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CLIMATE GEOENGINEERING TECHNOLOGIES

Corruption and integrity gaps

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Policy position

Climate geoengineering technologies

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This brief was prepared by Transparency International's Climate Governance Integrity Programme as a part of a policy brief series on issues of climate governance integrity.

ISBN: 978-3-96076-211-9

Supported by:

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

based on a decision of the German Bundestag

INTRODUCTION

The Intergovernmental Panel on Climate Change (IPCC)[1] has noted that global efforts to lower human-caused greenhouse gas emissions are falling short of achieving the objective of the UN Framework Convention on Climate Change (UNFCCC) and the goals of its Paris Agreement, in particular the temperature increase limits of 1.5 to 2 degrees celsius.[2] This is prompting a renewed search for new climate-related technologies.

In most cases, such technologies are seen as environmentally sound technologies.[3] In some instances, the concept of climate-related technologies has been extended to geoengineering technologies.[4] These are "a broad set of methods and technologies that aim to deliberately alter the climate system in order to alleviate the impacts of climate change"[5] through "solar radiation management" (SRM)[6] technologies to reflect sunlight back into space or remove carbon dioxide from the atmosphere through "carbon dioxide removal" (CDR).[7]

To have a measurable impact on climate change, geoengineering proponents generally suggest that these technologies should be deployed on a large scale.

CAN GEOENGINEERING TECHNOLOGIES ADDRESS CLIMATE CHANGE EFFECTIVELY?

The IPCC's assessed emission reduction pathways to limit global warming to 1.5 degrees celsius with limited or no overshoot "project the use of carbon dioxide removal (CDR) on the order of 100–1000 $GtCO_2$ over the 21st century." They do not, however, include SRM, within the IPCC noting that "although some SRM measures may be theoretically effective in reducing an overshoot, they face large uncertainties and knowledge gaps."[8]

Among CDR technologies, bioenergy with carbon capture and storage[9] and direct air carbon capture and storage[10] are the most cited in the literature. For SRM, marine cloud brightening[11] and stratospheric aerosol injection[12] are usually seen as the two most important technologies. Geoengineering proponents suggest that CDR and SRM technologies can be solutions to climate change, including as a "last resort."[13]

However, if deployed at large-scale, CDR and SRM technologies are likely to come with "far-reaching and profound social, political, and environmental risks and impacts. The effects would – by nature of the intervention – be transboundary as well as potentially large-scale, unpredictable and irreversible."[14] For example, according to the IPCC, "[m]ost current and potential CDR measures could have significant impacts on land, energy, water or nutrients if deployed at large scale …. Afforestation and bioenergy may compete with other land uses and may have significant impacts on agricultural and food systems, biodiversity, and other ecosystem functions and services."[15]

Furthermore, geoengineering could have significant levels of uncertainty and risk with respect to its impact on the global climate system, natural ecosystems, weather patterns, biodiversity, economic sustainability and other considerations such as human rights. These possible risks and impacts carry significant uncertainties and have governance and ethical implications. Regulatory or governance regimes would be needed to assess such impacts and risks, identify uncertainties, and put in place the required regulations to ensure transparency and address possible corruption risk avenues.[16]

For these reasons, geoengineering should not be seen as a substitute for action to rapidly reduce greenhouse gas emissions and adaptation to the adverse effects of climate change.

WHO OWNS WHAT? PATENTS, PROFITS, POWER FROM GEOENGINEERING

Geoengineering proponents see a great potential for profit from the CDR and SRM technologies that they own, control and profit from through the acquisition of patents. These technologies may be patented and deployed by a wealthy individual or private corporation. In addition to patent royalties from the use by others of patented CDR technology, for example, patent owners (particularly corporations) could potentially also profit from selling CO_2 removal or reduction units derived from CDR through carbon trading markets.

