

## Advisory Committee of the Human Rights Council

### Questionnaire on the impact of new technologies for climate protection on the enjoyment of human rights <sup>1</sup>

*Please answer core questions as well as specific questions addressed to your category of a stakeholder (UN agency, state, NHRI, civil society, technical community and academia or private sector). The questionnaire is distributed to you in its entirety for the purpose of transparency. Please respond as concretely and concisely as possible, listing factors and giving relevant examples. Please note the definition of “new technologies for climate protection” NTCP in the footnote. There is no need to answer all questions if some are irrelevant to your work.*

#### Core questions (for all stakeholders)

1. Which new technologies for climate protection (NTCP) are of particular importance when it comes to impact on human rights? List three most relevant and explain your choice.
  - a) **All existing climate response options can potentially have impacts on human rights.** The latest assessment by the Intergovernmental Panel on Climate Change (IPCC) highlights that new or additional risks arise from some responses that are intended to reduce the risks of climate change including maladaptation and adverse side effects of some emission reduction and carbon dioxide removal measures<sup>2</sup>.
  - b) **New technologies for Climate Protection (NTCP) using an approach known as Solar Radiation Modification (SRM)<sup>i</sup> are of particular importance when it comes to impact on human rights for a number of reasons:**
    - **The potential for SRM to protect or harm human rights.** On the one hand, they have the potential to offset warming and ameliorate some climate hazards (reducing some risks to human rights from global warming), while on the other, if they were to be implemented, introduce a widespread range of new risks to people and ecosystems, which are not well understood<sup>3</sup> (including potentially introducing new risks to human rights from SRM deployment). Effective governance for SRM will therefore be crucial to protect and promote human rights when considering whether or not SRM should be further researched, developed or deployed.

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<sup>i</sup> Solar radiation modification (SRM) (also referred to as ‘Solar Radiation Management’ or ‘Solar Geoengineering’) refers to a range of radiation modification measures not related to greenhouse gas (GHG) mitigation that seek to limit global warming. Most methods involve reducing the amount of incoming solar radiation reaching the surface, but others also act on the longwave radiation budget by reducing optical thickness and cloud lifetime. Source: [IPCC \(2022\) WG III Annex-I Glossary](#)

Research will be required to explore additional governance that may be needed to protect and further human rights should global temperature increase overshoot the 1.5°C goal<sup>4</sup>, particularly in light of the uncertainties and knowledge gaps around SRM in relation to governance, ethics, and impacts on sustainable development<sup>5</sup>.

- **The current lack of effective international SRM governance.** According to the most recent IPCC assessment there is currently no dedicated, formal international SRM governance for research, development, demonstration, or deployment.<sup>6</sup>
  - **Investment and interest in SRM research is increasing.** New public funded SRM-related research is currently underway in the EU and US including for example, the EUR€9m European Union funded *GeoEngineering and Negative Emissions Pathways in Europe (GENIE)* project<sup>7</sup> and the USD\$9m National Oceanic and Atmospheric Administration (NOAA) *Earth's Radiation Budget* program<sup>8</sup> in the US. In 2021 a US National Academies of Science report<sup>9</sup> recommended the US government provide USD\$100-200m over five years for SRM research. SRM research has also previously been supported by public and private investment in Australia, Canada, China, Finland, the EU, France, Germany, Japan, Norway, India, Sweden, the UK, and the US.
  - **SRM is increasingly appearing on the agenda of intergovernmental processes.** For example, in 2019 a Swiss-led resolution<sup>10</sup> submitted to the United Nations Environment Assembly during its fourth meeting (UNEA-4) proposed the UN Environment Programme (UNEP) prepare an assessment including SRM and during 2021-22, the UNESCO World Commission on the Ethics of Scientific Knowledge and Technology is addressing ethical dimensions of SRM<sup>11</sup>.
  - **SRM is increasingly appearing on the radar of intelligence and strategic foresight assessments.** For example, in 2021 the US National Intelligence estimate<sup>12</sup> noted the risk of unilateral geoengineering increasing, and in 2022 the World Economic Forum's annual Global Risks report highlighted the potential geopolitical risks of ungoverned SRM<sup>13</sup>.
- c) **Stratospheric Aerosol Injection (SAI) and Marine Cloud Brightening (MCB) are arguably the most relevant SRM techniques for consideration around impacts on Human Rights as they are among the most prominent and advanced in terms of research and development<sup>ii</sup>.** For example, outdoor MCB experiments were

