

# THE DARK SUN NETWORK

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*Climate scientists agree that climate change will soon require the deployment of a highly dangerous geoengineering approach known as “solar radiation management.” Solar radiation management uses chemical or physical barriers to solar energy entering the atmosphere and thereby forces global temperatures downwards almost immediately by creating “artificial shade.” Problematically, the unilateral deployment of domestic solar radiation management approaches can have different and potentially devastating effects around the world, even if they help the country deploying the approach to limit the worst climate change consequences at home. So far, there is no global governance framework that can guide the development and deployment of solar radiation management. In this Article, I develop how a networked, bottom-up governance approach can resolve the current solar radiation management global governance deadlock. I argue that such bottom-up governance must be consistent with principles of nondomination developed in civic republican and postcolonial theories of consent.*

*I submit that the most promising way to jumpstart such a network is to lean into what appears to many as U.S. unilateralism. I argue that U.S. environmental law provides a ready model for global bottom-up solar radiation management governance coordination and collaboration in the National Environmental Policy Act and the Clean Air Act. Centrally, the Dark Sun Network provides a realistic and meaningful governance approach that can be scaled up immediately on the basis of existing law.*

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## INTRODUCTION

How can we stop time? Policymakers responding to the energy transition challenge could be forgiven for asking that question. On the one hand, it is now increasingly clear that unless greenhouse gas emissions peak in the next four years and drastically fall thereafter, we will set off a catastrophic climate chain reaction.<sup>1</sup> Recently leaked documents from the world's leading scientific body on climate change—the

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1. Fiona Harvey, *Greenhouse Gas Emissions Must Peak Within 4 Years, Says Leaked UN Report*, GUARDIAN (Aug. 12, 2021, 9:47 AM), <https://www.theguardian.com/environment/2021/aug/12/greenhouse-gas-emissions-must-peak-within-4-years-says-leaked-un-report> [<https://perma.cc/FE39-ANCN>].

Intergovernmental Panel on Climate Change (IPCC)—confirm as much.<sup>2</sup> On the other hand, making the kind of deep changes needed to secure sufficiently sizeable emissions reductions precisely runs counter to what we must do to adapt to climate change. For example, we need more air conditioning and heating to counter heatwaves and arctic vortexes.<sup>3</sup> Heating and air conditioning require energy.<sup>4</sup> Doing both—*drawing down* net greenhouse gas emissions and *increasing* net energy availability—at the same time is a near impossible feat.<sup>5</sup>

The energy transition tragedy is even more vivid when we look below the top-line numbers. The same leaked IPCC report provides a lot of good news: energy policies are beginning to show real fruits.<sup>6</sup> Renewable energy is both broadly available and price competitive.<sup>7</sup> Energy efficiency measures are turning the curve of greenhouse gas emissions without negatively impacting global economic growth.<sup>8</sup> In addition, carbon capture technology is facing political and social (rather than technological) headwinds.<sup>9</sup> This technology can turn traditional energy infrastructure, such as gas-fired power plants, close to carbon neutral and might even be able to support significant net negative emissions in the future.<sup>10</sup> But all of these developments simply show that we need more time to successfully navigate energy transition. More time is the one thing we do not have.<sup>11</sup>

Simply “stopping” current greenhouse gas emissions on a dime is not a realistic option.<sup>12</sup> Consider two examples to highlight the pragmatic challenges such a policy would face.

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2. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2022: IMPACTS, ADAPTATION AND VULNERABILITY 18 (Priyadarshi R. Shukla et al. eds., 2022).

3. MATTHEW E. KAHN, ADAPTING TO CLIMATE CHANGE: MARKETS AND THE MANAGEMENT OF AN UNCERTAIN FUTURE 228 (2021).

4. *See id.* at 67–68, 135–36 (discussing the importance of air conditioning and heat and their relationship to electricity).

5. INT’L ENERGY AGENCY, NET ZERO BY 2050: A ROADMAP FOR THE GLOBAL ENERGY SECTOR 56–57 (2021).

6. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 2, at 15.

7. *Id.*

8. *See id.*

9. *See id.* at 17.

10. *See* Leonardo Sempertegui & Frédéric G. Sourgens, *The Importance of the State and Private Oil Sector for Successfully Implementing the Energy Transition* 67 ROCKY MOUNTAIN MIN. L. FOUND. (forthcoming 2022) (on file with the author).

11. *See generally* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 2.

12. *See* Frédéric G. Sourgens, *Diligent Zero*, 75 SMU L. REV. 417, 424–25 (2022).

**First**, the leaked IPCC report singles out “meat-eating . . . for blame.”<sup>13</sup> What would happen if the United States banned, say, beef tomorrow? A recent study suggests that “the Beef Industry is the third largest economic generator in Texas.”<sup>14</sup> And Texas is hardly alone.<sup>15</sup> A beef ban would lead to massive and understandable opposition from ranchers and their home states.<sup>16</sup> Such opposition would likely topple radical regulatory approaches.<sup>17</sup> **Second**, another recommendation is to reduce air travel significantly. What would happen to the economy in Central Florida if the United States curtailed flights tomorrow? Tourism is Florida’s leading economic driver.<sup>18</sup> Given Florida’s importance in U.S. electoral politics, it is not likely that any administration would push too hard in that direction.<sup>19</sup> **More generally**, as one U.S. government agency puts it, “[w]ithout a stable energy supply, health and welfare are threatened, and the U.S. economy cannot function.”<sup>20</sup> Therefore, dismantling existing energy infrastructure before replacing it is not a realistic option.

It turns out that there is, in fact, a tool available to buy more time—solar radiation management (SRM).<sup>21</sup> The idea behind

13. Harvey, *supra* note 1.

14. *What Is the Contribution of Cattle to the Texas and U.S. Economy*, TEX. A&M AGRILIFE EXTENSION, <https://pathtotheplate.tamu.edu/topics/beef/what-is-the-contribution-of-cattle-to-the-texas-and-u-s-economy> [https://perma.cc/K4M3-MYNC].

15. See *Beef*, KAN. DEP’T OF AGRIC., [https://agriculture.ks.gov/docs/default-source/ag-growth-summit/2021-growth-documents/beef.pdf?sfvrsn=15c296c1\\_8](https://agriculture.ks.gov/docs/default-source/ag-growth-summit/2021-growth-documents/beef.pdf?sfvrsn=15c296c1_8) [https://perma.cc/9VZZ-X2DZ]; *Nebraska: The Beef State*, NEB. BEEF COUNCIL, <https://www.nebeef.org/raising-beef/state-national-facts> [https://perma.cc/FY62-ACKA].

16. See Chuck Coffey, *Viewpoint: Fake Meat Is Not the Solution to Climate Change*, OKLAHOMAN (Aug. 29, 2021, 5:00 AM), <https://www.oklahoman.com/story/opinion/2021/08/29/fake-meat-is-not-the-solution-to-climate-change/5592966001> [https://perma.cc/NN7S-CJB8].

17. Sourgens, *supra* note 12, at 9.

18. Laura McCamy, *13 Mind-Blowing Facts About Florida’s Economy*, MKTS. INSIDER (May 20, 2019, 12:40 PM), <https://markets.businessinsider.com/news/stocks/florida-economy-facts-2019-5-1028214563?miRedirects=1> [https://perma.cc/6C9Q-WKM5].

19. Liz Mair, *Ron DeSantis Was a Slam Dunk. Until He Wasn’t.*, N.Y. TIMES (Sept. 24, 2021), <https://www.nytimes.com/2021/09/24/opinion/ron-desantis-florida.html> [https://perma.cc/C5YR-HZW4].

20. *Energy Sector*, CYBERSECURITY & INFRASTRUCTURE SEC. AGENCY, <https://www.cisa.gov/energy-sector> [https://perma.cc/6XN2-TR6J].

21. Jesse L. Reynolds, *Solar Geoengineering to Reduce Climate Change: A Review of Governance Proposals*, 475 PROC. ROYAL SOC. A1, 2 (2019); see also Alan Carlin, *Why a Different Approach Is Required if Global Climate Change Is to Be Controlled Efficiently or Even At All*, 32 WM. & MARY ENV’T L. & POL’Y REV. 685,

SRM is simple. Climate change is the result of heat getting trapped in greenhouse gases in the atmosphere.<sup>22</sup> With SRM, we can reduce the amount of heat getting trapped by keeping solar energy out of the atmosphere in the first place.<sup>23</sup> We can think of reducing atmospheric greenhouse gas concentrations, and thereby reducing climate change, as adjusting the global climate thermostat internally; that is, within the atmosphere. Most SRM adjusts the global climate thermostat *externally*; that is, outside the atmosphere.<sup>24</sup> Importantly, SRM theoretically can adjust the thermostat externally just as effectively as we could adjust it internally.<sup>25</sup>

There is an obvious catch—SRM is a uniquely dangerous tool, and all SRM approaches “have the potential for unintended negative consequences for both environmental and human systems.”<sup>26</sup> For example, one of the most popular SRM approaches releases sulfate aerosol particles into the stratosphere at ever-increasing concentrations to keep solar energy out.<sup>27</sup> These particles can cause anything from acid rain to a depletion of the ozone layer.<sup>28</sup> And, not only is SRM uniquely dangerous, but if deployed, it would have an immediate impact not just in the State deploying it but on all States around the world, leading to potential regional climate imbalances.<sup>29</sup>

Dangerously, there currently is no global governance mechanism for SRM development or deployment.<sup>30</sup> A web of legislation, regulation, international treaties, and customary international law is likely to make at least some SRM approaches unlawful to use under normal circumstances.<sup>31</sup> In

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686 (2008) (“Solar radiation management requires some development to optimize operational details, comparatively modest funding, a reliable command and control system, and a legal change—all of which has not started.”).