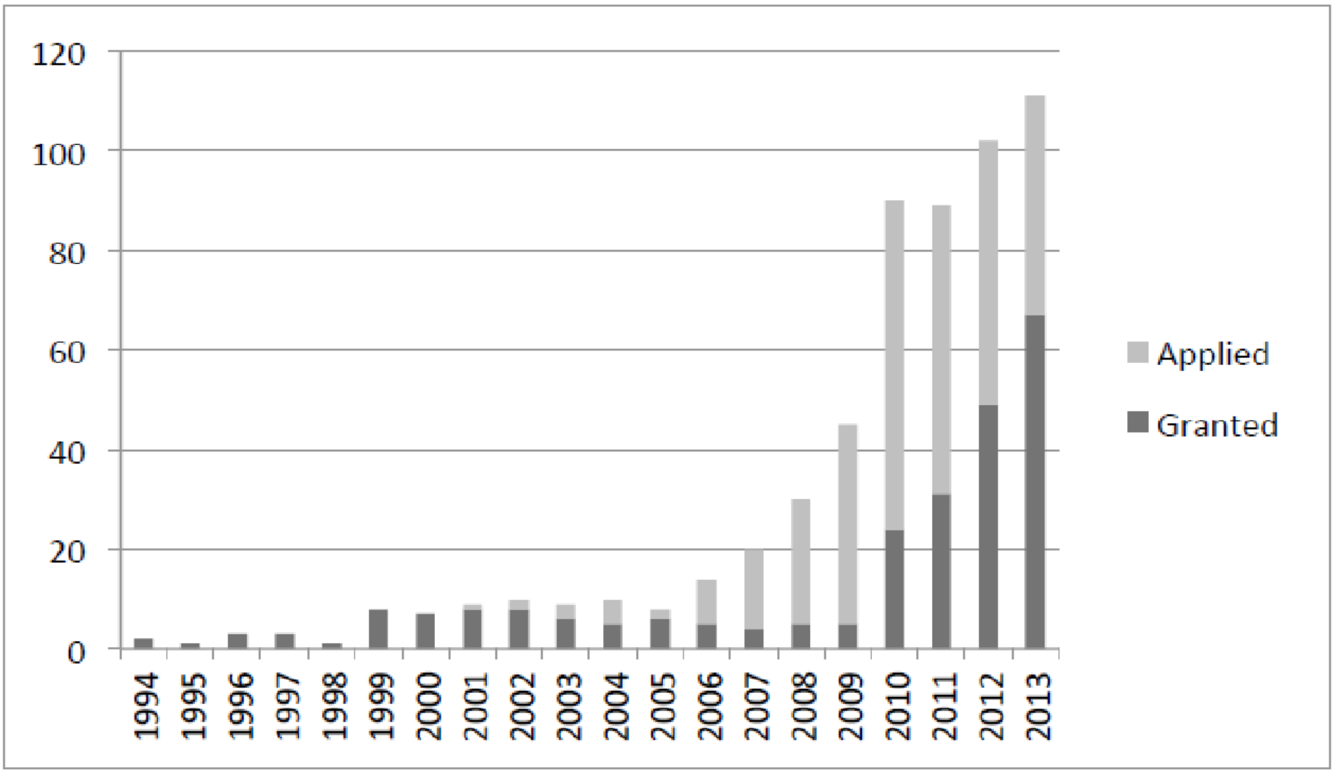
Research scientists, engineers and companies have already begun applying for and getting patents on geoengineering technologies.[17] In the United States, there was a significant increase in the number of geoengineering patent applications and issuances between the mid-1990s to the mid-2010s at the US Patents and Trademarks Office (USPTO), with both applications and issuances numbering cumulatively in the hundreds.[18] More than 90 per cent of the geoengineering patents approved by the USPTO during this period was for CDR technologies and methods, with only 6 per cent being SRM-related.[19] Most of the geoengineering patents are held (whether through direct corporate application or assignment from the original inventor or patent holder) by only a few corporate patent holders, including those in the renewable energy, manufacturing, oil and chemical industries.[20]

The surge in geoengineering patents could be seen as a "patent land-grab" with respect to so-called "building-block patents, which cover fundamental products and processes", and with seeking overly broad patents in order to concentrate control over such technology to only a few first-mover patent holders.[21]

Corruption risks exist in a situation where governments are placed in a position to grant rights or privileges, subject to certain eligibility conditions being met, to private individuals who may then obtain significant gains from the exercise of such rights or privileges. In the case of governments granting patents for geoengineering technologies, patents are subject to the fulfilment patent eligibility requirements.

To enhance patent eligibility, geoengineering technology inventors could try to conceal, suppress or misrepresent adverse information about the risks and impacts of such technologies while at the same time portraying such technologies as the solutions to climate change and its impacts, or try to establish "patent thickets" to block follow-on innovation or extract maximal royalties.[22] Such actions would undermine the patent system and negate any public

Figure 1: Geoengineering patent applications and issuances at the USPTO (1994-2013)



good rationale that may have been behind the patent grant in the first place.