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<sup>ii</sup> Stratospheric Aerosol Injection (SAI) involves “*Injection of Reflective aerosol particles directly into the stratosphere or a gas which then converts to aerosols that reflect sunlight*” (also referred to as ‘Stratospheric Aerosols’ or ‘Stratospheric Aerosol Interventions’). Marine Cloud Brightening (MCB) involves “*Spraying sea salt or other particles in marine clouds, making them more reflective.*” Source: [IPCC \(2022\). Chapter 16. Table Cross-Working Group Box SRM.1](#)

conducted in 2020<sup>14</sup> as part of the Australian funded Reef Restoration Project<sup>15</sup>, and in 2021 SAI-related experiments planned as part of the Harvard University SCOPEX project<sup>16</sup> were halted by the Swedish Space Agency<sup>17</sup> following objections from Indigenous people and environmental groups<sup>18</sup>. Other SRM options that have been assessed include Ocean Albedo Change (OAC), Ground-Based Albedo Modifications (GBAM), and Cirrus Cloud Thinning (CCT), but these are less well researched.<sup>19</sup>

2. What kind of NTCP may contribute to human rights promotion and protection? Please, explain how.

**Solar Radiation Modification (SRM) techniques may contribute to promotion and protection of human rights, or they may result in the opposite.** According to the IPCC, SRM has the potential to offset warming and ameliorate some climate hazards but could also introduce a widespread range of new risks to people and ecosystems.<sup>20</sup> The former could promote or protect human rights that are at risk as a result of global warming such as disruption to livelihoods and food security<sup>21</sup>, while the latter could introduce new risks to human rights through uneven or intended impacts resulting from SRM consideration or deployment<sup>22</sup>. Recent publications have begun to explore how to assess the relative risks posed by consideration (or not) of SRM, including dimensions relevant for human rights<sup>23</sup>.

3. What are the key human rights challenges and risks arising from NTCP and from which in particular? Do NTCP create unique and unprecedented challenges or risks, or are there earlier precedents that help us understand the issue area?

**SRM presents a risk-risk conundrum due to its potential to both enhance or diminish human rights either through the potential to reduce risks from global warming and/or create novel risks of its own<sup>24</sup>. Moreover, the lack of a comprehensive international governance framework for SRM<sup>25</sup> means potential legal protections are, at best, incomplete.** The 2021 report on SRM by the US National Academy of Science<sup>26</sup> identifies several earlier precedents that may be informative, including:

- Treaty on Non-Proliferation of Nuclear Weapons
- Biological Weapons Convention
- Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine
- Health-related Research Involving Humans
- Human Embryonic Stem Cell Research

4. What specific human rights may be affected by the use of NTCP? Please, explain how. Who are the rights-holders that potentially would be the most affected by the use of NTCP? Are they also the most affected by climate change? How could they and the society at large be engaged in the decision-making process?

- a) **As many as 28 potential SRM-associated risks and concerns have been identified** relating to physical and biological systems, human impacts, aesthetics, governance, ethics and other ‘unknowns’<sup>27</sup> all of which present potential implications for human rights.
- b) **The recent IPCC assessment identified a range of potential impacts and highlighted the knowledge gaps, in particular into the risks from SRM.** Modelling studies have shown SRM has the potential to offset some effects of increasing greenhouse gases on global and regional climate, including the increase in frequency and intensity of extremes of temperature and precipitation, melting of Arctic sea ice and mountain glaciers, weakening of Atlantic meridional overturning circulation, changes in frequency and intensity of tropical cyclones, and decrease in soil moisture increase flood and drought risk. However, compared with climate hazards, many fewer studies have examined SRM risks. Some studies suggest it could have impacts on crop yields, health outcomes, and may introduce novel risks for international collaboration and peace. Few studies have assessed potential SRM impacts on ecosystems and there is a general lack of research on the wide scope of potential risk or risk reduction to human health, wellbeing and sustainable development from SRM and on their distribution across countries and vulnerable groups.<sup>28</sup>
- c) **There could be regional and national ‘winners and losers’ from SRM,** depending on the deployment scenarios. Due in part to limited research, there is low confidence in projected benefits or risks to crop yields, economies, human health, or ecosystems<sup>29</sup> and new risks may be introduced to people and ecosystems, which are not well understood.<sup>30</sup>
- d) **Intergenerational justice issues may be a consideration** given the disproportionate impacts that climate change – and potential response options such as SRM – could have on future generations. As is the case for adaptation, intergenerational approaches to future climate planning and policy will become increasingly important<sup>31</sup>.
- e) **Preventing SRM research may have human rights implications.** International campaigns by academics<sup>32</sup> campaigners<sup>33</sup> and non-governmental organisations<sup>34</sup> calling to prevent research into SRM may potentially threaten the freedom of

