLAC and the UN Economic Commission for Africa (UNECA) to produce interactive tools to identify the CDR potential within the development objectives in their regions.

- **Contributing to regional resources and publications** – at the request of some UN regional commissions, C2G also contributed to regional resources and publication. For example, at the request of UNESCAP, the team curated information and e-learning pages on CDR and SRM governance for the region's SDG Helpdesk platform, steering users in the region to evidence and learning resources. The team also provided input on CDR to the *2022 Review of Climate Ambition in Asia and the Pacific* publication. In 2022, C2G was also contributed a chapter on CDR to a publication by the ECLAC *Nature-based Solutions and Carbon Dioxide Removal*.

- **Catalysing work and activities in the region** – For example, C2G's ongoing engagement in the LAC region, led to the creation of a workstream in the regional commission, as well as inter-institutional collaboration between ECLAC and IAI to complement their respective individual efforts at the regional level. The initiative's ongoing engagement in the European Union and with the European Commission also catalysed learning around CDR and SRM and the need for more effective governance, which then gained greater prominence in commission policy and investment. C2G also helped raise the awareness of relevant stakeholders in the Arctic region through organising events in the Arctic Circle Assembly in 2019 and 2021, producing special knowledge products, and through bilateral engagement with various actors in the region.

What we learned

- **Regional engagement gateway** – working with regional conveners and organisations such as the UN regional commissions provided an efficient and effective gateway to engaging with governments across the respective regions and helped catalyse regional learning and engagement.

- **Bridging capacity gaps** – while the regional commissions demonstrated the necessary political will and interest to move these issues forward, the capacity to do so was often limited by budget constraints and limited human resources. C2G's capacity to provide trusted support for the delivery of events and knowledge products to move these issues regionally was key.

- **Regional variations** – each regional interlocutor had unique circumstances and practices which determined the nature and speed of how issues were picked up in the region. C2G had to adjust its outreach approach to these regional variations to ensure most effective engagement in each case.

C2G's work was inherently global, given transboundary and global implications of climate-altering techniques. But there are also regional, national, and local considerations that are sometimes equally – if not more – pressing for policymakers as they consider how to govern these emerging techniques. Read more about how C2G worked with regional actors in the Learning story: Working with regional actors in Latin America and the Caribbean and Europe on p. 57.

14. Delivery insights: Facilitating online learning

From the outset of the initiative C2G established an online presence including a website and social media accounts to share information and promote learning. This presence was then further developed around the time of the COVID-19 pandemic as travel restrictions made face-to-face engagement increasingly challenging and then for a time, impossible. Online learning resources also became an increasingly efficient way to promote learning among C2G's target audience.

What we delivered

The initiative sought to facilitate online learning in a number of ways, including:

- **Delivering learning webinars** – C2GLearn was developed as a series of free-to-join online events, designed to catalyse learning about CDR, SRM and their governance. Featuring leading international experts and practitioners, events included both formal webinars and informal 'campfire chats', convened regularly throughout the year, with opportunities for questions and answers. The series did not aim to be an educational course, but rather to spark a first set of questions, and to catalyse wider societal engagement on the tough choices ahead. Feedback from post-event survey responses following the first 13 C2GLearn events indicated that 95% were satisfied with the speakers and presentations, 83% with the facilitation and discussion, 87% said they learned something and 78% said they would be able to connect or apply what they learned in their own work. The C2GLearn episodes were of sufficient quality and interest that in-principle agreement was secured for the series to be developed on the UN Climate Change Learning Partnership platform UN:CC Learn.

- **Delivering group discussion webinars** – C2GDiscuss was developed as a series of moderated in-depth conversations between diverse experts on some of the governance challenges posed by CDR and SRM. They aimed to encourage engaging conversations about some of the toughest questions faced by decision-makers on climate change, now and in the future.

- **Delivering one-to-one interviews** – C2GTalk was developed as a series of one-on-one interviews with influential practitioners and thought leaders, to explore the governance challenges raised by CDR and SRM. Discussions touched on a range of ethical, cultural, economic and political issues, whilst staying grounded in the practical and personal experiences of the interviewees.

- **Producing explainer videos** – aware of the benefit of using short videos to facilitate learning about the complex and challenging issues raised around the governance of CDR and SRM, C2G developed a series of short explainer videos that concisely communicate some of C2G's core messages.

- **Curating a C2G blog** – another important channel for C2G to provide a platform for diverse voices and perspectives on CDR and SRM governance was the C2G blog. The blog featured regular postings from both C2G team members and guest posts from a diverse range of stakeholders. The team frequently reviewed blog authorship and content for diversity and consequently commissioned new guest posts to help maintain some balance.

- **Promoting knowledge through social media and online groups** – the initiative established social media accounts on Twitter, LinkedIn and Facebook routinely promoting learning content and activities with at least one post per day per channel. In addition, content was shared with dedicated online expert Google groups to reach academic and research communities.

- **Promoting knowledge through direct email** – the initiative accumulated a mailing list of interested people which was used to share mailouts highlighting new learning products, event invitations and a quarterly newsletter on the latest developments around C2G's work.

What we learned

- **Diversity of voices** – in selecting interviewees, webinar participants and blog posts, mindful of the need to ensure diversity, the team frequently reviewed content and participants and authors to identify gaps. The team then focussed effort on identifying and engaging people to help provide diverse perspectives that were missing. This took time and effort, but the result was the presentation of a greater diversity of voices on the issues addressed.

- **UN CC:Learn** – despite C2G securing in principle agreement for the C2GLearn series to be developed for the UN Climate Change Learning Partnership platform (UN CC:Learn), unfortunately a lack of member government support at the time, prevented progress. With CDR and SRM now more prominently on the intergovernmental agenda, the time may soon come when such support will be more forthcoming.