22. NAT’L RSCH. COUNCIL, DIV. OF EARTH & LIFE STUD., *ADVANCING THE SCIENCE OF CLIMATE CHANGE: AMERICA’S CLIMATE CHOICES: PANEL ON ADVANCING THE SCIENCE OF CLIMATE CHANGE* 184 (2010).

23. *Id.*

24. *Id.* at 380–81.

25. *See id.* (discussing how SRM affects global average temperatures).

26. *Id.* at 382; *see also* Jonathan M. Gilligan & Michael P. Vandenbergh, *Beyond Wickedness: Managing Complex Systems and Climate Change*, 73 VAND. L. REV. 1777, 1798–99 (2020).

27. NAT’L RSCH. COUNCIL, DIV. OF EARTH & LIFE STUD., *supra* note 22, at 381.

28. *See* Reynolds, *supra* note 21, at 8.

29. NAT’L RSCH. COUNCIL, DIV. OF EARTH & LIFE STUD., *supra* note 22, at 383.

30. *See* Reynolds, *supra* note 21, at 6.

31. *See id.*; Craig Martin, *Atmospheric Intervention? The Climate Change Crisis and the Jus Ad Bellum Regime*, 45 COLUM. J. ENV’T L. 331, 372–73 (2020);

fact, there are even suggestions that the deployment of SRM “could provoke international conflict.”<sup>32</sup> Still, as Karen Scott noted in 2013, current international environmental law does not “provide a suitable forum or framework within which key ethical, policy, and legal questions associated with geoengineering for climate change mitigation can be addressed.”<sup>33</sup>

The lack of a global SRM governance framework is a pressing issue. Calls are growing louder that, under current circumstances, the traditional legal arguments against SRM no longer hold. Climate change creates a uniquely urgent and destructive emergency to which SRM (and likely only SRM) could respond with the necessary speed.<sup>34</sup> Traditional legal rules cited against SRM do not apply in such emergencies.<sup>35</sup> Even the authoritative *Oxford Handbook of International Environmental Law*, in its new 2021 edition, argues that “the scale of the challenge” and “the magnitude of the emissions gap is such that bridging it may well require use of . . . negative emissions technologies such as solar radiation management.”<sup>36</sup>

Even so, emergency does not provide an automatic roadmap for how specific SRM should be assessed or deployed. Emergency, almost by definition, eschews governance paradigms.<sup>37</sup> The climate emergency does not itself provide us

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Joshua Horton et al., *Liability for Solar Geoengineering: Historical Precedents, Contemporary Innovations, and Governance Possibilities*, 22 N.Y.U. ENV'T L.J. 225, 225–26 (2015); Benoit Mayer, *A Review of the International Law Commission's Guidelines on the Protection of the Atmosphere*, 20 MELB. J. INT'L L. 453, 485–86 (2019) (noting equivocation on this point by the International Law Commission).

32. Jody Freeman, *A Critical Look at “The Moral Case for Fossil Fuels”*, 36 ENERGY L.J. 327, 341 (2015).

33. Karen N. Scott, *International Law in the Anthropocene: Responding to the Geoengineering Challenge*, 34 MICH. J. INT'L L. 309, 354 (2013); see also David A. Wirth, *Engineering the Climate: Geoengineering as a Challenge to International Governance*, 40 B.C. ENV'T AFFS. L. REV. 413, 430–36 (2013).

34. See Charles R. Corbett, *The Climate Emergency and Solar Geo-Engineering*, 46 HARV. ENV'T L. REV. 197, 207 (2022); Daniel A. Farber, *Coping with Uncertainty: Cost-Benefit Analysis, the Precautionary Principle, and Climate Change*, 90 WASH. L. REV. 1659, 1677–78 (2015); Frédéric G. Sourgens, *Geo-Markets*, 38 VA. ENV'T L.J. 58, 112–33 (2020).

35. Sourgens, *supra* note 34, at 112–33.

36. Lavanya Rajamani & Jacob Werksman, *Climate Change*, in THE OXFORD HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW 492, 510 (Lavanya Rajamani & Jacqueline Peel eds., 2021).

37. For discussion of key governance questions, see Albert Lin, *The Missing Pieces of Geoengineering Research Governance*, 100 MINN. L. REV. 2509, 2513 (2016). For a discussion of applicable legal principles, see Anthony Chavez, *Using Legal Principles to Guide Geoengineering Deployment*, 24 N.Y.U. ENV'T L.J. 59, 70–

with mechanisms for deciding whether SRM approaches should be developed or deployed and, if so, which ones.<sup>38</sup> These questions can only be answered if a governance paradigm that enables decisions to counter it, which account for a concrete appraisal of the climate emergency and SRM approaches, is in place.

The classic governance paradigm proposed for SRM in the literature is a top-down, multilateral paradigm.<sup>39</sup> Problematically, the very urgency of the climate emergency makes it on the whole unlikely that traditional top-down multilateral global governance approaches, such as multilateral framework conventions, will solve our problem. Such mechanisms take too long and have failed to develop under less urgent circumstances.<sup>40</sup> Traditional U.N. mechanisms, such as the U.N. Security Council, are also unlikely to help: the Council's democracy deficit is too profound considering the veto power of the United States, U.K., France, China, and Russia.<sup>41</sup> We therefore need alternatives to such top-down approaches to SRM governance.

In light of our current top-down SRM governance deadlock, there is a commonplace fear of unilateralism.<sup>42</sup> In particular,

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109 (2016). Chavez does not himself propose a governance approach for the application of these principles. *Id.*

38. J. Samuel Barkin & Yuliya Rashchupkina, *Public Goods, Common Pool Resources, and International Law*, 111 AM. J. INT'L L. 376, 392 (2017).

39. For a discussion of such a top-down approach, see Adam D.K. Abelkop & Jonathan C. Carlson, *Reining in Phaëthon's Chariot: Principles for the Governance of Geoengineering*, 21 TRANSNAT'L L. & CONTEMP. PROBS. 763, 797 (2013). For a soft law approach, see Anna-Maria Hubert & David Reichwein, *An Exploration of a Code of Conduct for Responsible Scientific Research Involving Geoengineering, Introduction, Draft Articles and Commentaries* 62 (Inst. for Advanced Sustainable Stud., Working Paper, 2015) [hereinafter *Code of Conduct*]. I will explore the distinctions between the Code approach and mine in Section III.A.

40. See Wirth, *supra* note 33, at 430–36.

41. See LORAINIE SIEVERS & SAM DAWES, *THE PROCEDURE OF THE UN SECURITY COUNCIL* 296–312 (4th ed. 2012) (describing historical impact of veto threats on deliberations at the Council).

42. Oliver Geden & Susanne Dröge, *The Anticipatory Governance of Solar Radiation Management*, COUNCIL ON FOREIGN REL. (July 2, 2019), <https://www.cfr.org/report/anticipatory-governance-solar-radiation-management> [https://perma.cc/Z9XU-XNVM] (“As long as high uncertainty exists about the benefits of unilateral action, countries will have little interest in striving for global governance.”); Sikina Jinnah, *Why Govern Climate Engineering? A Preliminary Framework for Demand-Based Governance*, 20 INT'L STUDS. REV. 272, 275 (2018); see also Joshua B. Horton, *Geoengineering and the Myth of Unilateralism: Pressures and Prospects for International Cooperation*, in CLIMATE CHANGE GEOENGINEERING (William Burns & Andrew Strauss eds., 2013).

many fear U.S. or Chinese unilateral action.<sup>43</sup> Such unilateralism is seen as an outright cause for alarm and a potential threat to global peace and security.<sup>44</sup> I argue that this fear is not only misplaced, but it actively stands in the way of the best alternative to SRM governance we currently have available to us.

To solve this global problem, I propose a paradigm shift: instead of a top-down approach, we need to focus on a networked, bottom-up governance approach.<sup>45</sup> Contrary to fears of unilateralism, I argue that U.S. unilateralism is, in fact, our best hope of launching a bottom-up governance network. I develop how such a bottom-up governance approach would look and assert that it is wholly achievable within existing law. Existing policy literature already submits that “national-level policies are often the driver of international policy development as countries are more likely to agree and adhere to international policies that reflect pre-existing domestic policies.”<sup>46</sup> I now provide a legal theory of *how* such governance approaches can be made to converge in the SRM context.<sup>47</sup>

My global networked governance approach begins from the premise that national governments, and particularly agencies

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43. See Peter Irvine & David Keith, *The US Can't Go It Alone on Solar Geoengineering*, ENV'T AFFS., Spring 2021, at 44 (“If China and the US, for example, develop clearly aligned interests they could, no doubt, impose their decision.”).