scientific research, grounded in international human rights instruments<sup>35</sup> such as the ‘right of everyone to enjoy the benefits of scientific progress and its applications’<sup>36</sup>. According to the recent IPCC assessment co-evolution of SRM governance and research provides a chance for responsibly developing SRM technologies with broader public participation and political legitimacy, guarding against potential risks and harms relevant across a full range of scenarios<sup>37</sup>.

f) **Those most affected by climate change or any proposed consideration around NTCP’s could be engaged in decision-making via:**

- **Societal appraisal** – Inclusive discussions with globally diverse audiences, including the voices and views of climate-vulnerable communities and drawing on multiple disciplines, could help to address the high level of complexity associated with any policy position on SRM. In addition, such discussions could improve understanding of varying levels of risk tolerance and build a greater common understanding of the evidence base. Policymakers may wish to consider whether and how to encourage and support such activities.<sup>38</sup>
- **Multilateral discussions**, such as within the UN, could raise awareness and broaden understanding of the potential role of SRM – if any – as part of climate response options. Global discussions, knowledge sharing and reviews of SRM by processes like the UN Environment Assembly as well as assessments of the latest science by the IPCC could be helpful. An initial consideration by the UN General Assembly could provide high level guidance to multilateral discussions and identify follow-up actions to enhance the understanding of the role – if any – SRM could play in addressing scenarios in which global temperatures exceeded (overshoot) agreed temperature goals or climate-induced global tipping points. Policymakers may wish to consider whether and how to advance consideration of these issues in relevant intergovernmental processes and fora both informally as well as formally.<sup>39</sup>

5. **Is the existing international and your national human rights framework adequate to safeguarding human rights of those affected by the use of NTCP? Why or why not? If not, what principles may be identified in order to address the gaps? List them according to priority.**

In brief, no. There is currently no dedicated, comprehensive, formal international SRM governance framework<sup>40</sup>, including one that might include human rights provisions. Recent analysis of governance gaps and challenges around SRM have identified a range of governance gaps which may be important for safeguarding human rights.<sup>41</sup>

6. Given that NTCP may present potential risks for the enjoyment of human rights, to what extent do human rights legal obligations require the States to pursue other climate protection policies presenting less risks of harm, including mitigation and adaptation measures?

Guidance prepared by the International Law Commission (and adopted in 2021 by the UN General Assembly in Resolution 76/112 ‘Protection of the Atmosphere’) specifies: “Activities aimed at intentional large-scale modification of the atmosphere should only be conducted with prudence and caution, and subject to any applicable rules of international law, including those relating to environmental impact assessment.”<sup>42</sup>

7. As opposed to focusing on selected few technologies, do you think a holistic and inclusive approach will help reduce any gaps in the existing system for addressing human rights challenges from NTCP?

a) **A broader holistic approach may be sufficient to address many of the human rights challenges posed by SRM**, similar to the approach taken in drafting the recent new guidance for international law (76/112 Protection of the Atmosphere): “Activities aimed at intentional large-scale modification of the atmosphere should only be conducted with prudence and caution, and subject to any applicable rules of international law, including those relating to environmental impact assessment.”<sup>43</sup>

b) **However, consideration will also need to be given to any specific challenges** which may arise as a result of the varying means and location of deployment of different SRM techniques (such as SAI or MCB), and the consequent impacts that may result.<sup>44</sup>