15. Delivery insights: Insights from independent evaluation

Between 2020 and 2022 the C2G initiative was independently evaluated by Ian. C. Davies Conseil Inc. commissioned and funded by and reporting directly to, the initiative's founding funder the V. Kann Rasmussen Foundation (VKRF). The evaluation's key findings[6] included:

Values and credibility

"There is robust evidence that C2G's statements, choices, decisions and activities are clearly framed and bounded by its explicit and unwavering commitment to the rule of international law; to the need for effective governance of climate-altering techniques while remaining impartial regarding their potential use or not; to respect for different perspectives and their inclusion in governance considerations; to reliance on sound and up-to-date scientific evidence, and on evidence-informed policy processes and multilateral/global governance institutions, networks and systems.

These defining characteristics of C2G's organisational identity and deportment have contributed, among other factors, to giving it a high degree of credibility with a wide range of scientific and policy communities, governments, IGOs, politicians and non-state actors.

This high level of organisational credibility has enabled C2G to leverage and build on the established credibility and professional networks of its Executive Director, senior management, experts and advisory group, to gain access and be listened to by key individuals, communities and institutions.

In the relatively short period of its existence, and with modest resources, C2G has gone from start-up to gaining recognition and acceptance among key actors in the climate governance field as a leader and go-to resource on governance of climate-altering techniques."

Navigating complexity

"C2G's performance is a function of how well it navigates the complex inter-relationships between rapidly changing and unpredictable climate and ecosystem realities, scientific knowledge and global

6 C2G is grateful to Ian Davies Conseil Inc. for granting permission for the reproduction of this content from the evaluation report *Independent External Evaluation of C2G. Final Report: Executive Summary*. Ian. C. Davies Conseil Inc. 15 April 2022.

political dynamics. It is about navigating complex adaptive systems based on principles and values, rather than managing to implement a fixed plan. This is something that C2G does well. Its catalytic approach is characterised by flexibility, adaptability, and strategic management.

It identifies and attempts to engage with those actors who have visibility and looks for networks and systems that may be relevant and open to the C2G narrative on the need for sound governance of climate-altering techniques, with a view to have them engage and pick up on the conversation. C2G then sees what it can do with those interlocutors, within its resources and availability, that fits their comfort zone.

It is also however about assessing and deciding when to not or no longer invest in a specific engagement, and to manage strategically the allocation of C2G's resources, time and effort, which it does well."

Knowledge production and communication

"C2G's knowledge production and communication activities also constitute another channel through which it engages with a range of non-state actors in civil society organisations, academia, research institutions and the arts. By bringing different perspectives to bear on the discussion about governance of climate-altering techniques, including from those opposed to any form of climate-altering technology and related research, C2G acts impartially. In turn, its approach consolidates its credibility with different publics and increases the likelihood of its knowledge resources being accessed and used as part of policy considerations, providing a foundation for catalytic processes."

Value addition

"The value of C2G's work extends beyond its direct catalytic effects on policy communities, directly and indirectly, in a number of ways. C2G has effectively:

- provided in consistent manner impartial perspectives relative to the governance of climate-altering techniques, thereby creating spaces for constructive and reasoned policy exchanges based on available scientific knowledge and realistic governance considerations;
- expanded and deepened the climate-related governance policy space by linking and catalysing dialogue between scientific/technical communities and administrative/political communities;
- demonstrated good adaptive management practice principles and advanced innovative ways of influencing, engaging, leveraging and catalysing global, regional and national governance networks;
- generated and consolidated knowledge, including an implicit conceptual framework and explicit terminology for communicating and exchanging on governance of climate-altering techniques."

Learning stories

The following section provides a selection of case example stories illustrating various areas of C2G delivery, summarising activities delivered and some of the impacts and learning that resulted. The stories include:

- Catalysing learning through knowledge products
- Working with regional actors in Latin America and the Caribbean and Europe
- Working with the Executive Office of the UN Secretary-General
- Working with the UN Environment Programme
- Catalysing governance at the fourth session of the UN Environment Assembly
- The Global Commission on Governing Risks from Climate Overshoot
- Catalysing international philanthropy
- Catalysing young people

16. Learning story: Catalysing learning through knowledge products

When C2G began, it was clear that one of its main functions would need to be to provide impartial, high-quality, accessible and reputable information on carbon dioxide removal (CDR) and solar radiation modification (SRM) to help build awareness and understanding and inform decision-making for governance of these climate-altering techniques. This proved no easy task, and one that C2G would devote significant resources and time to developing, with strategic focus and timing critical for reaching its core audience.

Prior to C2G, the vast majority of information on CDR, and on SRM in particular, was to be found in academic journals, and to a much lesser degree, in materials from civil society organisations (CSOs). Neither of these information sources was fit for purpose: CSO materials were typically prepared as advocacy tools while academic articles were written for specialised audiences who already had in-depth understanding of the science and related issues and were communicated in an academic style wholly unsuited for policymakers with little time or extant understanding of the issues.

In addition, apart from a few paragraphs in the IPCC's latest assessment at the time of C2G's founding (AR5), and references in documents, inter alia, the Convention on Biological Diversity, London Convention and Protocol, and the Montreal Protocol, SRM and its governance was not discussed in any detail in UN publications, meaning governments had no agreed, non-academic source for learning more about this technique for the purposes of policymaking.

C2G stepped into this void seeking to provide governments and those who advise them with impartial knowledge products written in a style more accessible for non-specialists.

C2G first focused its knowledge products on CDR, given that the IPCC's Special Report on 1.5°C had, in 2018, found that large-scale use of CDR was essential to limit global average temperature rise to 1.5°C goal. However, significant governance gaps hindered attainment of CDR at a large-scale. C2G's knowledge products focused on these governance gaps and why it was necessary to fill them to meet the 1.5°C goal.

The credibility and accessibility of C2G's products on CDR helped build an audience for C2G's later work on SRM as a potential response option, in addition to rapid, deep mitigation cuts, removals

and adaptation, to manage the risks from the increasing probability the world would overshoot 1.5°C.