Additionally, increased patenting of geoengineering technologies in the United States and in the European Union will exacerbate the inequalities that exist between these developed countries and the rest of the world with respect to the patent ownership of environment-related inventions and technologies (such as those on environmental management, water quality management and climate change mitigation) and over technological innovations in general. [23] [24] This would create patent and cost barriers to the rapid diffusion, uptake, adoption and adaptation of such inventions and technologies in the rest of the world.[25] Patent barriers could make it more difficult for developing countries to obtain the technologies they need to undertake effective climate action and ultimately develop their own endogenous environmental technologies.[26]

OPENING WINDOWS TO CORRUPTION RISKS

The UNFCCC, its two related legal instruments (the Kyoto Protocol and the Paris Agreement) and the plethora of decisions taken by States Parties through the Conference of the Parties since 1994 comprise the multilateral treaty regime with respect to international cooperation and national action to address climate change and its adverse effects. However, the UNFCCC and its Paris Agreement do not explicitly address geoengineering or contain specific commitments for Parties to undertake geoengineering or refrain from doing so. This has meant that the UNFCCC regime has not put in place any specific multilateral rules to regulate geoengineering activities that would require these to be subject to public accountability and oversight mechanisms to ensure that environmental and social risks are avoided.

The possible profits that may be obtained from patented carbon dioxide removal (CDR) and solar radiation management (SRM) technologies may push individuals and corporations supporting such technologies to try to manipulate governmental and intergovernmental decision-making and norm-setting in order to, for example, obtain funding or policy endorsements for the technologies they support.[27] This is a cause for concern given that potential large-scale research, development and deployment of CDR and SRM technologies could be pursued by governments through "a monopsony (or oligopsony) procurement structure" like in the national defence sector in which "the government and other public bodies make major operative decisions while commercial actors provide goods and services according to governmental specifications."[28]

The potential of getting millions or billions of dollars' worth of government-funded research, development and deployment contracts for CDR or SRM could create an almost irresistible temptation on the part of patent owners and manufacturers to lobby and seek to influence, including through corrupt means, governmental CDR/SRM regulation and policymaking and governmental procurement decisions.

Profit maximisation could come in the form of engaging in political and economic corruption and lobbying to win governmental contracts as well as in participation in regulatory norm-making in a manner that constitutes a conflict of interest.

Corruption risks are created or enhanced by the existence of climate change-related financial flows, the pressure for "fast-track" climate solutions, the level of complexity, uncertainty and novelty that surrounds many climate issues, and the many regulatory grey zones and loopholes in relation to climate action. Such is the case, for example, with respect to carbon markets and geoengineering.[29] There have been cases of corruption reported in adaptation and forestry projects.[30] Such corruption can weaken environmental regulations, favour projects that give greater possibilities for further corruption or enable industry lobbies to have undue influence on government decisions.[31]

Ensuring public accountability and oversight over geoengineering research, development, patenting and deployment is a key policy challenge at both the national and international levels.

In its landmark 2011 report on corruption and climate change,[32] Transparency International pointed out that climate-related corruption at the national level can include:

+ the misappropriation of funds
+ bribery in the awarding of contracts
+ nepotism
+ the distortion of scientific facts
+ the breach of principles of fair representation

+ false claims about the green credentials of consumer products.[33]

Furthermore, the potential profits to be gained from having technology, knowledge and innovation control in addition to the information asymmetry that arises between governments, the public and geoengineering technology owners also create the following national-level corruption risks:

+ The concentration of knowledge/power in a few individuals or corporations with respect to geoengineering technologies, creating potential conditions for corruptive lobbying or influence buying practices.
+ Patent and technology concentration in only a few individuals or corporate actors could make it easier to rig public procurement for such technologies to de facto favour such actors.

Internationally, corruption risks may arise in terms of lobbying and engagement by geoengineering proponents in multilateral rule development with respect to geoengineering in a manner that may constitute a conflict of interest.

However, a single set of internationally binding treaty rules to specifically govern or regulate geoengineering and the corruption risks that it poses currently does not exist.

There are some multilateral environmental regimes that may contain provisions which are relevant to regulating or restricting aspects of geoengineering. For example, international space law, such as the UN Outer Space Treaty, the UN Space Objects Liability Convention and the UN Space Object Registration Convention, could apply to sun-deflecting mirrors in space and the Long-Range Transboundary Air Pollution Treaty to SAI. Academics and researchers have also looked at the applicability of general norms of international environmental law and of international human rights law to geoengineering and its possible impacts on ecosystems and on human rights.

More specifically, the Convention on Biological Diversity has adopted a broad de facto moratorium on most geoengineering technologies while the London Convention/London Protocol has restricted marine geoengineering.[34]

This gap in terms of multilateral governance with respect to geoengineering has prompted some initiatives, such as the Carnegie Climate Governance Initiative,[35] the Solar Radiation Management Governance Initiative,[36] and an on-going initiative beginning in 2019 by Switzerland and a few other countries in the United Nations Environment Assembly for a resolution on geoengineering governance.[37]

A critical gap in terms of multilateral governance with respect to geoengineering is ensuring public accountability and oversight over geoengineering research, development, patenting and deployment.