8. What should be the responsibilities of key stakeholders (UN agencies, states, NHRIs, civil society, technical community and academia, private sector) in mitigating the risks of NTCP to human rights and/or fostering its protection?

a) **Address knowledge gaps** – The recent IPCC assessment<sup>45</sup> notes that while SRM may potentially be able to offset warming and alleviate some climate hazards as a supplement to the main climate response options (i.e., mitigation and adaptation) their potential to reduce risks or introduce novel risks remains poorly understood. Policymakers may wish to consider whether and how to strengthen understanding and address knowledge gaps around SRM, to inform any potential considerations or decision making in the future while addressing issues related to moral hazard.

Strengthening transdisciplinary knowledge of SRM risks and impacts could help inform risk-risk analysis to compare the relative risks of deploying – or not deploying - SRM in future scenarios in which the world exceeds or overshoots the agreed temperature goals or significant global climate tipping points. Such comparative risk analysis may become increasingly important for policymakers. Such analysis could also provide important inputs for strengthening governance relating to SRM.<sup>46</sup> Stakeholders including intergovernmental entities, governments, academia and civil society can all contribute to expand the world’s knowledge of SRM.

- b) **Develop governance of research** – The recent IPCC assessment<sup>47</sup> highlights the growth, but current paucity, of SRM research and lack of formal international research governance, which are also contributing factors to, inter alia, the particular challenges concerning outdoor experiments where the distinction between research and deployment may be less clear. Policymakers may wish to consider how more formal, dedicated international governance around such research may be important and how it could be implemented in practice, including how to best address the issue of moral hazard. One potential approach highlighted in the report suggests to “legitimise any future research or policymaking through active and informed public and expert community engagement [...and] ensure that SRM is considered only as a part of a broader, mitigation-centred portfolio of responses to climate change.” Policymakers may also wish to address concerns that researching SRM could distract, delay or downplay the critical need for transformative emission reductions, removals and adaptation (moral hazard of doing research). They may also wish to weigh these concerns against the risks of not knowing whether, or not, SRM might be scientifically, societally, operationally, and politically viable as a possible additional climate response option (moral hazard of not doing research).<sup>48</sup> Stakeholders including intergovernmental entities, governments, academia, technical bodies and CSOs (including philanthropic funders of research) can all contribute to developing such governance.
- c) **Address governance gaps** – The recent IPCC assessment<sup>49</sup> highlights the current lack of dedicated, formal international SRM governance for research, development, demonstration, or deployment. It also assesses that “there is high agreement in the literature that for addressing climate change risks, SRM cannot be the main policy response to climate change and is, at best, a supplement to achieving sustained net zero or net negative CO<sub>2</sub> emission levels globally”. With no comprehensive international frameworks to provide space to exchange views on; to learn about the risks, benefits, and governance challenges of; and

eventually to enable decision-making about SRM, this leaves a governance vacuum that is itself a global risk. Policymakers may wish to consider:

- i. Whether, how and where to organize the needed inclusive, transparent, global discussions so that countries can together assess and then decide whether or not the risks and benefits of using SRM outweigh the risks and benefits of not using it;
- ii. Whether and how the world might minimize risks (both known and unknown) and maximize gains related to any potential use of SRM; and,
- iii. Whether and how to deal with the implications of including – or excluding – SRM from the list of potential responses to manage climate risks<sup>50</sup>.

Stakeholders including intergovernmental entities, governments and CSOs can all contribute to addressing these governance gaps.