Access to a base level of knowledge was a key concern, which is why C2G translated many of its materials into four languages (English, Spanish, French and Chinese) all publicly accessible on its website and actively promoted via social media and newsletters.

Several other criteria have also been key for developing C2G's knowledge products, including creating:

- a wide range of products, online learning tools, from infographics and short videos to two-page policy briefs and detailed reports and evidence briefs that delved into issues in-depth;

- a wide representation of authors coming from a broad range of different viewpoints, regions of world, gender, and ages;

- materials that are policy relevant, but not directive or prescriptive, much like the IPCC's approach and in keeping with C2G's fidelity to impartiality; materials commissioned by C2G to authors who normally may not work together or come from different regions of the world.

In addition to written materials, C2G produced numerous "C2GLearn, C2GTalk and C2GDiscuss" products. These enabled a wide range of speakers to present their views or information for online viewing. C2G also launched a podcast series interviewing relevant stakeholders – from senior policy makers and their advisors, climate and environmental justice activists to intergovernmental experts to science fiction novelists.

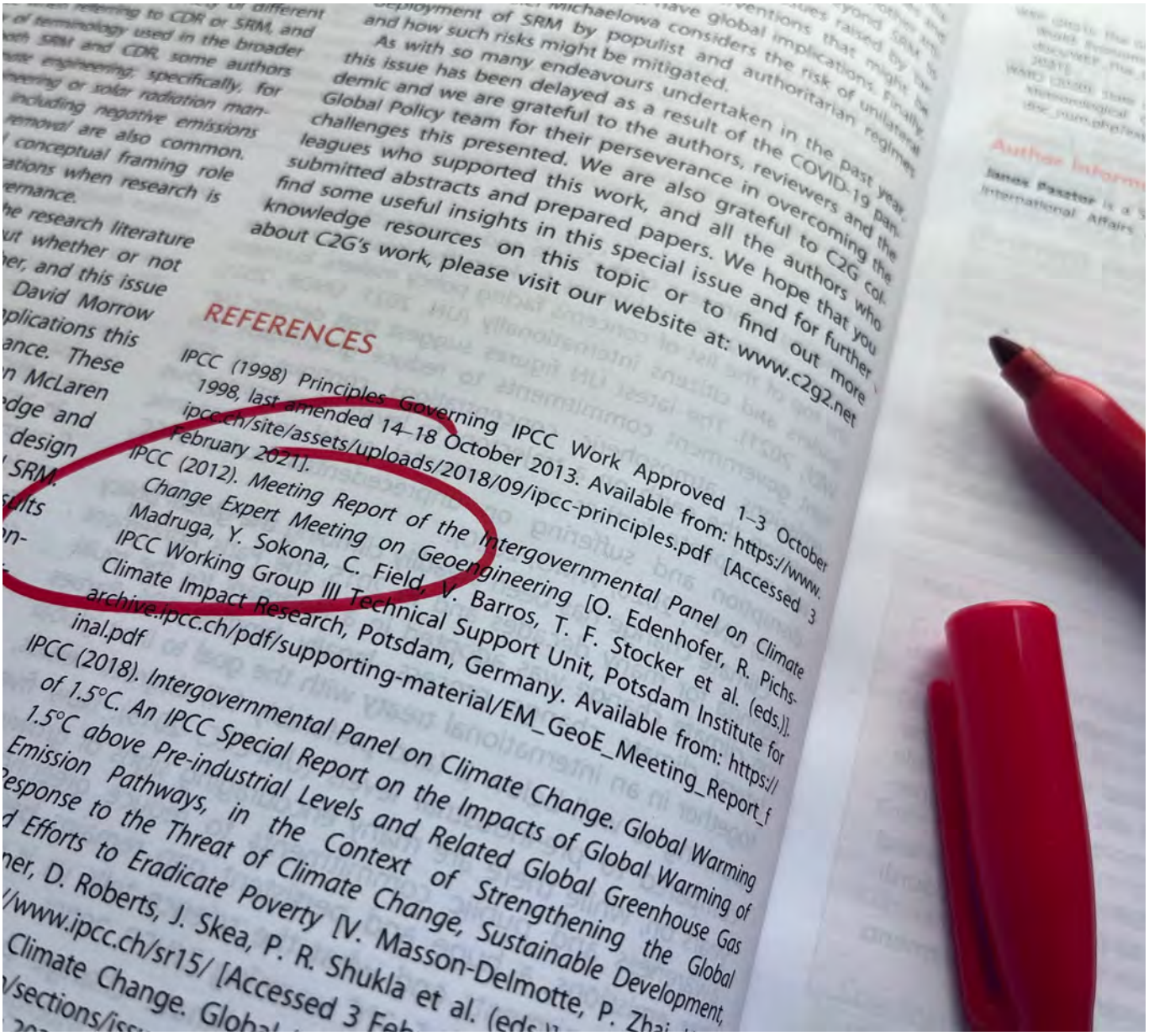
One over-arching lesson from our work was that the process was key, and in some cases, as important as the product itself. C2G's principle of impartiality meant the team needed to scrupulously consider, commission, manage, review, edit and re-edit materials to ensure they did not exhibit bias toward any one source (apart from the IPCC), region, perspective, or viewpoint for or against the potential testing or deployment of a technique This inevitably took time, but overall, an independent evaluation and anecdotal feedback suggests that C2G's products have been well-received as credible, reliable and impartial.

A few products stand out for their impact and utility to C2G's target audience of policymakers. C2G's two-page "Global Update of Activities on SRM and its Governance" has been used and cited by many as a concise source of credible information on what is happening on the science, research and policy efforts around SRM. In terms of scientific impact, C2G commissioned authors to write on SRM governance for a special issue of the peer reviewed academic journal Global Policy; several of these articles were then cited in the IPCC's AR6 report, thus adding to the IPCC's evidence base. C2G commissioned a report using a 'risk-risk' framework for comparative analysis of use or non-use of SRM, which has emerged as a helpful framing for policymakers grappling to understand the implications and potential options available to respond to a world with continued rising temperatures and worsening climate impacts. This framework was consequently used in the 2023

UNEP “One Atmosphere” report, which was produced by some of the same authors.