As noted in a recent Transparency International policy brief, "Policy development has always been subjected to lobbying from private (sector) interests. Often this lobbying goes together with conflicts of interest, undue influence, elite capture, and corruption and continues to be a major challenge in systems of governance around the world."[38] This extends to engagement in multilateral and national climate change policy, where there currently are few and largely inconsistent rules in place that would limit conflicts of interest relating to the involvement of those with vested interests in promoting geoengineering in multilateral climate policy-making.[39] There is currently nothing in the multilateral climate regime comparable to the relatively robust conflicts of interest rules under the World Health Organization's Framework Convention on Tobacco Control.[40]

Under the Paris Agreement, private sector engagement in climate action is explicitly referred to with respect to mitigation under Article 6.4(b) and in the implementation of nationally determined contributions under Article 6.8(b). These references to private sector participation in Article 6 activities under the Paris Agreement are highly relevant to geoengineering.

Geoengineering proponents could open a discussion on geoengineering in the UNFCCC by highlighting that industrial carbon capture and storage (CCS) is already within the UNFCCC, Kyoto Protocol and Paris Agreement regime,[41] even if neither CDR nor SRM have been officially discussed as such in the UNFCCC regime. Some Parties, however, have referred to or included some CCS measures among the Nationally Determined Contributions (NDCs) that they have communicated under Article 4 of the Paris Agreement.[42] These measures could then be the subject of voluntary cooperation activities under Article 6 of the Paris Agreement.[43]

The enhanced transparency framework under the Paris Agreement is relevant to governments' engagement with the private sector in relation to industrial CCS or (potentially) other geoengineering-related activities. Developed countries are required to provide information on: their policies and regulations “to incentivize further private climate financing and investment”;[44] how they avoid double-counting private and public climate financing;[45] their efforts “to encourage private sector activities related to technology development and transfer and how such efforts support developing countries”;[46] and whether the technology development and transfer activities implemented or planned were undertaken by the private sector.[47] The rules for the implementation of Articles 6.2 and 6.4 were agreed at COP26 in Glasgow.[48] Developing country governments, however, are not subject to such finance and technology transfer reporting requirements[49] with respect to private sector involvement in their climate actions.[50]

The Paris Agreement’s reporting requirements do not call for governments to provide (or require the private sector to provide) any information regarding private sector lobbying and other advocacy and influencing efforts relating specifically to geoengineering at both the national and the international levels. Calling for such information to be provided as part of governments’ national reporting requirements under the Paris Agreement could make geoengineering initiatives more publicly transparent, making it easier to hold governments and geoengineering proponents publicly accountable. This could be complemented or supported at the national level by public accountability mechanisms such as public disclosure requirements for geoengineering investments, funding or initiatives, interest and asset disclosure requirements or public registration requirements.

Public awareness, participation and public access to information are key elements for ensuring public accountability with respect to climate change actions at international and national levels. Both the UNFCCC and Paris Agreement recognise this.[51] Under the Paris Agreement’s enhanced transparency framework, all Parties shall provide information on stakeholder engagement related to the implementation and achievement of their NDCs[52] and are encouraged to provide information about stakeholder involvement in adaptation activities.[53] However, these still fall short of providing for full public accountability at the international level and may thus need to be supplemented by national-level public transparency requirements with respect to geoengineering initiatives.

RECOMMENDATIONS

There is a governance and public accountability gap with respect to geoengineering technologies. The UNFCCC regime is constrained with respect to addressing issues of conflict of interest, transparency and public awareness of geoengineering activities, and providing possible avenues for the redress of grievances that may arise from harm or damage caused by geoengineering activities. The possible (transboundary) impacts of the large-scale deployment of geoengineering measures need multilateral rules as well as domestic policies to be proactively put in place. This would ensure public ownership, accountability, transparency and redress to regulate corporate geoengineering activities and provide for remedies for any harm that these may cause.