44. See Craig Martin, *Geoengineering and the Use of Force*, OPINIOJURIS.ORG (Jan. 20, 2021), <http://opiniojuris.org/2021/01/20/geoengineering-and-the-use-of-force> [<https://perma.cc/7SHT-DSB3>].

45. See Cinnamon P. Carlarne, *Arctic Dreams and Geoengineering Wishes: The Collateral Damage of Climate Change*, 49 COLUM. J. TRANSNAT'L L. 602, 666 (2011) (discussing the role of bottom-up governance in geoengineering); Geden & Dröge, *supra* note 42 (calling for the development of a bottom-up governance approach). Geden & Dröge call for “setting up enforceable codes of conduct for responsible SRM research, adopted by project funders and national research organizations” and thus differ from the international approach followed by the Code of Conduct to which Geden & Dröge also link. *Id.*; *Code of Conduct*, *supra* note 39. My key contribution is to develop how such codes of conduct can in fact be made to converge *without* ex ante agreement.

46. See F. FOR CLIMATE ENG'G ASSESSMENT, ACAD. WORKING GRP. ON CLIMATE ENG'G, GOVERNING SOLAR RADIATION MANAGEMENT 23 (2018). Despite this observation, the report does not propose a bottom-up governance approach but rather proposes an international, organization-led approach. *Id.* at 30.

47. This is where I differ from soft law approaches like that of Hubert & Reichwein. I do not assume that regulators will share common normative starting points concerning geoengineering but rather that they share an understanding that they wish to solve a common problem only. See sources cited *supra* note 39. The point of networked governance is that it will arrive at normative convergence even in the absence of ex ante shared normative principles.



such as the Environmental Protection Agency (EPA) and their global counterparts, have the expertise to understand the chemical and physical processes involved in SRM and their environmental impacts. These agencies, therefore, have the tools to understand the relevant risks and benefits of specific SRM strategies.<sup>48</sup> These agencies also typically have the statutory authority to regulate airborne emissions, meaning that they would have natural regulatory authority over many SRM activities in their respective domestic jurisdictions.<sup>49</sup> The best course of action is for these agencies to begin engaging in proposals to deploy SRM as soon as possible and thus gather risk data about specific strategies.<sup>50</sup>

A networked approach adds a global layer to such regulatory activities. I argue that global regulators must interact with each other and with the data they each generate as part of their respective domestic analyses of SRM strategies and proposals. Because SRM has a global impact, any approval by a domestic regulatory agency has the potential to cause transboundary harm.<sup>51</sup> As I will argue, the chief means to respond to such a potential for transboundary harm is meaningful consultation before the potentially harmful activity is licensed or undertaken. This is true both from an international law and from a U.S. environmental law perspective.<sup>52</sup> Such meaningful consultation requires an exchange of data and risk projections.<sup>53</sup> It further requires each regulatory agency to take into account the global impact of a proposed SRM approach rather than exclusively the domestic impact.<sup>54</sup>

This bottom-up, networked governance approach allows us a path out of the SRM governance impasse. The literature on global governance networks strongly suggests that creating

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48. See Albert C. Lin, *Myths of Environmental Law*, 2015 UTAH L. REV. 45, 55–57 (2015).

49. See, e.g., *id.* at 55–57 (noting that “[r]isk assessment is at the heart of many environmental statutes and regulatory actions” and noting further that “[w]hile almost all environmental statutes are in some way concerned with risk, the standards in some statutes purport to focus solely on risk regardless of economic costs”).

50. See *Geden & Dröge*, *supra* note 42.

51. *Reynolds*, *supra* note 21.

52. See *Sourgens*, *supra* note 12, at 458.

53. *Id.*

54. *Id.* at 451 (energy companies and policymakers “will need to account for the potential transboundary harm such projects and policies might produce in their own right”).

conduits for global governance by providing opportunities for regulators to interact with each other causes each decision-maker to internalize the concerns raised by their peers.<sup>55</sup> That is, while it is not possible to achieve a negotiated SRM agreement *ex ante*, networked governance approaches allow for regulatory convergence *ex post*.<sup>56</sup> Further, to the extent that disagreement persists, such disagreement can be articulated in concrete ways based on specific data. Such disagreement can then be resolved in tangible ways based on specific data points. The question would no longer be whether the deployment of SRM by a particular actor is lawful or unlawful *in the abstract*. Rather, the question would be whether the *specific diligence* conducted by a particular actor was sufficient and whether the *concrete choices* made as a result of that diligence were appropriate. When time is of the essence, such concrete questions are easier to answer on the whole. And they can be answered within these very networked regulatory dialogues.

This change in perspective offers four surprising insights. *First*, bottom-up, networked global governance approaches are far more *flexible* than top-down approaches. Consequently, bottom-up governance approaches can build buy-in for global SRM governance while accounting for the urgent need for action. Bottom-up governance can therefore speed up global and domestic SRM development and deployment efforts rather than slow them down.

*Second, U.S. leadership is instrumental* to achieving the benefits of such networked governance. U.S. leadership will take the form of *unilateral (i.e., domestic) action*. But due to the framework of U.S. environmental legislation, such domestic action can serve as a needed push to commence a thick global regulatory dialogue around SRM.<sup>57</sup>

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55. See generally ANNE-MARIE SLAUGHTER, A NEW WORLD ORDER (2004) (providing the classical explanation for how networked governance works effectively to solve global policy problems).

56. See *id.* at 61 (discussing the logic of convergence in environmental regulation).

57. A key condition for my approach is that the United States adopts a civilian rather than a military approach. On the civilian path, see Charles R. Corbett, "Extraordinary" and "Highly Controversial": Federal Research of Solar Geoengineering Under NEPA, 115 NW. U. L. REV. ONLINE 240, 243 (2021). On the potential military path, see Meredith Doswell, *The Department of Defense Is Poised to Update Its Climate Change Adaptation Roadmap to Consider "Mitigation Measures": Now Is the Time to Nationally Regulate Solar Radiation Management*, 22 N.C. J.L. & TECH. 487, 487–88 (2021).

*Third*, existing global governance mechanisms are sufficiently capacious to address the apparently unilateral deployment of SRM proposed here. Such unilateral deployment proposals will cause domestic regulators to engage with a broader global impact of proposed SRM strategies. This dialogue, in its own right, will provide an **inclusive** foundation for better, global SRM decision-making.

*Fourth*, such engagement with global impacts by U.S. regulators is a matter of **law** (both U.S. and, though more tenuously, international environmental law) and **not** just a matter of **prudential choice**. Law tells us how to build these dialogues between regulators. It tells us where regulators need to look for domestic and foreign civil society groups for input. And law tells us how regulators can internalize these inputs by working together in governance networks rather than as regulatory islands working at cross-purposes.

This Article has four parts. Part I introduces SRM and its environmental impact. Part II outlines the goals for successful SRM governance. Part III introduces bottom-up, networked governance as a means to achieve these goals. Part IV then explains how U.S. SRM governance leadership, far from being a threat to inclusive global SRM governance, can jump-start such inclusive global SRM governance within the confines of existing domestic U.S. environmental law.

## I. SOLAR SHIELDS AND THEIR COLLATERAL COSTS

SRM has a sad provenance. At the height of the Cold War, scientists at the vaunted Lawrence Livermore National Laboratory, a chief site of U.S. nuclear weapons research, studied two related, grizzly scenarios: nuclear winter brought on by the use of the weaponry its scientists perfected and the weaponization of the weather through climate control.<sup>58</sup> The problems of modelling shock waves of nuclear explosions and climate events share many mathematical similarities, and understanding one helped model the other.<sup>59</sup> From the mid-1950s onwards, the U.S. military injected vast amounts of

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58. Paul N. Edwards, *Entangled Histories: Climate Science and Nuclear Weapons Research*, 68 BULL. ATOMIC SCI. 28, 37 (2012).

59. *Id.* at 32–33.

money into obtaining a military advantage out of either (nuclear weapons and climate control).<sup>60</sup>

The link between nuclear weapons, nuclear winter, and the climate makes intuitive sense. Nuclear explosions are powerful enough to inject smoke plumes of soot and ash not just into the lower atmosphere but also into the upper troposphere and stratosphere some thirty miles off the ground.<sup>61</sup> If soot reaches this height, “enough light is blocked to cause global surface cooling.”<sup>62</sup> As this research developed, Lawrence-Livermore scientists suggested that “smoke from 100 simultaneous firestorms would block sunlight for about four years . . .”<sup>63</sup> Even at a comparatively early stage of the research, the basic idea took hold: human action can change the climate in either direction.<sup>64</sup> If we want to fight global warming, all we have to do is block out the sun.<sup>65</sup> Consequently, and somewhat unsurprisingly, three of the pioneers of developing today’s ideas for a solar shield were senior members of the Lawrence-Livermore team—Edward Teller (the father of the hydrogen bomb), Lowell Wood, and Ken Caldeira.<sup>66</sup>

Despite sizeable military interest in the technology, both in the U.S.S.R. and the United States, solar shields and geoengineering were long considered fringe or “post-normal”

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60. *Id.* at 31.

61. Stephen Wampler, *Examining Climate Effects of Regional Nuclear Exchange*, LAWRENCE LIVERMORE NAT’L LAB’Y (Nov. 30, 2020), <https://www.llnl.gov/news/examining-climate-effects-regional-nuclear-exchange> [<https://perma.cc/MVX5-M22E>].