- d) **Pursue societal appraisal** – Inclusive discussions with globally diverse audiences, including the voices and views of climate-vulnerable communities and drawing on multiple disciplines, could help to address the high level of complexity associated with any policy position on SRM. In addition, such discussions could improve understanding of varying levels of risk tolerance and build a greater common understanding of the evidence base. Policymakers may wish to consider whether and how to encourage and support such activities<sup>51</sup>. Stakeholders including intergovernmental entities, governments and CSOs can all contribute to expanding a societal dialogue and appraisal of SRM.
- e) **Encourage multilateral discussions**, such as within the UN, could raise awareness and broaden understanding of the potential role of SRM – if any – as part of climate response options. Global discussions, knowledge sharing and reviews of SRM by processes like the UN Environment Assembly as well as assessments of the latest science by the IPCC could be helpful. An initial consideration by the UN General Assembly could provide high level guidance to multilateral discussions and identify follow-up actions to enhance the understanding of the role – if any – SRM could play in addressing scenarios in which global temperatures exceeded (overshoot) agreed temperature goals or climate-induced global tipping points. Policymakers may wish to consider whether and how to advance consideration of these issues in relevant intergovernmental processes and fora both informally as well as formally<sup>52</sup>. Stakeholders including intergovernmental entities, governments and CSOs can all contribute to furthering multilateral discussions.

### **Specific questions for UN Agencies**



1. Please describe the relevant work that your organization/agency/body has done on the issue of NTCP and human rights. What have been the key challenges and accomplishments? What lessons were learned in the process? How and to what extent is the human rights approach included in the design and implementation of the policies undertaken by your organization in this area? How is human-rights impact analyzed and assessed?
2. Could your organization be involved (for instance, in supporting, financing or monitoring role) in the use of the NTCP in the future? If so, how would it contribute to the protection and promotion of human rights?
3. Are there or do you expect any opportunities for your organization to collaborate with other organizations on the issue of NTCP and human rights? What challenges do you anticipate?

### **Specific questions for States**

1. In your country, what are the main human rights challenges arising from the implementation of climate change national plans and policies? List and describe them briefly.
2. Is your country involved in or supports in any way the development, implementation or use of NTCP?
3. What measures, if any, (legislative, administrative, institutional, or other) have been put in place to regulate the use of NTCP? Have the human rights challenges arising from such activity been taken into account in their adoption?
4. In your country, which government agency has the initiative in the decision-making related to NTCP policies? If so, how much does the agency take the human rights issues into account in its agenda and decisions?

### **Specific questions for NHRIs**

1. Please describe the relevant work that your organization has done on the issue of NTCP and human rights. What have been the key challenges and accomplishments?
2. How may the use of NTCP impact the enjoyment of human rights in your country? Is there any group that may be disproportionately affected? How should the rights to access information, to participate in environmental decision-making and to access to remedy be applied in the context of NTCP-related research, experimentation, development and deployment?
3. What are the policy gaps in national policies? What national and international actions would be required to effectively address these challenges?

4. Has your country used or does it consider using NTCP? If so, how does your organization act or intend to act to protect and promote human rights? What methodology do you use or propose to analyze and assess the impact on human rights of NTCP?

### Specific questions for civil society organizations

1. Please describe the relevant work that your organization has done on the issue of NTCP and human rights. What are the key accomplishments? What challenges has your organization faced?
2. Should your organization be involved in the use of the NTCP (for instance, in a monitoring role) how would it contribute to the assessment of human rights impacts and ensuring its protection?
3. What will be the impact of NTCP on the enjoyment of human rights in the field that your organization covers? What are the main human rights challenges that these technologies pose? Is the international human rights framework well equipped to address them? What are the policy gaps in national policies? What actions at national and international level would be required in order to effectively address these challenges?
4. How should the rights to access information, to participate in environmental decision-making and to access to remedy be applied in the context of NTCP-related research, experimentation, development and deployment?
5. How do you evaluate citizens' awareness of the potential impact of NTCP on human rights? Does your organization have a roadmap to enhance public awareness of the issue?
6. What are the means to ensure meaningful public participation in the debate and decision-making process over the use and potential risks of NTCP, particularly of those most vulnerable or affected?

### Specific questions for the technical community and academic institutions

1. How would you differentiate between “new” and “old” technologies for climate protection?

Two useful dimensions to consider in differentiation between “old” and “new” NTCPs are the **maturity** and **scale of application**. For the former, methods such as Technology Readiness Level (TRL)<sup>53</sup> provide a useful technical framework for differentiating between “new” and “old” on the basis of maturity. For the latter, when existing (“old”) techniques are applied at larger (“new”) scales they might be referred to as “new”. An example of this can be found in Carbon Dioxide Removal (CDR). The concept of CDR (or “carbon removals”) has been present in the UN Framework Convention on Climate Change (UNFCCC) for three decades, and thus the techniques involved (e.g. afforestation and forest restoration) might be described as “old” NTCPs. However, implementing CDR at the large scales now assessed by the IPCC as necessary to limit global warming to 1.5–

2°C presents new challenges and risks and thus might also be described as a “new” NCTP.