In this context, Transparency International recommends the following:

At the international level

+ Clear and explicit conflict of interest rules should be put in place at the UNFCCC to prevent geoengineering proponents from influencing and lobbying UNFCCC decision-makers.
+ Geoengineering activities with potential transboundary impacts should be first discussed and agreed to at the relevant intergovernmental forum, with the involvement of non-government and community stakeholders and subject to clear conflict of interest, lobbying and anti-corruption rules.
+ The reporting requirements under the Paris Agreement for Parties with respect to private sector involvement in the implementation of Nationally Determined Contribution (NDCs) through geoengineering activities should be more robust. This would include reporting on private sector activities such as financing and technology development and transfer as well as activities under Article 6 of the Paris Agreement. More information could be required on the sources and objectives of private sector financing or technology development and transfer; activities engaged in by the private sector with governments; policies or regulations being proposed or influenced; professional, financial, institutional or other interests linking the private sector with government policymakers; and private sector lobbying and influencing efforts relating to geoengineering at both national and international levels.
+ There should be public accountability remedies with respect to geoengineering activities. This could include the establishment of an independent grievance redress mechanism, with full and effective stakeholder participation, for all processes concerning activities (including CCS) under Article 6 of the Paris Agreement.[54] Accountability options under international human rights instruments could also be explored, such as the use of the UN Human Rights Council's special procedures.[55]

At the national level

+ Patent revocation, compulsory licensing, governmental march-in rights or other policy conditionalities should be imposed on geoengineering patent grants to remove the market dominance and profit incentive and protect the public interest.
+ Governments should require that proposals for the inclusion of geoengineering technologies or activities in their NDC be subject to compliance with explicit public access to information and public participation rules. These would include adherence to international environmental law principles that may be relevant and applicable to geoengineering, such as decisions adopted by the Parties to the Convention on Biological Diversity and the London Convention/London Protocol, as well as under international human rights law, other multilateral environmental agreements and other treaties that may be

relevant to the rights to information, participation and access to justice.

+ Free and prior informed consent by potentially affected communities is crucial as the basis for public acceptance. The consent should be a condition for official authorisation to proceed.
+ Public accountability remedies with respect to geoengineering is needed, including ensuring access to appropriate administrative and judicial remedies and full and effective stakeholder participation in its oversight.

ENDNOTES

[1] See for example Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press. Available at: www.ipcc.ch/report/ar6/wg1.

[2] UNFCCC, Article 2 of the Paris Agreement, Articles 2.1(a) and 4.1.

[3] UNEP, for example, defines ESTs as products that "protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products and handle residual wastes in an environmentally friendly manner. Examples include renewable energy technologies such as solar panels and wind turbines, as well as air pollution mitigation equipment." See for example UNEP, Trade in Environmentally Sound Technologies – the Perspective of Developing Countries. Available at: www.unep.org/explore-topics/green-economy/what-we-do/environment-and-trade-hub/our-work/trade-environmentally.

[4] See, for example, Geneva Environment Network, Update: Climate-Altering Technologies and Measures. Available at www.genevaenvironmentnetwork.org/resources/updates/climate-altering-technologies-and-measures.

[5] Geneva Environment Network

[6] SRM would include putting highly reflective aerosols into the stratosphere, increasing cloud reflectivity by seeding them with seawater droplets, or genetic modification of crops to increase their reflectivity. Through these, the amount of incoming sunlight would theoretically be reduced and thereby possibly resulting in a reduction in global average temperature.

[7] CDR would include include bioenergy with carbon capture and storage (BECCS), direct air carbon capture and storage (DACCS), ocean iron fertilisation, accelerated terrestrial or ocean mineral weathering, as well as land management to enhance natural sinks and reservoirs. The idea is to remove carbon dioxide directly from the atmosphere, thereby theoretically reducing the amount faster than would have happened with natural carbon cycles, and hence reducing the greenhouse effect and lowering global average temperatures over the long term.

[8] IPCC, Special Report on 1.5C: Summary for Policymakers (2018), paras. C.3 and C.1.4, www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf. See also the references to CDR and SRM in IPCC, Climate Change 2021: The Physical Science Basis (2021). Available at: www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report_smaller.pdf.

[9] Bioenergy with carbon capture and storage involves growing and harvesting or otherwise obtaining waste biomass (plant matter) to then be burned as feedstock in power plants, with the released CO2 being captured and then stored (sequestered) permanently in underground geological formations. There are, however, many limitations to this carbon dioxide removal technology. Furthermore, the CCS aspect of this technology remains largely at the demonstration stage, and there continues to be issues about the permanence of the carbon sequestration. See for example C2G, Evidence Brief: Carbon Dioxide Removal and its Governance (Carnegie Climate Governance Initiative, 2 March 2021). Available at: www.c2g2.net/wp-content/uploads/CDR-Evidence-Brief.pdf.