62. *Id.*

63. *Id.*

64. See Ken Caldeira & Govindasamy Bala, *Reflecting on 50 Years of Geoengineering Research*, 5 EARTH’S FUTURE 10 (2017).

65. Wampler, *supra* note 61; Stephen Wampler, *Examining Climate Effects of Regional Nuclear Exchange*, LAWRENCE LIVERMORE NAT’L LAB’Y (Nov. 30, 2020), <https://www.llnl.gov/news/examining-climate-effects-regional-nuclear-exchange> [<https://perma.cc/YG7T-8MSE>].

66. Caldeira & Bala, *supra* note 64, at 11; Joel N. Shurkin, *Edward Teller, ‘Father of the Hydrogen Bomb,’ Is Dead at 95*, STAN. REP. (Sept. 24, 2003), <https://news.stanford.edu/news/2003/september24/tellerobit-924.html> [<https://perma.cc/Y7QD-ENPY>].

science.<sup>67</sup> The idea was simply taboo.<sup>68</sup> This changed when Paul Crutzen, a Nobel Prize winning atmospheric chemist with a decidedly nonmilitary background, reluctantly suggested the use of SRM as a means to combat climate change in 2006.<sup>69</sup> Since Crutzen broke the taboo in the scientific community by discussing SRM as a policy option, SRM has become increasingly mainstream in global policy circles.<sup>70</sup>

Obviously, SRM would have to be controlled—it could not rely on the detonation of hundreds of nuclear warheads.<sup>71</sup> But scientists used to designing nuclear weapons are no strangers to precisely calibrating devastatingly powerful physical processes. In this case, their inspiration for a less disastrous solar shield came from nature—massive volcanic eruptions.<sup>72</sup> Past eruptions had in fact led to measurable global cooling.<sup>73</sup> This provided a blueprint for engineering solutions.<sup>74</sup> And, as it stands, these blueprints look like they will work—both SRM experts and leading climate scientists project “with a [degree of] high agreement” that SRM in fact can stabilize global temperatures in the Paris Agreement zone of well below 2 degrees Celsius (or even 1.5 degrees Celsius) above preindustrial levels.<sup>75</sup>

#### A. SRM Basics

So how does it work? The perhaps best known (and least expensive) SRM approach is the one reluctantly endorsed by Crutzen in 2006.<sup>76</sup> As Crutzen wrote, SRM “can be achieved by burning S<sub>2</sub> [disulfur] or H<sub>2</sub>S [hydrogen sulfide] carried into the

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67. See Alexander C. Kaufman, *Geoengineering the Climate Just Became More of a Real Possibility in the U.S.*, HUFFPOST (Mar. 25, 2021, 11:56 AM), [https://www.huffpost.com/entry/solar-geoengineering-climate-change\\_n\\_605c765dc5b67593e055ff9d](https://www.huffpost.com/entry/solar-geoengineering-climate-change_n_605c765dc5b67593e055ff9d) [<https://perma.cc/6B2X-TEZK>]; *Once a Fringe Idea, Geoengineering Moves to Center Stage in Policy Arena*, ENV'T F., May/June 2020, at 52.

68. CLIVE HAMILTON, *EARTHMASTERS, THE DAWN OF THE AGE OF CLIMATE ENGINEERING* 15 (2013).

69. *Id.*; Paul J. Crutzen, *Albedo Enhancement by Stratospheric Sulfur Injections: A Contribution to Resolve a Policy Dilemma?*, 77 *CLIMATIC CHANGE* 211, 212 (2006).

70. Caldeira & Bala, *supra* note 64, at 12.

71. Reynolds, *supra* note 21, at 17.

72. See Caldeira & Bala, *supra* note 64.

73. See DAVID KEITH, *A CASE FOR CLIMATE ENGINEERING* 26 (2013).

74. *See id.*

75. Reynolds, *supra* note 21, at 3.

76. Crutzen, *supra* note 69, at 212.

stratosphere on balloons and by artillery guns to produce SO<sub>2</sub> [sulfur dioxide].”<sup>77</sup> He went on to say that, “[t]o enhance the residence time of the material in the stratosphere and minimize the required mass, the reactants might be released, distributed over time, near the tropical upward branch of the stratospheric circulation system.”<sup>78</sup> Once in “the stratosphere, chemical and microphysical processes convert SO<sub>2</sub> into sub-micrometer sulfate particles.”<sup>79</sup> Crutzen argued that “to derive the radiative forcing,” that is the change to the equilibrium of solar energy entering and exiting the atmosphere “caused by the presence of 1 Tg S in the stratosphere, we adopt a simple approach based on the experience gained from the Mount Pinatubo volcanic eruption.”<sup>80</sup> Crutzen calculated that “a stratospheric sulfate loading of 1.9 Tg S [teragram of sulfur] would be required,” which “can be achieved by a continuous deployment of about 1–2 Tg S per year for a total price of U.S. \$25–50 billion . . . .”<sup>81</sup> This form of SRM is also known as stratospheric aerosol injection (SAI).<sup>82</sup>

SAI is far from the only SRM approach. One alternative is to introduce engineered reflective nanoparticles into the stratosphere instead of sulfur compounds.<sup>83</sup> Further, it may be possible “to increase the albedo [whiteness/reflectivity] of relatively dark stratocumulus clouds” by spraying seawater “upwards as a fine mist” in a process known as “marine cloud brightening” (MCB).<sup>84</sup> Alternatively, it may be possible to thin high altitude cirrus clouds in a process called “cirrus cloud thinning” (CCT) by “injecting ice nuclei, such as bismuth triiodide, into the areas where cirrus clouds are likely to form.”<sup>85</sup> Another alternative is to “consider a system of mirrors in space engineered so that each could be rotated on command . . . .”<sup>86</sup> Other approaches are indeed feasible, and practical research is in a comparatively early stage as most research at this point

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77. *Id.*

78. *Id.*

79. *Id.*

80. *Id.* One teragram is 1,000,000 metric tons.

81. *Id.* at 213.

82. Reynolds, *supra* note 21, at 3.

83. KEITH, *supra* note 73, at 72.

84. Reynolds, *supra* note 21, at 3.

85. *Id.*

86. KEITH, *supra* note 73, at 112.

relies principally upon modelling and analogy to natural events.<sup>87</sup>

### *B. Local Effects of SRM Approaches*

Crucially, many SRM approaches can be developed *locally*. Obviously, a global deployment of any number of methods would achieve better results.<sup>88</sup> But, in Crutzen’s case, artillery guns shooting sulfur compounds into the stratosphere are located *somewhere*.<sup>89</sup> Similarly, balloons releasing sulfur compounds would do so in specific airspace (as would airplanes injecting aerosols).<sup>90</sup> The same is true for cloud-based SRM approaches like MCB and CCT—they spray salt water or inject ice into clouds *from somewhere*.<sup>91</sup> It is thus entirely conceivable that a State would use its sovereign territory, sovereign airspace, or maritime areas under its jurisdiction for SRM operations.<sup>92</sup>

While the *deployment* of SRM can be *local*, the *effects* of SRM are likely to be *global*. Air and water pollution frequently do not stay in one place but follow air and water currents.<sup>93</sup> To use an admittedly imperfect analogy, think of the nuclear power plant accidents at Fukushima or Chernobyl.<sup>94</sup> Radiation from

87. See Caldeira & Bala, *supra* note 66, at 14–15; Reynolds, *supra* note 21.

88. See Wilfried Rickels et al., *Who Turns the Global Thermostat and by How Much?*, 91 ENERGY ECON., Aug. 2020, at 1.

89. Crutzen, *supra* note 69, at 212.

90. *Id.*

91. Reynolds, *supra* note 21, at 3.

92. See JAMES CRAWFORD, BROWNIE’S PRINCIPLES OF PUBLIC INTERNATIONAL LAW 204 (9th ed. 2019) (discussing the international legal concept of territory and the right of States to make use of their own territory); Terry Gill & Dieter Fleck, *Air Law and Military Operations*, in THE HANDBOOK OF INTERNATIONAL LAW OF MILITARY OPERATIONS 354, 354 (Terry Gill & Dieter Fleck eds., 2d ed. 2015); Umberto Leanza & Maria Cristina Caracciolo, *The Exclusive Economic Zone*, in 1 THE IMLI MANUAL ON INTERNATIONAL MARITIME LAW: THE LAW OF THE SEA 177, 184 (David J. Attard et al. eds., 2014) (discussing the “exercise of the coastal State jurisdiction for the purposes of . . . installations, and structures, in order to monitor scientific research at sea and to protect the marine environment against pollution” in the exclusive economic zone).

93. See Dennis Normile, *Watch Air Pollution Flow Across the Planet in Real Time*, SCIENCE (Nov. 28, 2016), <https://www.science.org/news/2016/11/watch-air-pollution-flow-across-planet-real-time> [<https://perma.cc/8HKS-LY3Q>]; Catherine Zandonella, *Ocean Currents Push Phytoplankton, and Pollution, Around the Globe Faster than Thought*, SCIENCEDAILY (Apr. 19, 2016), [www.sciencedaily.com/releases/2016/04/160419130133.htm](http://www.sciencedaily.com/releases/2016/04/160419130133.htm) [<https://perma.cc/9ZZV-JVS7>].