Given its catalytic mission, C2G has always sought to find actors that would step into its shoes when it closed and assume various roles that C2G has temporarily filled. It’s clear there will be a need for trusted organisations, institutions, and intergovernmental processes to provide ongoing, impartial and credible assessments of SRM globally, which all governments and the public could turn to.

In addition, there will also be a need for identifying and addressing policy-relevant knowledge gaps and communicating research to policy audiences. The rise of artificial intelligence and the potential for mis-or dis-information means that impartial, trusted sources of information will be all the more vital as governments come to terms with how they respond to the development of emerging climate-altering techniques.



17. Learning story: Working with regional actors in Latin America and the Caribbean and Europe

C2G's work was inherently global, given that the impacts of climate altering techniques, have potential transboundary and global implications related to all aspects of sustainable development. Accordingly, C2G's outreach focused on trusted actors at global, regional as well as national levels supporting sustainable development efforts who could connect and integrate the transboundary and global CDR and SRM governance issues with local, regional, and global concerns and opportunities. This included regions of the world that might share similar economic and political interests, for example, the African Union, the European Union or the Small Island Developing nations.

C2G conducted extensive regional outreach, including through the UN regional commissions (the UN Economic and Social Commission for Asia and the Pacific - ESCAP, the UN Economic Commission for Africa – ECA, and the UN Economic Commission for Latin America and the Caribbean - ECLAC).

The Latin America and Caribbean region and the European Union are two examples of where C2G catalysed significant governance developments on both CDR and SRM.

Latin America and the Caribbean

In its outreach to global policymakers, C2G engaged multiple times with UN regional commissions, as well as intergovernmental organisations (IGOs) and civil society organisations (CSOs) in Africa, Asia and the Pacific, Latin America and the Caribbean, and Europe, providing information and briefings, co-hosting meetings, and catalysing the commissions themselves to learn more about CDR and SRM governance.

C2G's catalytic work with UN commissions was most fruitful with the Economic Commission for Latin America and the Caribbean (ECLAC). Strong leadership from ECLAC's Executive Secretary and senior management were important drivers, as was the willingness of governments, some academics and CSOs in the region to explore the interlinkages between CDR and SRM with respect to the region's goals for sustainable development.

C2G invested significant time in building close working relationships with ECLAC partners at all levels, from the senior leadership to working level partners. Building on existing ties and forging new bonds of trust and cooperation rooted in science (for example, the IPCC and regional knowledge sources) were essential for ECLAC, other regional organisations, and member governments to collaborate among themselves and with C2G.

Over a five-year period, C2G provided or co-hosted multiple learning opportunities with ECLAC, other actors and globally recognised researchers from the region, including conferences, meetings, simulation exercises such as EN-ROADS[7], webinars, and reports about the potential risks, benefits, governance gaps and challenges of climate altering techniques. The work focused first on the role of CDR in IPCC pathways and national development planning (including in an ECLAC publication and a toolkit) and then built on that awareness to develop learning activities on the lack of governance around understanding the potential role - if any - of SRM in the context of overshooting the 1.5°C temperature goal.

One important example was the "Americas Conference on Solar Radiation Modification: Science, Governance and Implications for the Region" co-delivered by C2G in August 2022 with the Inter-American Institute for Global Change Research (IAI) and the Degrees Initiative and hosted by the government of Jamaica. The goal of the event was to foster learning and understanding about SRM (science, status, and governance), build bridges between science and policy makers, and start planting the seeds of a regional research agenda on SRM.

A presentation at the event on the development of a US research agenda on SRM, and a failed attempt at an outdoor experiment in Sweden, helped participants understand how important the region's ability to collaborate regionally on SRM research will be, and how vitally important it was to be part of international policy discussions.

The Latin America and Caribbean region experienced the lack of robust governance around SRM when, in late 2022, a US-based commercial start-up called "Make Sunsets" claimed to have injected sulphur particles into the stratosphere with the help of a weather balloon purchased online and launched from Mexico's Baja California. The Mexican government reacted by noting it will put in place a law that will prohibit such activities. This incident attracted international attention and quickly elevated the issue of SRM governance with governments in the LAC region, and indeed elsewhere. In the meantime, this same commercial start-up moved its activities to the USA and has continued to release balloons from different locations there.

7 EN-ROADS is a global climate simulator that allows users to explore the impact that dozens of policies—such as electrifying transport, pricing carbon, and improving agricultural practices—have on hundreds of factors like energy prices, temperature, air quality, and sea level rise. https://www.climateinteractive.org/en-roads/

The European Union

In 2018, C2G significantly accelerated its outreach to the European Union, holding an extensive series of meetings with relevant senior officials in the European Commission (EC) directorates (research, climate, and environment) and with EU Member States in capitals and their Missions in New York and Geneva. C2G established trusted working relationships with these officials and provided them with impartial, evidence-based information and briefings on the latest IPCC science and governance developments on climate-altering techniques.

Over the course of several years, this diplomatic outreach catalysed significant developments. In meetings with EU officials and representatives of its member governments, C2G addressed the need to: close CDR governance gaps to improve overall awareness of the critical role of CDR in reaching 1.5°C and its relation to emission reductions; understand the strength and weaknesses of different CDR techniques to enable societal choices that deliver speed and scale; improve monitoring, reporting and verification; strengthen safety and liability concerns; and address land-use and human rights concerns. C2G was invited to submit ideas and comments on CDR governance for the EU's Horizon Europe research programme, which included governance activities on CDR and later also SRM.

C2G's outreach to EU policymakers on SRM governance also proved both timely and effective. C2G was requested to provide a policy briefing note on managing the risks of overshoot and the governance of SRM to a senior EC official, which – as we heard later – was an important catalyst for the eventual inclusion of a paragraph on SRM governance in a June 2023 EC report, "A New Outlook on the Climate and Security Nexus".