2. Which NTCP do you find most important for the global efforts to combat climate change and why?

According to the recent IPCC assessment<sup>54</sup>, in addition to emissions reductions and adaptation, large-scale Carbon Dioxide Removal (CDR) will now be essential to avoid overshoot 1.5-2C and is thus currently the most important.

3. What will be the impact of NTCP on the enjoyment of human rights in the short-term and the long-term?

The impacts of overshooting 1.5°C global warming presents many potential challenges to the enjoyment of human rights in both the short- and long-term.<sup>55</sup> SRM, if it were to be implemented, has the potential to offset warming and ameliorate some climate hazards<sup>56</sup> (potentially enhancing enjoyment of the human rights threatened by the impacts of global warming) but also introduces a widespread range of new risks to people and ecosystems which are not well understood<sup>57</sup> and which may consequently introduce new threats to the enjoyment of human rights in both the short- and long-term. The bottom line is we currently do not yet know enough to reliably conclude whether or how SRM may result in a net benefit or harm to the enjoyment of human rights (compared to the impacts of global warming without it) given the large uncertainties and knowledge gaps associated with its potential to reduce climate change risks.<sup>58</sup>

4. How should the impact of the use of NTCP be assessed and attributed given scientific uncertainty? What is the role for the precautionary approach?

**The application of the precautionary approach may be too narrow to provide an optimal framework for decisions around SRM.** For example, if the precaution is against the risks from climate change impacts, then deployment of SRM technologies may be encouraged with less consideration for their side effects. If instead the precaution is against the risks of emerging technologies such as SRM, then deployment of SRM technologies would be discouraged while the benefits of climate risk reduction and the co-benefits of the technologies may be left out of the decision framework. SRM and climate change present a case of “duelling precautions” where selection of the target risk can switch the precautionary posture, while an “optimal precaution” approach would take into account the broader multi-risk effects. A broader risk-risk framework may therefore offer a more holistic optimal solution.<sup>59</sup>

5. Will the current international human rights framework and standards as well as national policies be effective in addressing human rights challenges from NTCP? If not, how can they be improved?

- a. **In short, no. There is currently no dedicated, comprehensive, formal international SRM governance framework<sup>60</sup>**, including one that might include human rights provisions. Recent analysis of governance gaps and challenges around SRM have identified a range of governance gaps which may be important for safeguarding human rights<sup>61</sup>.
- b. **They might be improved in a number of ways**, including via addressing knowledge gaps and governance gaps, developing governance for research, pursuing social appraisal and multilateral discussions (see above).

6. Do you think that policy efforts to address human rights challenges in NTCP will promote their use or deter it? How to strike a balance between the need to employ technology with the goal of reaching net zero CO2 emissions and the need to protect human rights?

- a. **There is some concern that publicly debating, researching and potentially deploying SRM could involve a ‘moral hazard’**, with potential to obstruct ongoing and future climate mitigation efforts. Others have speculated that research and outdoors experimentation may create a ‘slippery slope’ toward eventual deployment, leading to a lock-in to long-term SRM but there is low agreement on this in the recent IPCC assessment.<sup>62</sup>
- b. **SRM, as with other NTCPs presents a risk-risk conundrum given its potential to both diminish some risks while introducing others<sup>63</sup>** (including those relating to human rights). On the one hand it has the potential to reduce risks from global warming, while on the other, to create novel risks of its own. Recent research suggests that because both climate change and SRM could have effects on human rights, a risk-risk framework could help broaden the analysis to assess and weigh the conflicting impacts.<sup>64</sup>

### Specific questions for the private sector

1. Is your company or sector involved or will it be involved in the use of NTCP? How? Does your company take into account human considerations while assessing the risks and potential impact of the use of these technologies?
2. What would you identify as the key benefits and risks associated with these technologies to human rights in the short-term and the long-term? What needs to be done (at the company, state or global level) to avoid or mitigate possible risks?