94. *Fukushima Daiichi Accident*, WORLD NUCLEAR ASS’N (May 2022), <https://world-nuclear.org/information-library/safety-and-security/safety-of->

those accidents did not stay in Japan and Ukraine; they travelled via air and sea currents around the world.<sup>95</sup> Depending exactly upon where SRM is deployed, it is thus possible (and in fact highly likely) that the particles used in SRM will also travel beyond the original injection site. In fact, airborne global travel of small soot particles from mainland China already provides a real-life, small-scale example of such global aerosol movements.<sup>96</sup>

And it is not just the chemicals introduced to bring about SRM that are potentially problematic. A change in temperatures over, say, the United States is bound to have climate consequences further afield given the interconnectivity of global climate systems, such as the Jetstream over the North Pole or the Gulfstream in the Atlantic.<sup>97</sup> Large-scale *local deployment of SRM* therefore will have *varied global climate impacts* no matter what method is used.<sup>98</sup>

### C. *The Environmental Consequences of SRM Approaches*

The environmental consequences of any SRM approach are likely going to be significant. The first of these potential consequences, again, is reasonably intuitive. We—and certainly our parents and grandparents—know that introducing sulfur compounds into the stratosphere is environmentally harmful given our experiences with acid rain in the 1980s.<sup>99</sup> And Crutzen

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plants/fukushima-daiichi-accident.aspx [https://perma.cc/V4Z3-8TUD]; *Chernobyl Accident 1986*, WORLD NUCLEAR ASS'N (Apr. 2022), <https://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident.aspx> [https://perma.cc/ZU94-FDS8].

95. Michael Simmons, *Radiation High over Europe After Chernobyl Disaster—Archive, 1986*, GUARDIAN (May 3, 2021, 12:30 AM), <https://www.theguardian.com/environment/2021/may/03/radiation-high-over-europe-after-chernobyl-disaster-1986> [https://perma.cc/V2ML-2QRS]; Amanda Grennell, *California Wines Contain Fukushima Radiation, and It's Not a Bad Thing*, PBS (July 24, 2018, 4:32 PM) <https://www.pbs.org/newshour/science/california-wines-contain-fukushima-radiation-and-its-not-a-bad-thing> [https://perma.cc/W5S4-WEVC].

96. Normile, *supra* note 93.

97. Xiaojun Yuan et al., *The Interconnected Global Climate System—A Review of Tropical-Polar Teleconnections*, 31 J. CLIMATE 5765, 5765 (2018).

98. Wilfried Rickels et al., *supra* note 88, at 7 (noting “[t]he heterogeneous economic interests involved in SRM deployment under future climate conditions are more nuanced than . . . climate-change losers and winners.”).

99. *The Legacy of EPA's Acid Rain Research*, EPA (Aug. 18, 2020), <https://www.epa.gov/sciencematters/legacy-epas-acid-rain-research> [https://perma.cc/VV7V-2P5A].



doesn't mince words—"According to the World Health Organization, the pollution particles affect health and lead to more than 500,000 premature deaths per year worldwide."<sup>100</sup> Further, "[t]hrough acid precipitation and deposition, SO<sub>2</sub> and sulfates also cause various kinds of ecological damage."<sup>101</sup> Just as dangerously, the use of sulfur compounds has been linked to ozone depletion and thus would return a significant environmental threat to the ozone layer.<sup>102</sup> These effects may well be reduced depending upon *how* sulfur is delivered into the stratosphere.<sup>103</sup> But significant negative impacts are likely to remain—the question is whether these effects are sufficiently small to warrant deployment to counter the threat of climate change.

Pollution may be diminished by finding aerosols or particles other than sulfur-based compounds.<sup>104</sup> It is also possible that SRM approaches other than SAI could be less environmentally harmful in their own right.<sup>105</sup> These questions will have to be studied, and environmental impacts remain to be fully assessed.<sup>106</sup> As a general rule, however, the introduction of large quantities of foreign substances into the air is likely to have some polluting effect—and the larger the quantity, the greater the problem.<sup>107</sup>

Second, even if pollution from SRM delivery approaches *themselves* was kept at a minimum, SRM has negative environmental consequences because of what it intends to do (block sunlight). One of these consequences is that SRM weakens the hydrological cycle—in other words, weather patterns responsible for precipitation around the world.<sup>108</sup> Importantly, SRM will not impact the hydrological cycle

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100. Crutzen, *supra* note 69, at 211.

101. *Id.*

102. *Id.* at 214–15.

103. *Id.* at 215.

104. KEITH, *supra* note 73, at 72.

105. Reynolds, *supra* note 21.

106. Caldeira & Bala, *supra* note 64.

107. See *Ambient (Outdoor) Air Pollution*, WHO (Sept. 22, 2021), [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health) [<https://perma.cc/R8GC-63F3>] (“By reducing air pollution **levels**, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma.”) (emphasis added).

108. Katherine Dagon & Daniel P. Schrag, *Exploring the Effects of Solar Radiation Management on Water Cycling in a Coupled Land–Atmosphere Model* 29 J. CLIMATE 2635, 2636 (2016).

uniformly around the world—local soil and vegetation patterns matter, meaning that the SRM impacts on the hydrological cycle will be regionally diverse.<sup>109</sup> There has also been some discussion in the literature that SRM (no matter what kind) could negatively affect the monsoon.<sup>110</sup> As such, it could have a negative impact on large ecosystems.<sup>111</sup> These ecosystems support farming for large populations around the world.<sup>112</sup> The problem is made more complex in that climate change itself affects the hydrological cycle.<sup>113</sup> As it stands, climate change has weakened the monsoon in Burma/Myanmar.<sup>114</sup> Instead of accounting only for SRM effects, climate change modelling must also account for the effects of climate change on climate systems. Consequently, modelling must account for SRM effects, climate change effects, and any interactions between SRM and climate change events.<sup>115</sup>

Finally, SRM does not address the concentration of CO<sub>2</sub> in the atmosphere. This means that the negative consequences of growing CO<sub>2</sub> concentrations remain untouched.<sup>116</sup> This includes increased ocean acidification—something that SRM does not reduce.<sup>117</sup> Just as importantly, if one terminates SRM processes, atmospheric greenhouse gases will rapidly increase global temperatures.<sup>118</sup> Global ecosystems could not keep up with such rapid change.<sup>119</sup> This means that SRM does not itself solve the

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109. *Id.* at 2646.

110. Compare Simone Tilmes et al., *The Hydrological Impact of Geoengineering in the Geoengineering Model Intercomparison Project (GeoMIP)*, 118 J. GEOPHYSICAL RSCH.: ATMOSPHERES 11036, 11054 (2013) (“Considering the multimodal median and the interannual variability of G1, we find a robust and significant decrease of monsoonal precipitation over land for East Asia (6%), North America (7%), South America (6%), and South Africa (5%), and a robust but not significant decrease of 2% over India.”), with Jesse L. Reynolds et al., *Five Solar Geoengineering Tropes that Have Outstayed Their Welcome*, 4 EARTH’S FUTURE 562, 565 (2016) (submitting that “the degree of cooling from SRM and the magnitude of the associated reduction in monsoon precipitation would be a choice”).

111. Tilmes et al., *supra* note 110, at 11054.

112. HAMILTON, *supra* note 68, at 64.

113. See Zbigniew W. Kundzewicz, *Climate Change Impacts on the Hydrological Cycle*, 8 ECOHYDROLOGY & HYDROBIOLOGY 195 *passim* (2008).

114. THANT MYINT-U, *THE HIDDEN HISTORY OF BURMA, RACE, CAPITALISM, AND THE CRISIS OF DEMOCRACY IN THE 21<sup>ST</sup> CENTURY* 203 (2020).

115. See Tilmes, *supra* note 110, at 11053.

116. Ronald Sandler, *Solar Radiation Management and Nonhuman Species*, in *ENGINEERING THE CLIMATE, THE ETHICS OF SOLAR RADIATION MANAGEMENT* 95, 107 (Christopher Preston ed., 2012).

117. *Id.*

118. Sourgens, *supra* note 34, at 116–17.

119. *Id.* at 113–17.

underlying problem from increased greenhouse gas emissions while presenting significant environmental risks.<sup>120</sup>

*D. The Legal Consequences of SRM Approaches*

Given these potential consequences, it should not be surprising that the deployment of SRM is legally problematic. For instance, customary international law prohibits one State from engaging in, or permitting others to engage in, conduct within its jurisdiction that causes serious transboundary harm.<sup>121</sup> As Philippe Sands and Jacqueline Peel put in their authoritative *Principles of International Environmental Law*, this principle “remains the cornerstone of international environmental law.”<sup>122</sup> Several international treaties have since codified that rule in different contexts.<sup>123</sup> As we have outlined above, SRM in fact does risk causing significant transboundary harm in the form of pollution as well as in the form of climate impacts brought on by SRM itself.<sup>124</sup> But SRM also reduces another kind of global harm—the harm from climate change. A simple prohibition of SRM (unrealistic as it is in current circumstances) therefore would do little to help us weigh these concerns against each other. Just as importantly, given the significant consequences of SRM on the ecosystem, it would be unlawful to simply implement SRM on a whim and without regulatory scrutiny as a matter of U.S. law.<sup>125</sup> Any injection of aerosols into the stratosphere would need to meet at least Clean Air Act, Endangered Species Act, and National Environmental Policy Act scrutiny.<sup>126</sup>

There’s the rub: SRM will become inevitable. Leading climate experts confirm as much.<sup>127</sup> But given the dangers of SRM itself and the current state of the law, how are we to govern its use? A tempting escape valve is to look to emergency as an

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120. *Id.* at 116–17.