In this report, the EC announced its support for international efforts to comprehensively assess the risks and uncertainties of SRM and "promote discussions on a potential international framework for its [SRM] governance". This was the first time the EC had publicly called for a global assessment and international governance discussions on SRM.

Earlier in 2023 the EC's directorate on climate (DG-Climat), which C2G had engaged with several times on both CDR and SRM governance, had also taken significant steps. A senior official is now dedicated to working on SRM governance issues. Activities have been started to look at a range of governance issues including research governance, modelling, exploring ethical considerations of SRM – all with a view to better understanding SRM while reaffirming the EU's position (in the June 2023 report) that SRM is not a solution to climate change and in its present state of development, represents an unacceptable risk.

Overall, based on comments made to C2G by senior policyholders and their advisors, C2G's impartial, evidence-based, diplomatic approach has borne fruit and catalysed significant governance developments on SRM in the European Commission.

18. Learning story: Working with the Executive Office of the UN Secretary-General

Strong leadership is vital for spurring action on climate change. The UN system's highest official, Secretary-General Antonio Guterres, has been very vocal – indeed, starkly so – about the urgent need to act to reduce emissions to net zero by mid-century and strengthen adaptation. His climate leadership follows that of the previous UN Secretary-General, Ban Ki-moon.

Early in its tenure, C2G reached out to key interlocutors, including the UN Deputy Secretary-General, the Special Adviser on Climate Action, and the Director for Sustainable Development, who invested their time and were receptive to learning more about the governance gaps around these climate-altering techniques, while being clear that traditional mitigation and adaptation remained the Secretary-General's top priorities. C2G provided information materials to his office about these techniques and their governance challenges. These contacts were instrumental to raising the visibility of CDR and SRM governance with the Secretary-General and his senior colleagues.

C2G remained in close contact with the Deputy Secretary-General and her staff throughout its work and exchanged views on how to address the governance gaps around CDR and SRM, the roles of different UN entities. C2G also continued to provide relevant information materials as needed.

19. Learning story: Working with the UN Environment Programme

One of C2G's priorities from the very beginning was to catalyse relevant UN entities and processes to engage on the governance of CDR and SRM. This was necessary due to the transboundary and global nature of the impacts of climate change, as well as of the responses, including the potential use – or non-use – of these emerging techniques. Moreover, many of the solutions to the lack of governance around these techniques had to be addressed through multilateral processes.

The team's collective experience with intergovernmental and non-state actor processes, as well as its prior, trusted relationships with many colleagues working on different aspects of the climate crisis, proved pivotal for opening doors to senior officials and representatives who otherwise may have been reluctant to engage on CDR and SRM governance issues given their controversial nature. Moreover, C2G's first-hand knowledge of which UN entities and processes to work through proved valuable for eliciting cooperation with not only the representatives of UN entities, but also with representatives of the national governments that comprise the UN's membership.

C2G's work with the UN Environment Programme (UNEP) and its governing body, the UN Environment Assembly (UNEA), and the CSO community around it, is a case in point. An important part of UNEP's mandated role is to bring to the attention of Member States the impact on the environment of new developments, which makes it a logical candidate for addressing the potential risks and benefits of CDR and SRM in the context of the climate crisis.

One of the first trips C2G made was to meet with the Executive Director and the senior management team of UNEP in its Nairobi headquarters. In the years that followed, C2G visited many senior officials in capitals who were responsible for their government's relationship to UNEP, and to UNEA. Over the course of seven years, C2G met many times with senior UNEP officials to brief them on discussions with Member State governments and to exchange information on a range of SRM and CDR governance issues.

Discussions by senior UN leaders on the governance of CDR and SRM, which were catalysed by inputs C2G had prepared for this purpose, eventually led UNEP to gather an independent expert group to undertake an initial assessment of the state of the science and governance needs for SRM. This included an assessment of SRM's potential risks and benefits if ever deployed. In essence, this was part of the request contained in a draft resolution considered at UNEA-4 and put forward by Switzerland and a group of countries, which C2G had catalysed and supported.

In February 2023, UNEP published the experts' assessment in the "One Atmosphere" report, which found the evidence base is not yet available to make informed decisions about the use or non-use of SRM as an additional measure in the context of overshoot. The report concluded that SRM's environmental and social impacts, as well as many scientific uncertainties and ethical issues still needed to be addressed. The experts called for a robust, equitable and rigorous trans-disciplinary scientific review process to reduce uncertainties associated with any potential use of SRM and to better inform decision-making that is transparent and inclusive and includes all potentially affected parties.

In the foreword to the report by the Executive Director of UNEP, a senior UN official for the first time affirmed publicly that "the international community must invest in understanding the potential risks and uncertainties of SRM technologies."

This statement, along with other important findings from the "One Atmosphere" report, reflect some of the key messages C2G has learned and shared with policymakers throughout its existence. These include urging relevant UN entities and national governments to recognise existing governance gaps, whether one supports or does not support SRM; and learning more about SRM including the potential risks and benefits of this technique in the context of a world that, according to the IPCC, is more likely than not to overshoot the 1.5°C temperature goal.

In September 2023, UNEP's Executive Director prepared a report for all UNEA Member States listing several issues to consider as part of UNEP's role in providing strategic foresight for the upcoming period. Further research into SRM was identified as one of these issues – a finding which, from C2G's perspective, was hard to imagine in 2017 when the Initiative started, but one that reflects how far the governance developments have come during C2G's brief tenure.

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20. Learning story: Catalysing governance at the fourth session of the UN Environment Assembly

The Fourth UN Environment Assembly (UNEA-4), held in 2019, marked one of C2G's most ambitious and consequential efforts to catalyse the governance of emerging climate-altering approaches, including large-scale carbon dioxide removal (CDR) and solar radiation modification (SRM), termed by some as "geoengineering." UNEA is the world's highest decision-making body on the environment; has universal membership; and is the governing body of the UN Environment Programme (UNEP).