[10] Direct air carbon capture and storage (DACCS) technologies seek to suck in and capture CO2 directly from the atmosphere with subsequent permanent sequestration of the captured CO2. Currently, DACCS technologies are in some small-scale or prototype pilot projects. Issues relating to DACCS technologies include their high energy and other resource requirements, their cost relative to the amount of CO2 that would be sequestered, the permanence of CO2 storage, their scalability and public acceptability. See for example C2G, Evidence Brief: Direct Air Carbon Capture and Storage (DACCS) (Carnegie Climate Governance Initiative, 23 August 2021), www.c2g2.net/wp-content/uploads/DACCS-Evidence-Brief.pdf

[11] Marine cloud brightening (MCB) would involve constantly seeding the skies above ocean surfaces, for example with sea salt spray, to encourage and enhance above-ocean cloud formation which would then reflect sunlight back into space. This technology has not been tested nor deployed on a large scale, and the infrastructure is not in place for its deployment. There are significant uncertainties on what the impact on the global climate system would be of a large scale MCB deployment, concerns about MCB deployment control, ownership, and liability and accountability for any harm caused, as well as increasing geopolitical tensions. Cessation of MCB deployment would stop the cooling effect, and cause "termination shock" as global temperatures suddenly rise again. See for example C2G, Evidence Brief: Governing Solar Radiation Modification (Carnegie Climate Governance Initiative, 21 January 2020), www.c2g2.net/wp-content/uploads/c2g_evidencebrief_SRM.pdf

[12] Id. Stratospheric aerosol injection (SAI) envisions the continuous release of reflective aerosols – with sulphur dioxide being most frequently explored – from aircraft or other means into the stratosphere between 7 to 15 kilometers above sea level to cool the planet by reflecting sunlight back into space. SAI has to date been theoretical and confined to modelling studies and computer simulations, and the infrastructure and financing for large-scale deployment is lacking. Large-scale deployment could result in significant adverse climate and global ecosystem impacts, uncertainty over who will deploy and control SAI, as well as concerns over liability and accountability for any loss or damage caused by SAI deployment. Sudden cessation of SAI could also lead to "termination shock". It could also give rise to, or exacerbate, geopolitical tensions and security threats.

[13] See, for example, Geoengineering Global: https://geoengineering.global/; Fred Pearce, Geoengineering the Planet? More Scientists Now Say It Must Be an Option (Yale Environment 360, 29 May 2019): https://e360.yale.edu/features/geoengineer-the-planet-more-scientists-now-say-it-must-be-an-option; P Khanna and M Ferrari, Geoengineering Is the Only Solution to Our Climate Calamities (Wired.com, 20 September 2020): www.wired.com/story/geoengineering-is-the-only-solution-to-our-climate-calamities/; RS Aouf, Five geoengineering solutions proposed to fight climate change (Dezeen.com, 18 October 2018): www.dezeen.com/2018/10/18/five-geoengineering-solutions-climate-change-un-ipcc-technology

[14] Heinrich Boell Stiftung, Geoengineering, https://www.boell.de/en/geoengineering

[15] IPCC, Special Report on 1.5C: Summary for Policymakers (2018), para. C.3.4, www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf.

[16] See for example IPCC, Fifth Assessment Report: Synthesis Report (2018), p. 89, Box 3.3 - Carbon Dioxide Removal and Solar Radiation Management Geoengineering Technologies— Possible Roles, Options, Risks and Status, www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf#page=105

[17] DE Lai, Deployment of Geoengineering by the Private and Public Sector: Can the Risks of Geoengineering Ever Be Effectively Regulated? (12 January 2015), pp. 21-22, https://cdrlaw.org/wp-content/uploads/2020/04/fulltext_stamped.pdf

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[19] Id. See also P Oldham, B Szerszynski, J Stilgoe, C Brown, B Eacott, A Yuille, Mapping the landscape of climate engineering (372 Philosophical Transactions of the Royal Society A 20140065), https://royalsocietypublishing.org/doi/pdf/10.1098/rsta.2014.0065.

[20] Id. Examples of geoengineering patents that have been issued by the USPTO can be found in D Bronson, H Shand, J Thomas (eds.), Earth Grab: Geopiracy, the New Biomasters and Capturing Climate Genes (ETC Group, 2011), pp. 31-33, https://books.google.ch/books?id=iubBggHoHDYC&pg=PA30&lpg=PA30&dq=Geoengineering+patents&source=bl&ots=70JhTuYZM-&sig=ACfU3U3FiDceGtPLYjQQX5bhMW84vZUd0g&hl=en&sa=X&ved=2ahUKEwiewe-Op5_zAhV1hv0HHSMqAKg4HhDoAXoECAIQAw

[21] Id.