121. PHILIPPE SANDS & JACQUELINE PEEL, *PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW* 201 (4th ed. 2018).

122. *Id.*

123. *Id.* at 199–210.

124. *See supra* Section I.C.

125. *See* Albert Lin, *US Law, in CLIMATE ENGINEERING AND THE LAW, REGULATION AND LIABILITY FOR SOLAR RADIATION MANAGEMENT AND CARBON OXIDE REMOVAL* 154, 154–201 (Michael Gerrard & Tracy Hester eds., 2018).

126. *See id.*

127. Rajamani, *supra* note 36, at 510.

authorizing principle.<sup>128</sup> But emergency is not a governance framework. Emergency suggests the very opposite—it suggests an irrepressible need for action that is so overwhelming, it thwarts deliberation.<sup>129</sup> If this is how we take emergency, it is fairly certain that the cure of SRM may well exacerbate rather than resolve the climate change threat—the climate wars of Cold War nightmares in which multiple powers try to force the climate in opposite directions to meet strategic objectives would leave the test tube and become a reality.<sup>130</sup> We need a governance framework capable of banishing such a specter back to the shelf housing other classics of dystopian science fiction where it safely belongs. And such a framework must allow deployment of SRM to avoid the dystopian future of a planet ravaged by climate change.<sup>131</sup> Yet, this framework also must be sensitive to the significant risks SRM poses on a global scale and must coordinate risk mitigation strategies. So far, we have not yet created such a “suitable forum or framework within which key ethical, policy, and legal questions associated with geoen지니어ing for climate change mitigation can be addressed.”<sup>132</sup>

## II. WHAT WE NEED FROM SRM GOVERNANCE

We have now seen the problem: it is becoming increasingly likely that SRM will become a necessary tool to combat climate change.<sup>133</sup> Climate change threatens millions of lives in the Global South—a threat that becomes more acute with each passing day.<sup>134</sup> Further, existing solutions are not reactive enough. Decarbonization, for example, is too slow to protect low-

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128. See sources cited *supra* note 34.

129. See CARL SCHMITT, *POLITISCHE THEOLOGIE* 42–46, 80–84 (2d ed. 1934); Adrian Vermeule, *Our Schmittian Administrative Law*, 122 HARV. L. REV. 1095, 1142–43 (2009). Carl Schmitt used “emergency” to justify and defend National Socialist dictatorship in Germany. See Frédéric G. Sourgens, *Curious Unilateralism*, 13 FED. CTS. L. REV. 113, 132–35 (2021).

130. See Edwards, *supra* note 58, at 35.

131. DAVID WALLACE-WELLS, *THE UNINHABITABLE EARTH: LIFE AFTER WARMING* (2019).

132. Scott, *supra* note 33, at 354; see also Wirth, *supra* note 33, at 430–36.

133. See *What Next? 22 Emerging Technologies to Watch in 2022*, ECONOMIST (Nov. 8, 2021), <https://www.economist.com/the-world-ahead/2021/11/08/what-next-22-emerging-technologies-to-watch-in-2022> [<https://perma.cc/Q5RP-5P5>].

134. Jocelyn Timerley, *The World’s Fight for ‘Climate Justice’*, BBC (Nov. 8, 2021), <https://www.bbc.com/future/article/20211103-the-countries-calling-for-climate-justice> [<https://perma.cc/2NWT-EWXX>].

lying island States from sea level rise and risks catalyzing climate tipping points.<sup>135</sup> It is tempting to analyze SRM through the lens of emergency or necessity.<sup>136</sup> This legal lens permits countries and, in the case of the United States, the president to take actions needed to respond to a threat even if the actions themselves may otherwise be unlawful.<sup>137</sup> But such an approach precisely undercuts any governance attempt, setting up our current problem.<sup>138</sup>

We can see how SRM can create such governance problems. SRM governance must meet two core, conflicting goals at the same time: (1) it must be *flexible* to respond to the climate threat, but (2) it must also be *inclusive* to make sure that harms and benefits are appropriately distributed. These goals are obviously *in tension* with each other. But as we will see, these twin goals *do not contradict* each other. It is therefore entirely possible to balance them against each other so that they in turn strengthen outcomes—but only if done correctly. The goal of any SRM governance paradigm must be to strike the right balance.

#### A. Flexibility

Time is of the essence for the deployment of SRM. It is prudent, at this point, to assume that climate tipping points cannot be avoided with climate mitigation measures alone.<sup>139</sup> The pace of energy transition is heartening.<sup>140</sup> But as it stands,

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135. Rhoda Kwan, *Island Nation at Risk of Extinction from Rising Seas Laments Watered-Down Climate Pact*, NBC (Nov. 15, 2021), <https://www.nbcnews.com/news/world/tuvalu-laments-watered-cop26-climate-pact-rcna5575> [<https://perma.cc/B9SP-ARUT>]; see also Mélissa Godin, *I Get Scared: The Young Activists Sounding the Alarm from Climate Tipping Points*, GUARDIAN (Nov. 7, 2021), <https://www.theguardian.com/environment/2021/nov/07/young-activists-climate-tipping-points-coral-reefs-ice-sheets> [<https://perma.cc/AYE4-2VR4>].

136. See STEPHEN M. GARDINER, A PERFECT MORAL STORM: THE ETHICAL TRAGEDY OF CLIMATE CHANGE 403 (2011); Rep. of the Int'l Law Comm'n on the Work of Its Fifty-Third Session, U.N. Doc. A/56/10, at 80–84 (2001); Lin, *supra* note 125.

137. See sources cited *supra* note 129.

138. See DIANE A. DESIERTO, NECESSITY AND NATIONAL EMERGENCY CLAUSES: SOVEREIGN IN MODERN TREATY INTERPRETATION 137–38 (2012) (discussing the dangers of such attempts).

139. Godin, *supra* note 135.

140. Fatih Birol, *COP26 Climate Pledges Could Help Limit Global Warming to 1.8 °C, but Implementing Them Will Be the Key*, INT'L ENERGY AGENCY (Nov. 4, 2021), <https://www.iea.org/commentaries/cop26-climate-pledges-could-help-limit->

greenhouse gas emissions continue to increase rather than decrease.<sup>141</sup> Commentators agree that the current pace of emissions reductions may well be too slow to stave off disaster.<sup>142</sup> The construction of a global renewable energy or nuclear energy infrastructure sufficient to displace existing fossil-fueled systems may not be achieved in time.<sup>143</sup> Carbon capture technology similarly is promising but unlikely to be available at a sufficient scale quickly enough.<sup>144</sup>

This assessment does not intend to be defeatist. The point is not that current efforts to decarbonize the world economy are doomed to fail. The point is that they may need more time to be successful. This assessment highlights the uncertainty surrounding how long these efforts require before they are successful. Consequently, it will be necessary to have tools available for deployment the moment it becomes clear that action beyond mitigation is needed.

There are two complementary needs for flexibility. The *first* is that there needs to be an approach—today—that allows for the *development* of SRM technologies so that they can be ready for deployment in 2030 (the time when climate tipping points are currently projected to be reached on existing emission trajectories).<sup>145</sup> This flexibility concerns not the actual deployment of SRM but the *study of different methods*, their cost of deployment, and the readying of all necessary

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global-warming-to-1-8-c-but-implementing-them-will-be-the-key  
[<https://perma.cc/ZG7M-J2PL>].

141. *Global Carbon Dioxide Emissions Are Set for Their Second-Biggest Increase in History*, INT'L ENERGY AGENCY (Apr. 20, 2021), <https://www.iea.org/news/global-carbon-dioxide-emissions-are-set-for-their-second-biggest-increase-in-history> [<https://perma.cc/J2FQ-5K7L>].

142. Nina Chestney & Andrea Januta, *U.N. Climate Change Report Sounds 'Code Red for Humanity'*, REUTERS (Aug. 9, 2021, 4:52 PM), <https://www.reuters.com/business/environment/un-sounds-clarion-call-over-irreversible-climate-impacts-by-humans-2021-08-09> [<https://perma.cc/4256-D2GF>] (“The pledges to cut emissions made so far are nowhere near enough to start reducing level of greenhouse gases - mostly carbon dioxide (CO<sub>2</sub>) from burning fossil fuels - accumulated in the atmosphere.” (emphasis omitted)).