From the earliest days of its work, C2G had UNEA in its sights as part of its mission to put the issue of "geoengineering" governance on the agenda of relevant intergovernmental bodies. Its catalytic work toward this aim was several years in the making and focused initially on some two dozen governments as well as Missions to UNEP in Nairobi, in particular those countries that chaired political or regional groups.

C2G also engaged with several civil society organisations (CSOs) linked to UNEA as well as regional intergovernmental and non-governmental organisations, providing them briefings and opportunities to learn about large-scale CDR and SRM and why addressing gaps in multilateral governance was crucial for minimising their potential risks and maximising benefits, including in relation to the Sustainable Development Goals. C2G also engaged with the President of UNEA as well as the other members of the UNEA bureau. Most importantly, C2G reached out and worked closely with UNEP's Executive Director (who later left and was succeeded by interim leadership) to ensure that UNEP was briefed on these issues; aware of C2G's mission; and prepared to support and collaborate with C2G.

Key steps in C2G's outreach included a formal briefing of the Committee of Permanent Representatives to UNEP as well as a workshop for UNEA observers in Nairobi, which was supported by and in collaboration with UNEP. At least some twenty-plus government, CSO, and academic participants joined to learn about and discuss the gaps in governance of these emerging techniques that could alter the climate. Discussions were stimulated by short presentations from international experts and commentary provided by leading voices from international organisations, academia, research and civil-society groups. During the workshop, participants also engaged in an interactive game that explored the challenges of balancing development needs with managing

climate risk and the role of effective governance in doing so.

C2G also prepared a number of materials, which were posted on the UNEA-4 platform, that provided interested UNEA participants with impartial, reputable information on the governance of "geoengineering" and the many issues it raises from environmental, sustainable development, geopolitical and ethical perspectives.

Early on in 2018, Switzerland's Ambassador for Climate Change and the Environment, recognised the importance of these issues following a presentation by C2G. He showed keen interest in putting forth a potential UNEA resolution on the governance of geoengineering. With continued support from C2G, Switzerland then engaged other governments on these issues seeking to catalyse their interest in developing and submitting the first-ever UNEA resolution related to international governance of geoengineering.

Switzerland, backed by a dozen other countries from several regions, eventually did submit a draft resolution, which was intensely negotiated but withdrawn shortly before the end of UNEA-4 due to lack of consensus. Unfamiliarity with the topic among negotiators, challenges around terms and the definition of what was meant by "geoengineering," as well as broader climate and geopolitical issues, combined with a lack of time for diplomatic solutions, stood in the way of consensus.

From C2G's perspective, the adoption of a resolution calling for a global assessment of climate-altering approaches would have been a very helpful contribution to the overall goal of advancing international governance of CDR and SRM. That said, C2G's mission was to bring these issues to the attention of governments and other actors so they could take them forward. In that perspective, catalysing some countries to table a draft resolution at UNEA-4, an intergovernmental body, was a success.

As part of its catalytic work, C2G provided impartial learning materials; and opportunities for participants to exchange views and learn about the issues. These activities sparked substantive intra- and inter-governmental discussions before and during the UNEA-4 session. Moreover, even though the draft resolution was not adopted at UNEA-4, discussions on these issues have continued. Some governments indicated they were considering a new UNEA resolution in the future.

Several key lessons resulted from this experience:

First, C2G saw how divisive and confusing the term "geoengineering" was, and consequently dropped it from its title and materials. Importantly, it explained publicly why it did so, and received positive feedback from key interlocutors as a result.

Second, C2G decided to keep its work on CDR and SRM separate while clarifying how they relate, given the two approaches are very different in nature and their specific purposes and have different governance characteristics.

Third, C2G had assumed that its catalytic approach would require that, at some point it would need to step back from active diplomatic outreach. The UNEA-4 experience showed that C2G needed to step back earlier than planned, as staying on too long risked undermining the impartiality, crucial for C2G's overall credibility and trustworthiness by all actors.

International discussions on CDR and SRM governance progressed after 2019, particularly on the former. UNEA-5 did not take up CDR or SRM governance, as its focus was on starting an international negotiation on a plastics treaty. Discussions between some governments are currently continuing on whether and how the issue of SRM governance could come up at UNEA-6 or later, when C2G will no longer exist. But there can be no doubting C2G's catalytic impact at UNEA-4, and the outcomes and learning that resulted from this experience.

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21. Learning story: The Global Commission on Governing Risks from Climate Overshoot

On 9-10 June 2022, the Global Commission on Governing Risks from Climate Overshoot, an independent group of leaders from around the world, held its first meeting to discuss ways the world could reduce climate risks - including through the potential use of solar radiation modification (SRM) - should humanity overshoot the Paris temperature goals. C2G was one of a number of external speakers invited to present different perspectives to the Commission's first meeting.

C2G did not serve on the Commission. However, in several important ways, it was a catalyst for the Commission's existence given C2G's core message that governance is broader than just government rules, but a process through which many actors learn, discuss, and engage on climate altering techniques, regardless of their views on the advisability of their potential use or non-use. Their engagement can trigger other actors to participate in the governance process.

The origins of the Commission stem from multiple conversations that key figures inside the SRM governance space had held over the past few years, including some at C2G-hosted events. C2G interacted a number of times with proponents of such a commission. C2G's Executive Director was a member of the steering committee set up by the Paris Peace Forum, to provide advice on whether or not, and if yes, how to set up such a commission. C2G's involvement ended with the dissolution of the steering committee.

The Commission's report was released in September 2023. As to be expected there were supporters as well as critics of its final recommendations. From C2G's perspective, the report was welcome, as it provided inputs to the discussion of temperature overshoot and humanity's responses to it, including suggesting ways to explore whether or not SRM has a role in that response.