3. How can human rights due diligence be enhanced in the private sector in response to the existing human rights concerns that arise in relation to the use of NTCP?
4. What is the policy of your company or sector vis-a-vis public involvement in decision-making process on the development and use of NTCP?

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<sup>1</sup> \*The term *new technologies for climate protection* for the purpose of this questionnaire broadly refers to techniques of deliberate intervention in the Earth's natural system in order to prevent further climate change or reverse it. The two main kinds are (1) Solar Radiation Management SRM (i.e. stratospheric aerosols) and (2) Carbon Dioxide Removal CDR. CDR solutions can be nature-based (forestation, soil carbon sequestration, biochar, etc.) or technological (enhanced weathering, bioenergy with carbon capture and storage, direct air capture and storage, etc.).

<sup>2</sup> IPCC (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Working Group II contribution to the sixth assessment of the Intergovernmental Panel on Climate Change. Summary for Policymakers. SPM B.5.4 [https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC\\_AR6\\_WGII\\_SummaryForPolicymakers.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf)

<sup>3</sup> IPCC (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Working Group II contribution to the sixth assessment of the Intergovernmental Panel on Climate Change. Summary for Policymakers. SPM B.5.5 [https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC\\_AR6\\_WGII\\_SummaryForPolicymakers.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf)

<sup>4</sup> The goal of the [Paris Agreement on Climate Change](#) is “to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels”.

<sup>5</sup> IPCC (2018). Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C. Intergovernmental Panel on Climate Change. Summary for Policymakers. SPM C.1.4. <https://www.ipcc.ch/sr15/>

<sup>6</sup> IPCC (2022). Climate Change 2022: Impacts, Adaptation and Vulnerability. Working Group II contribution to the sixth assessment of the Intergovernmental Panel on Climate Change. Chapter 16. Cross-Working Group Box: Solar Radiation Modification. [https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC\\_AR6\\_WGII\\_FinalDraft\\_Chapter16.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_FinalDraft_Chapter16.pdf)

<sup>7</sup> <https://genie-erc.github.io/> Accessed: 27 Apr 2022

<sup>8</sup> <https://csl.noaa.gov/research/erb/> Accessed: 27 Apr 2022

<sup>9</sup> NASEM (2021). National Academies of Sciences, Engineering, and Medicine 2021. Reflecting Sunlight: Recommendations for Solar Geoengineering Research and Research Governance. Washington, DC: The National Academies Press. <https://doi.org/10.17226/25762>

<sup>10</sup> <https://www.climatechangenews.com/2019/02/26/swiss-push-talk-geoengineering-goes-sci-fi-reality/> Accessed: 27 Apr 2022

<sup>11</sup> UNESCO (2021) Concept note of COMEST on the ethics of climate engineering. World Commission on the Ethics of Scientific Knowledge and Technology [144]. SHS/COMEST-12/21/3 <https://unesdoc.unesco.org/ark:/48223/pf0000379991>

<sup>12</sup> NIC (2021). National Intelligence Estimate. Climate Change and International Responses Increasing Challenges to US National Security Through 2040. NIC-NIE-2021-10030-A <https://www.dni.gov/index.php/newsroom/reports-publications/reports-publications-2021/item/2253-national-intelligence-estimate-on-climate-change>

<sup>13</sup> WEF (2022) Global Risks Report 2022. World Economic Forum. ISBN: 978-2-940631-09-4 <https://www.weforum.org/reports/global-risks-report-2022>

<sup>14</sup> <https://www.youtube.com/watch?v=o8JkN7XbdZk> Accessed: 27 Apr 2022

<sup>15</sup> <https://gbrrestoration.org/> Accessed: 27 Apr 2022

<sup>16</sup> <https://www.keutschgroup.com/scopex> Accessed: 27 Apr 2022

<sup>17</sup> <https://sscspace.com/news-activities/no-technical-test-flight-for-scopex-from-esrange/> Accessed: 27 Apr 2022

<sup>18</sup> <https://www.geoengineeringmonitor.org/2021/02/letter-to-the-swedish-space-corporation-on-planned-scopex-test-flight/> Accessed: 27 Apr 2022

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