143. For a discussion of supply chain problems, see Sourgens, *supra* note 12.

144. For a discussion of carbon capture, see Sempertegui & Sourgens, *supra* note 10.

145. See Damian Carrington, *Climate Tipping Points Could Topple Like Dominos, Warn Scientists*, GUARDIAN (June 3, 2021, 12:34 PM), <https://www.theguardian.com/environment/2021/jun/03/climate-tipping-points-could-topple-like-dominoes-warn-scientists> [<https://perma.cc/97RW-3EWQ>].

components for deployment such that deployment can occur if it is indeed needed.<sup>146</sup>

The *second* need for flexibility concerns the actual *deployment* of SRM. Climate science continues to play catch up to real life events.<sup>147</sup> As it stands, the science consistently has underestimated the pace of climate change.<sup>148</sup> Consequently, it is entirely possible that societies around the world will learn of impending climate disasters with only very short notice.<sup>149</sup> Design and deployment of SRM technologies may need to be scrambled with less notice than we would have thought to avoid these tipping points.<sup>150</sup> The governance framework must account for this potential need or else risk being undone by an emergency precisely when it is needed most.

The point of flexibility must be understood for what it is. If past is prologue, States *will deploy* SRM as a last-ditch effort to prevent a climate catastrophe.<sup>151</sup> At that time, imploring States that such an act would be illegal would be of no practical consequence.<sup>152</sup> Governance must therefore build toward an acceptable process of SRM development and toward early deployment to be successful. The goal of networked governance I outline here is to provide a flexible guide to SRM decision-making leading toward its eventual deployment. Any further attempt to prohibit its deployment is simply not attuned to human nature and what humans will do in circumstances where

146. Sikina Jinnah et al., *Governing Climate Engineering: A Proposal for Immediate Governance of Solar Radiation Management*, 11 SUSTAINABILITY 3954, 3956–57 (2019).

147. For a discussion of risk-mitigation management in light of this problem, see Frédéric G. Sourgens, *The Precaution Presumption*, 31 EUR. J. INT'L L. 1277 (2020).

148. Naomi Oreskes et al., *Scientists Have Been Underestimating the Pace of Climate Change*, SCI. AM. (Aug. 19, 2019), <https://blogs.scientificamerican.com/observations/scientists-have-been-underestimating-the-pace-of-climate-change> [<https://perma.cc/KGB2-Y4C6>].

149. Timothy M. Lenton et al., *Climate Tipping Points—Too Risky to Bet Against*, 575 NATURE 592, 592 (2019) (“[S]everal cryosphere tipping points are dangerously close . . .”).

150. *See id.*

151. *See* Daniel Grossman, *Geoengineering: A Worst-Case Plan B? Or a Fuse Not to Be Lit?*, YALECLIMATECONNECTIONS (June 8, 2021), <https://yaleclimateconnections.org/2021/06/geoengineering-a-worst-case-plan-b-or-a-fuse-not-to-be-lit> [<https://perma.cc/GV6W-SWJK>] (noting predictions of inevitable deployment of SRM from 1974 onwards).

152. *See* Sourgens, *supra* note 34, at Part III.

their bare survival is at stake. Nor is it attuned to the legal claims of necessity and emergency.<sup>153</sup>

### *B. Inclusion*

Flexibility is clearly not enough. The asserted need for flexibility to respond to an alleged climate emergency with SRM deployment leads to a breakdown in governance when it matters most—such an emergency would cut States potentially harmed by SRM deployment out of decision-making processes in the State deploying SRM.<sup>154</sup> The potentially harmed third State(s) outside of the deploying State would likely claim that the impending SRM action itself presents an emergency and would do all in its power to interdict it.<sup>155</sup> This sets up a vicious governance circle that has no easy way out. Holding off on SRM only makes the climate emergency more pressing; deploying more radical SRM approaches is only likely to set up stronger claims of emergency and more vigorous attempts at SRM interdiction. To avoid this scenario, we must take into account reasoned objections to specific SRM proposals as early as possible during the development of SRM protocols. Waiting until the eventual deployment of SRM is clearly too late.<sup>156</sup>

#### 1. Thin Conceptions of Consent

To avoid this problem, there is an additional need for governance beyond flexibility: SRM governance must be highly *inclusive*. In the first place, it needs to be domestically inclusive. But just as importantly, it needs to include foreign parties. This idea of inclusivity goes back to an idea of *consent*—for SRM governance to be legitimate, it needs to have the consent of those upon whom SRM could be unleashed.

True inclusivity demands that any regulatory SRM dialogue requires *more than a thin conception of consent*.<sup>157</sup> A thin conception of consent would be satisfied if everyone affected by

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153. See sources cited *supra* note 34.

154. See Sourgens, *supra* note 34, at 112–24.

155. See Craig Martin, *Geoengineering and the Use of Force*, OPINIO JURIS (Jan. 20, 2021), <https://craigmartin.com/2021/01/geoengineering-and-the-use-of-force> [<https://perma.cc/62FQ-D245>].

156. See *id.*

157. ADOM GETACHEW, *WORLDMAKING AFTER EMPIRE, THE RISE AND FALL OF SELF-DETERMINATION* 50 (2019).



an SRM rule had an opportunity to provide comments in a (foreign-led) administrative proceeding.<sup>158</sup> In a thin conception of consent scenario, the domestic regulator would continue to have wide discretion in shaping policy so long as it took into account the comments it received.<sup>159</sup>

A thin conception of consent is intuitively problematic. *First*, take, for instance, subsistence farmers in India affected by SRM decisions in the United States; it is unlikely these farmers would in fact participate in U.S. notice-and-comment proceedings.<sup>160</sup> Granting them an opportunity to speak would do reasonably little to make sure that their concerns are in fact incorporated in policymaking given that they are *unlikely to learn of the opportunity* in the first place.<sup>161</sup> To call such an approach “inclusive” would therefore not take seriously the concerns of such subsistence farmers.

*Second*, a thin conception of consent does not provide affected persons with the *information needed to comment* in a timely manner. Rather, policymaking can move forward behind closed doors. Comment is sought when reasonable alternatives to the one proposed by the regulator are few.<sup>162</sup> And even then, important information is not always exchanged in a transparent manner.<sup>163</sup> Thin conceptions of consent are likely to lead to similar problems in the SRM context, given the stakes.

*Third*, and relatedly, a thin conception of consent does not allow affected persons to have *authorship and agency* with regard to the formulation of the rules that will end up governing

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158. *See id.*

159. *See id.* For an account of participation in agency rulemaking as against settlement efforts, see Seema Kakade, *Remedial Payments in Agency Enforcement*, 44 HARV. ENV'T L. REV. 117, 119 (2020).

160. *See* Ayelet Berman, *Taking Foreign Interests into Account: Rulemaking in the US and EU*, 15 INT'L J. CONST. L. 235, 241 (2017) (“[O]ther kinds of impacts on foreigners (e.g., health, environmental, social) are not flagged and can go unnoticed.”). For a recent scientific discussion of the potential relationship between SRM and Indian monsoons, see Mansi Bhowmick et al., *Response of the Indian Summer Monsoon to Global Warming, Solar Geoengineering and its Termination*, 11 SCI. REPS., no. 9791, 2021, at 1.

161. *See* Berman, *supra* note 160, at 241.

162. *See* Quechan Tribe of Fort Yuma Indian Reservation v. U.S. Dep't of Interior, 755 F. Supp. 2d 1104 (S.D. Cal. 2010).

163. *See id.*; Elizabeth Kronk Warner et al., *Changing Consultation*, 54 UC DAVIS L. REV. 1127, 1152–54 (2020) (discussing caselaw involving claims as to alleged violations of statutory consultation requirements).

them.<sup>164</sup> Rather, authorship would remain in the hands of a (foreign) regulator.<sup>165</sup>

**Fourth**, and finally, this thin conception of consent as a matter of logic does little for *coordinating responses* between different States. Even if each regulator applied a thin conception of consent globally, each regulator would simply continue to make its own domestic policy. It would not strive to make policy as part of a broader global plan of action.

Given these problems, it should be unsurprising that this thin conception of consent is subject to a strong critique from anti-colonialist authors such as Professor Adom Getachew.<sup>166</sup> Thin conceptions of consent, argues Professor Getachew, are tools of oppression.<sup>167</sup> They do not give equal moral agency to those immediately affected by a particular decision.<sup>168</sup> And the decision is made in faraway power centers that have little to no regard for the welfare of those whom it affects.<sup>169</sup>

## 2. Strong Conceptions of Consent

It is therefore equally intuitive that any desirable SRM governance paradigm must rely upon a stronger conception of inclusion and consent. Persons affected by SRM must not be subject to the arbitrary power of those developing or deploying SRM. What makes such power arbitrary is a structural question: those affected by a decision are excluded from actual decision-making because they are excluded from decision-making processes and decision-making structures.<sup>170</sup> In a thin conception of consent, they at most enjoy a limited right of submitting comments to decision-makers. But they are not active participants in designing decisions or deliberating choices. In other words, thin consent precisely disguises arbitrary exercises of power because it does not include the voices of affected persons on an equal footing.

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164. For a discussion of similar concerns in the context of the Dakota Access Pipeline, see Warner et al., *supra* note 163 at 1166–68.

165. *See id.*

166. GETACHEW, *supra* note 157, at 50–71.

167. *See id.*

168. *Id.*

169. *Id.*

170. *See* PHILIP PETTIT, REPUBLICANISM: A THEORY OF FREEDOM AND GOVERNMENT 90–92 (1999).

A strong conception of consent and inclusion reverses these attributes of a thin conception of consent. **First**, a strong conception of consent solicits input from affected persons. It is not enough that these persons have standing to make comments in a proceeding of which they know little. This reversal of consent requirement is nothing novel. Rather, it is a typical requirement of community consent in infrastructure and tribal consent in energy projects.