[22] S Rayner, C Redgwell, J Savulescu, N Pidgeon, T Kruger, Memorandum with regard to the role of the private sector in geoengineering (UK Parliament, 2007), https://publications.parliament.uk/pa/cm200910/cmselect/cmsctech/memo/geoengineer/ucm07a02.htm. See also M Rimmer, Geopiracy: Patent law, climate change, and geoengineering (Friends of the Earth-Australia Emerging Tech Project, 2 July 2014), http://emergingtech.foe.org.au/geopiracy-patent-law-climate-change-and-geoengineering/; D Cressey, Cancelled project spurs debate over geoengineering patents (485 Nature 429, 2012), https://doi.org/10.1038/485429a and www.nature.com/articles/485429a; S Parthasarathy: Geoengineering patents could follow the U.S. atomic energy model (Ford School, University of Michigan, 23 May 2012), https://fordschool.umich.edu/news/2012/parthasarathy-geoengineering-patents-could-follow-us-atomic-energy-model; B Hardin, Compulsory Licensing of Climate Engineering Patents: How Embracing Technology- and Research-Sharing Strategies Brings Us One Step Closer to Solving Climate Change (73 Arkansas Law Review 611, 2020), https://scholarworks.uark.edu/cgi/viewcontent.cgi?article=1119&context=alr

[23] I Hascic, M Migotto, Measuring environmental innovation using patent data (OECD Environment Working Papers No. 89, 2015), Tables 4 and 5, pp. 27-28, www.oecd-ilibrary.org/docserver/5js009kf48xw-en.pdf?expires=1634211518&id=id&accname=guest&checksum=EDC08AEF7DF26C9E4CC03A9853655728.

[24] See H Bucher, J Drake-Brockman, A Kasterine, M Sugathan, Trade in Environmental Goods and Services: Opportunities and Challenges (International Trade Centre Technical Paper, 2014), Figure 3, www.intracen.org/uploadedFiles/intracenorg/Content/Publications/AssetPDF/EGS%20Ecosystems%20Brief%20040914%20-%20low%20res.pdf

[25] Examples of patents serving as barriers to technology transfer to developing countries can be found in, for example S Shashikant and M Khor, Intellectual Property and Technology Transfer Issues in the Context of Climate Change (Third World Network, 2010), www.twn.my/title2/IPR/pdf/ipr14.pdf.

[26] See, for example, M Khor, Climate Change, Technology and Intellectual Property Rights: Context and Recent Negotiations (South Centre Research Paper No. 45, April 2012): www.econstor.eu/bitstream/10419/232163/1/south-centre-rp-045.pdf.

[27] See, for example, CIEL, Fuel to the Fire: How Geoengineering Threatens to Entrench Fossil Fuels and Accelerate the Climate Crisis (2019): www.ciel.org/wp-content/uploads/2019/02/CIEL_FUEL-TO-THE-FIRE_How-Geoengineering-Threatens-to-Entrench-Fossil-Fuels-and-Accelerate-the-Climate-Crisis_February-2019.pdf.

[28] J Reynolds, J Contreras, J Sarnoff, Intellectual Property Policies for Solar Engineering (SJ Quinney College of Law, University of Utah, 9:2 (e512) WIREs Climate Change, 2 February 2018), https://doi.org/10.1002/wcc.512 and https://dc.law.utah.edu/cgi/viewcontent.cgi?article=1085&context=scholarship. See also Pilita Clark, Carbon capture: Miracle machine or white elephant? (The Financial Times, 9 September 2015), www.ft.com/content/88c187b4-5619-11e5-a28b-50226830d644

[29] Id.

[30] See, for example, A Thorpe and L Ogle, Staying on Track: Tackling Corruption Risks in Climate Change (UNDP, 2010), www.undp.org/content/dam/aplaws/publication/en/publications/democratic-governance/dg-publications-for-website/staying-on-track--tackling-corruption-risks-in-climate-change/Staying_on_Track_corruption_risk_in_CC.pdf. Another study cites examples of corruption in relation to climate change projects. See M Nest, S Mullard, and C Wathne, Corruption and climate finance: Implications for climate change interventions (U4 Anti-Corruption Resource Centre Brief 2020:14, 2020), www.u4.no/publications/corruption-and-climate-finance.pdf

[31] See M Guy, COP26: Is corruption on the agenda? (Basel Institute on Governance, 1 November 2021), https://baselgovernance.org/blog/cop26-corruption-agenda

[32] Transparency International, Global Corruption Report: Climate Change – A User's Guide (2011), www.transparency.org/files/content/publication/GCR_ClimateChange_UsersGuide_EN.pdf

[33] Transparency International, Global Corruption Report: Climate Change – A User's Guide (2011), www.transparency.org/files/content/publication/GCR_ClimateChange_UsersGuide_EN.pdf

[34] See Convention on Biological Diversity, decision X/33 (2010), paras. 8(w) and (x), www.cbd.int/decision/cop/?id=12299; and decision IX/6 (2008), para. C.4, www.cbd.int/decisions/cop/9/16.