Given its impartial stance, C2G did not offer specific views on the content of this report. However, the report was broadly consistent with the key findings C2G developed over the years, based on what it has heard during conversations and dialogues with representatives of governments, intergovernmental organisations and non-state actors.

One example was the report's consideration of SRM as a potential (not inevitable), supplemental, but integrated, part of other climate responses (e.g., mitigation, carbon removal and adaptation) to an increasingly likely overshoot context. Support for this kind of governance approach was voiced by many C2G interlocutors and may help to ensure that both moral hazard and moral imperative concerns are addressed in a balanced manner.

Not surprisingly, the recommendation of the Commission that received the most attention was for a moratorium on SRM deployment.

C2G viewed the Commission as one additional example of the many global discussions on SRM and CDR governance that will continue to be needed as the likelihood of overshooting 1.5°C becomes more apparent and the risks emanating from the impacts of overshoot become more significant throughout the world.

In that sense, C2G viewed the creation of the Commission as one example of its catalytic impact on other actors, and a positive step contributing to SRM and CDR governance.

22. Learning story: Catalysing international philanthropy

Philanthropic interest in solar radiation modification (SRM) is well over ten years old, but in 2016 it remained a relatively new field for mainstream climate philanthropies. The VK Rasmussen Foundation (VKRF), a family foundation, had funded a small number of civil society organisations (CSOs) and academics to work on the governance of large-scale carbon dioxide removal (CDR) and SRM before it became C2G's first and only funder for the first two years of C2G's work.

In the second year of its support for C2G, VKRF spoke with numerous climate change philanthropies seeking to find a co-funder for C2G, but unfortunately none came forward. SRM was seen as a highly controversial topic, and foundations remained very cautious about supporting it.

Things began to change as C2G demonstrated its impartiality and credibility in the first years of its existence. In 2018, two other private philanthropies, the Children's Investment Fund Foundation (CIFF) and the Oak Foundation, joined VKRF in providing support to C2G.

In 2019, VKRF decided to renew its investment with C2G by providing financial support for an additional two years. This anchor funding, plus C2G's track record to date in engaging with a wide range of governments, intergovernmental actors, and other stakeholders, began to convince other larger foundations to join VKRF in supporting the initiative.

Building on VKRF's initial outreach to other philanthropies, C2G redoubled and focused its efforts in 2019 on securing full funding for its final years of operations. In this, it was successful, bringing in support from the Open Society and strong, multi-year support from the IKEA Foundation, and later, from the MacArthur Foundation. With these funds, C2G was able to co-organise and fund several activities with Global South partners.

Four factors were critical for engaging the support of major philanthropic actors:

- First, was C2G's ability to remain impartial – and to be acknowledged as such by nearly all the actors it worked with - on an otherwise highly contested issue;
- Second, was the UN experience and credentials of members of the C2G team;
- Third, C2G was able to help foundations understand the linkages between SRM and other issues/

goals they support, in particular the Sustainable Development Goals, including geopolitical and peace and security concerns;

- Fourth, C2G listened to and answered questions from potential funders, building a trusted relationship, long before presenting them with any proposal.

These four factors, taken in combination, proved essential for C2G's eventual success in not only funding its multi-year budget in entirety through 2023, but also for bringing in four new philanthropic actors to publicly support C2G's work toward SRM governance – something that had never happened before.

Attracting support for SRM governance from large, mainstream climate funders is something that many, including C2G's original funder, thought extremely unlikely. However, in the end, the four factors cited above proved powerful enough to sway key potential funders.

It is a marker of C2G's success as a catalyst that governance of SRM is now a topic that numerous international philanthropies, as well as scores of governments, CSOs, think tanks and other actors have engaged in, and want to engage with further, whether publicly or privately.

23. Learning story: Catalysing young people

A growing number of young people around the world are increasingly urging their societies and leaders to take more ambitious action on climate change, insisting that their voices and views today shape the world they will inherit tomorrow.

At present, however, they are largely absent from international discussions on how to manage the increasing risks of overshooting 1.5°C of warming; on preparing for eventual decisions on the role - if any - solar radiation modification (SRM) may or may not play in the future; and on the consequences those decisions - either way - will have on their lives.

C2G's Youth Climate Voices initiative was created to help change this situation, so that intergenerational equity and climate justice issues might be better addressed in deliberations about SRM.

In 2022, after engaging with young people in its Advisory Group, briefing to youth groups and in several C2G events and online activities, C2G launched a catalytic youth project on SRM governance.

The Youth Climate Voices project supported young people in building their understanding of the latest science and diverse perspectives on SRM. It also enabled participants to share awareness and information with their peers about an emerging technology in an impartial manner and facilitated discussions of diverse views.

Six young climate change activists from Bangladesh, Brazil, France, India, Rwanda and Uganda, ages 19-24, were selected by C2G in a global competition. They were provided with the opportunity for in-depth learning about the science, governance, and the range of perspectives on SRM from some of the world's leading experts and activists.

C2G encouraged these young people to develop their own perspectives about SRM, and provided resources so they could enhance their skills, and create and disseminate their own educational and communication tools to their peer climate networks. C2G also facilitated introductions and invitations so these young climate leaders could participate in early-stage discussions on SRM being held by scientists, think tanks, the UN, policymakers and CSOs.

After six months of intensive learning activities, the six young leaders shared their knowledge and participated in international discussions, which included presenting a science policy brief at the Multi-Stakeholder Forum on Science, Technology and Innovation (STI) Forum for the SDGs at the UN; at a side event on SRM and Youth Perspectives on its Governance during the UN Economic Commission for Europe's Regional Forum of Sustainable Development; and joining a research team in Australia exploring the use of marine cloud brightening and its governance challenges. Fostering collaboration was a key characteristic of the project. Together, the participants created an animated video, social media content, and a cartoon graphic book on SRM governance, as well as an online platform, all of which were designed to appeal to their own age group.

C2G's initiative has catalysed the commitment of several of these young climate leaders to further their learning and that of their peer networks by dedicating themselves to SRM governance work after C2G closes.

To that end, three of the young female leaders from the global south formed their own civil society initiative, 'SRM Youth Watch', which they launched during New York Climate Week in September 2023. They also organised an event that included presentations from global climate youth activists sharing their concerns about SRM, and briefings from young women working on SRM as scientists, academics, or civil society leaders.

As they say on the SRM Youth Watch website, "it is crucial that more young people are knowledgeable on the topic to both participate in discussions and be empowered to make decisions in the near future."

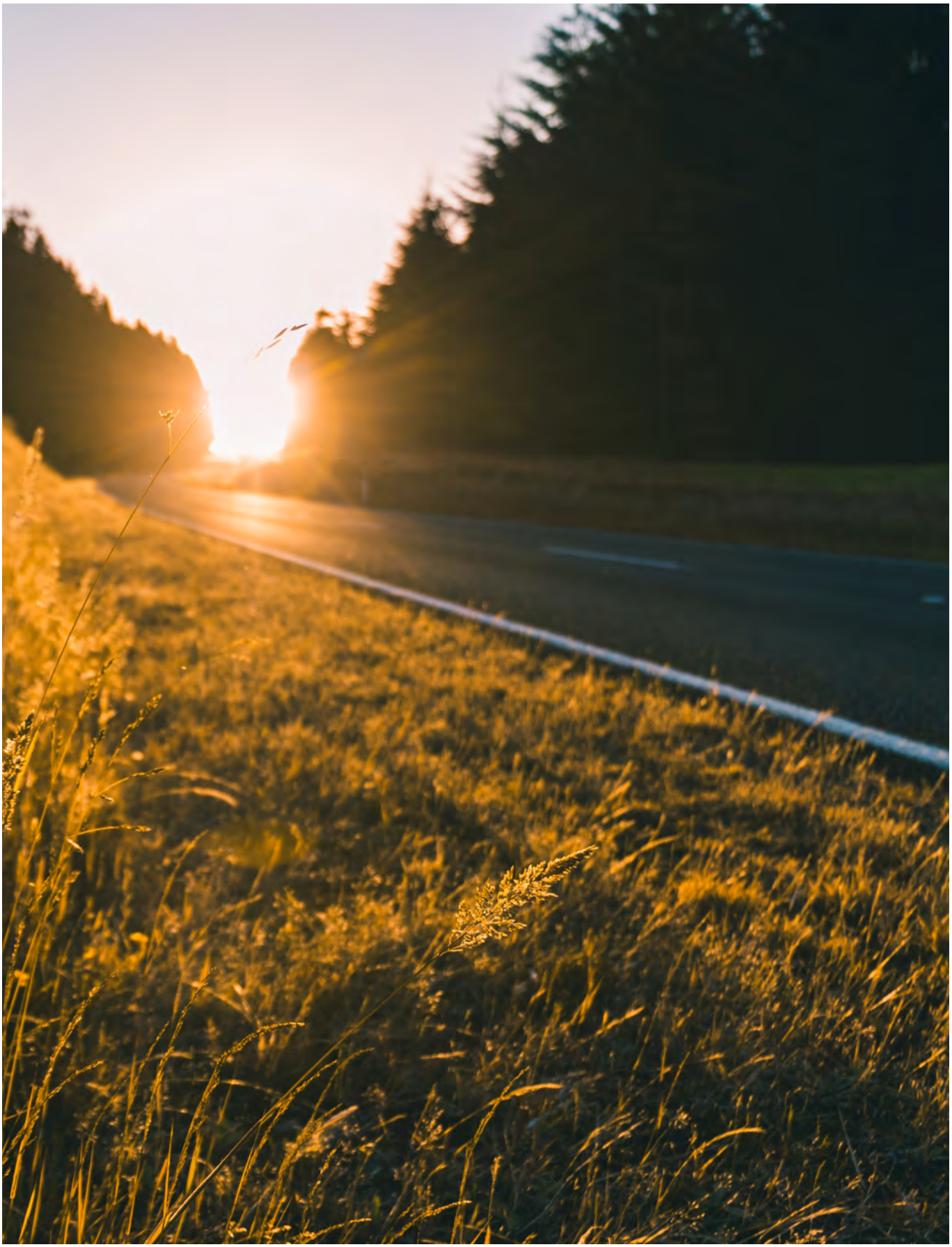
24. What next?

Firstly, we need transformative greenhouse gas emissions reductions as deep and fast as possible. The scale and speed of implementation will drive the amount of carbon that will have to be removed from the atmosphere; define the likelihood, scale, and duration of overshooting 1.5°C; and consequently, the extent of our future adaptation needs, and the context in which consideration of potential temporary emergency measures such as SRM might take place.

Secondly, while some progress has been made in addressing some governance gaps around CDR, much remains to be done. Domestic, as well as international institutions are, however, largely in place to address these issues, and there is also active engagement from the private sector, academia and civil society. Progress may have been slow, but with the mid-century, net-zero targets of countries approaching, step-by-step, the issues will have to be, and surely will be addressed.

Thirdly, on the governance of SRM, and in particular for SAI, the situation is different. The increasingly likely temperature overshoot and the risks posed by the lack of governance, coupled with considerable efforts by C2G – and increasingly many other actors – to bring these issues to policymakers as well as to representatives of non-state actors, awareness of the issues, and a range of possible options ahead is now there. It is now up to governments and civil society organisations to take on their respective governance responsibilities related to SRM, including deciding whether or not they wish to learn more about or even eventually consider making use of SRM, or not. Discussions, consultations and in some cases negotiations, could enable decisions to be taken about which institutions and processes they wish to address which aspects of governance, when, and how.

And finally, with its mission to bring these issues to the attention of governments and non-state actors now complete, the C2G initiative has reached its conclusion. It is now up to other non-state actors and of course to governments to advocate how to move forward.



C2G Carnegie Climate Governance Initiative

An initiative of CARNEGIE COUNCIL for Ethics in International Affairs