[35] See C2G, www.c2g2.net/

[36] See SRMGI, www.srmgi.org/

[37] See for example S Stefanini, Switzerland puts geoengineering governance on UN environment agenda (Climate Home News, 26 February 2019), www.climatechangenews.com/2019/02/26/swiss-push-talk-geoengineering-goes-sci-fi-reality

[38] Transparency International, Closing the Gap on Conflicts of Interest and Undue Influence in Climate Policy: Putting a stop to corporate efforts to undermine climate action (forthcoming, October 2021).

[39] See id.; see also B Dambacher, M Stilwell, J McGee, Clearing the Air: Avoiding Conflicts of Interest Within the United Nations Framework Convention on Climate Change (32:1 Journal of Environmental Law 53-81, March 2020), https://academic.oup.com/jel/article-abstract/32/1/53/5511704?redirectedFrom=fulltext; Corporate Accountability, Primer: Conflicts of interest at the UNFCCC, www.corporateaccountability.org/resources/primer-conflicts-of-interest-at-the-unfccc/; UNFCCC, Background paper on conflict of interest and oath of service for constituted bodies under the Convention (14 September 2020), https://unfccc.int/sites/default/files/resource/BN10_SCF22_Oath%20of%20Service.pdf

[40] The Framework Convention on Tobacco Control (FCTC), Article 5.3, states that: "In setting and implementing their public health policies with respect to tobacco control, Parties shall act to protect these policies from commercial and other vested interests of the tobacco industry in accordance with national law." See FCTC, www.who.int/fctc/cop/doi/en.

[41] Industrial CCS in geological formations were recognised as activities that can be undertaken under the Kyoto Protocol's Clean Development Mechanism (CDM). See UNFCCC, decision 10/CMP.7 (2011), https://unfccc.int/resource/docs/2011/cmp7/eng/10a02.pdf#page=13. Industrial CCS projects are also eligible for funding under the Green Climate Fund (GCF), as clearly indicated in paragraph 35 of its Governing Instrument, see GCF, Governing Instrument, www.greenclimate.fund/sites/default/files/document/governing-instrument.pdf.

[42] These include Algeria, Australia, Bahrain, Bolivia, Canada, China, Egypt, Lesotho, Malawi, Mongolia, Norway, Saudi Arabia, South Africa, United Arab Emirates, United Kingdom and the United States.

[43] The mitigation outcomes could be internationally transferred under Article 6.2 PA, or be covered by the Article 6.4 PA mechanism, or be the subject of non-market approaches under Article 6.8 PA.

[44] UNFCCC, decision 18/CMA.1, Annex, para. 119(c), https://unfccc.int/sites/default/files/resource/cma2018_3_add2_new_advance.pdf

[45] Id., paras. 121(m)(ii) and (iii), (n) and (o).

[46] Id., paras. 126(d).

[47] Id., para. 127(h).

[48] See UNFCCC, Guiddance on cooperative approaches referred to in Article 6, paragraph 2, of the Paris Agreement, decision 12a/CMA.3, https://unfccc.int/sites/default/files/resource/cma3_auv_12a_PA_6.2.pdf; and UNFCCC, Rules, modalities and procedures for the mechanism established by Article 6, paragraph 4, of the Paris Agreement, decision 12b/CMA.2, https://unfccc.int/sites/default/files/resource/cma3_auv_12b_PA_6.4.pdf

[49] This is because developing countries do not have mandatory obligations under the UNFCCC and its Paris Agreement to provide climate finance and technology to other developing countries. These obligations are only for developed countries. See UNFCCC, Articles 4.3, 4.4, 4.5 and 4.7; Paris Agreement, Article 9.1.

[50] UNFCCC, decision 18/CMA.1, Annex, para. 118, https://unfccc.int/sites/default/files/resource/cma2018_3_add2_new_advance.pdf

[51] See UNFCCC, Article 6 and Paris Agreement, Article 12.

[52] UNFCCC, decision 18/CMA.1, Annex, para. 62, https://unfccc.int/sites/default/files/resource/cma2018_3_add2_new_advance.pdf

[53] Id., paras. 109(h) and 114(a).

[54] Transparency International, Corruption Blindspots in International Cooperation on Climate Action: Building Governance and Accountability to Deliver Article 6 of the Paris Agreement (3 November 2021), www.transparency.org/en/publications/corruption-blindspots-climate-action-paris-agreement

[55] See UN Office of the High Commissioner for Human Rights, Special Procedures of the Human Rights Council, www.ohchr.org/EN/HRBodies/SP/Pages/Welcomepage.aspx

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