**Second**, a strong conception of consent requires a significant exchange of information at the earliest feasible time.<sup>171</sup> This exchange of information is necessary precisely because available information conditions comments.<sup>172</sup> And the sooner information is exchanged, the more effectively comments can guide decision-making because the information can intervene before significant expenditures have been made in a problematic direction.<sup>173</sup>

**Third**, a strong conception of consent requires that affected communities have an ability to take a hand at regulatory drafting.<sup>174</sup> They must have proposal rights rather than just rights to comment on the proposals of others.<sup>175</sup> They must have active rights to participate in decision-making.<sup>176</sup> Affected communities cannot be relegated to the status of passive participants.<sup>177</sup>

A strong conception of consent also reverses the fourth problem I identified in the context of thin consent above. Rather than leading to arbitrary regulatory approaches, a strong conception of consent can lead to paralysis.<sup>178</sup> Requiring a strong conception of consent can tie a regulator's hands.<sup>179</sup> Requiring strong conceptions of consent, even in emergency situations, therefore risks succumbing to the emergency.<sup>180</sup>

Intuitively, flexibility and inclusion appear to be in tension with each other. Now we have a better understanding why that

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171. Warner et al., *supra* note 163, at 1161.

172. Quechan Tribe of Fort Yuma Indian Rsrv. v. U.S. Dep't of Interior, 755 F. Supp. 2d 1104, 1104 (S.D. Cal. 2010).

173. *See id.*

174. *See* GETACHEW, *supra* note 157, at 50–71.

175. *Id.*

176. *Id.*

177. *Id.*

178. *See* David Takacs, *Environmental Democracy and Forest Carbon (REDD+)*, 44 ENV'T L. 71, 118 (2014).

179. *See id.*

180. *See id.*

is. SRM has potentially far-reaching implications for those affected by it, which increases the need for a strong conception of consent. But at the same time, the need for flexibility makes it difficult to give full voice to those affected by decisions. There is thus a pull toward thinner conceptions of consent. Both flexibility and inclusion thus are poised to fight each other to a stalemate unless governance processes provide a means to reconcile and leverage this tension.

Identifying this problem is crucial for devising a governance solution. The goal must be to build a model that is capable of generating meaningful global consultation. Such consultation must be able to yield flexible results, rather than lead to a one-size-fits-all approach. And as I will submit, the best way to secure these two goals is to follow a bottom-up governance approach. The reason for this choice is simple: bottom-up governance has a track record for successfully navigating the flexibility-inclusion dilemma identified so far in this Article.

### III. THE DARK SUN NETWORK

In the remainder of this Article, I develop how a networked, bottom-up governance approach can solve the SRM governance challenge outlined above. Networked governance provides a means for flexible problem solutions. It also provides a means for implementing a meaningful strong conception of consent. Networked, bottom-up governance is frequently associated with cyberspace.<sup>181</sup> In fact, this decentralized approach to governance from the grassroots up is part of cyberspace's founding mythology.<sup>182</sup> Cyberspace, of course, did not invent bottom-up, networked governance.<sup>183</sup> Rather, it adopted as its own the

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181. David R. Johnson & David Post, *Law and Borders—The Rise of Law in Cyberspace*, 48 STAN. L. REV. 1367, 1387–91 (1996); Paul Schiff Berman, *The Globalization of Jurisdiction*, 151 U. PA. L. REV. 311, 534 (2002); Milton Mueller, *Communications and the Internet*, in THE OXFORD HANDBOOK OF INTERNATIONAL ORGANIZATIONS 535, 541 (Jacob Katz Cogan et al. eds., 2016).

182. For a discussion of the literature arguing that such a bottom-up approach is inappropriate for cyberspace and therefore a myth, see Dan Hunter, *Cyberspace as Place and the Tragedy of the Digital Anticommons*, 91 CAL. L. REV. 439, 450 (2003). For a full discussion of the nature of cyberspace as a true commons, see Frédéric G. Sourgens, *Cyber-Nuisance*, 42 U PA. J. INT'L L. 1005 (2021).

183. See Ralf Michaels & Nils Jansen, *Private Law Beyond the State? Europeanization, Globalization, Privatization*, 54 AM. J. COMP. L. 843, 883 (2006) (embedding cyber-governance in the broader private, international law governance discourse). For the purposes of this Article, bottom-up governance does not mean

existing governance approaches to global commerce (such as global finance, international sales transactions for raw materials, or finished goods).<sup>184</sup> To this day, bottom-up governance remains one of the key features of international private governance in both the brick-and-mortar world and in virtual reality.<sup>185</sup>

As we will see in this Part, the story of bottom-up governance as a viable approach for global *public* governance problems is a story of three scholar-diplomats: Janet Koven Levit, Harold Hongju Koh, and Anne-Marie Slaughter.<sup>186</sup> Bottom-up governance is not focused in the first instance on a formal, substantive legal norm such as, say, an international treaty.<sup>187</sup> Instead, bottom-up governance connects administrative agencies across States to solve shared problems in a collaborative fashion through engagement and exchange. Their work has deeply influenced the existing structure of global climate regime.<sup>188</sup> A bottom-up approach to SRM governance is a natural continuation of their story. And for the reasons that drove Levit, Koh, and Slaughter to bottom-up governance—its flexibility, the inclusive manner in which it builds consensus,

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soft law governance. Instead, it means networked governance as discussed in this Section.

184. *See id.* For a discussion of the development of these broader bottom-up governance processes in transnational law, see KLAUS PETER BERGER, *THE CREEPING CODIFICATION OF THE NEW LEX MERCATORIA* 1–13 (2d ed. 2010).

185. *See* GERALF-PETER CALLIESS & PEER ZUMBANSEN, *ROUGH CONSENSUS RUNNING CODE: A THEORY OF TRANSNATIONAL PRIVATE LAW* 134–52 (2d ed. 2010).

186. *See* Janet Koven Levit, *A Bottom-Up Approach to International Lawmaking: The Tale of Three Trade Finance Instruments*, 30 *YALE J. INT'L L.* 125 (2005); Harold Hongju Koh, *Triptych's End: A Better Framework to Evaluate 21<sup>st</sup> Century International Lawmaking*, 126 *YALE L.J. FORUM* 338 (2017) (hereinafter Koh 2017); HAROLD HONGJU KOH, *THE TRUMP ADMINISTRATION AND INTERNATIONAL LAW* (2018) [hereinafter Koh 2018]; SLAUGHTER, *supra* note 55.

187. Benedict Kingsbury et al., *Global Administrative Law and Deliberative Democracy*, in *THE OXFORD HANDBOOK OF THE THEORY OF INTERNATIONAL LAW* 526, 528–29 (Anne Orford & Florian Hoffmann eds., 2016).

188. For example, Harold Koh served as legal adviser to the State Department and Anne-Marie Slaughter as director of policy planning at the State Department as the new bottom-up approach to climate governance in U.S. foreign policy began to take shape. *Anne-Marie Slaughter*, *NEW AM.*, <https://www.newamerica.org/our-people/anne-marie-slaughter> [https://perma.cc/4W23-KPRW] (Slaughter was the director of policy planning for the U.S. State Department from 2009 to 2011); *see* *Harold Hongju Koh*, *YALE L. SCH.*, <https://law.yale.edu/harold-hongju-koh> [https://perma.cc/H34G-9LAC] (Koh was the legal adviser to U.S. State Department from 2009 to 2013). The switch to a bottom-up approach became apparent in the Copenhagen Conference of the Parties in 2009 and the period immediately thereafter. *See* Radoslav S. Dimitrov, *Inside Copenhagen: The State of Climate Governance*, 10 *GLOBAL ENV'T POL.* 18, 21–22 (2010).

and its ability to deliver coordinated results even before that consensus is firmly established—bottom-up governance is also a particularly good fit for solving our SRM governance impasse.

### A. *Bottom-Up Global Governance*

Why bottom-up governance? Janet Levit classically answers this question by pointing out a bias in legal scholarship.<sup>189</sup> Legal scholars prefer a top-down governance lens (legislators legislate and diplomats conclude treaties and the like to solve governance problems). Yet, this top-down approach leaves much of actual global governing (that is, how decisions are actually made and implemented in the real world) by the wayside.<sup>190</sup> In fact, even accounts that suggest that global governance is far less monolithic than top-down approaches would “nonetheless relegate most of their analysis to a top-down approach, usually starting with a state-based treaty in the context of a banner headline national security or foreign relations question.”<sup>191</sup> As former assistant general counsel to the U.S. Export-Import Bank and associate general counsel of TradeCard, Inc. (and thus an active participant in bottom-up governance processes in the government and private sector), Levit knew that there is a lot more to global governance than the traditional top-down approach would suggest.<sup>192</sup> Not only that, the missing piece (bottom-up governance) may interact and “be mutually reinforcing and sustaining” with the traditional top-down perspective.<sup>193</sup> It is therefore necessary that bottom-up governance be brought to the fore.

The key difference between a top-down and a bottom-up governance approach is that a top-down approach looks to specific instruments that lay down new formal rules agreed upon ahead of time by legislators and diplomats in legislative deliberations and treaty negotiations.<sup>194</sup> Before the deliberations reach that crucial stage of passing the text of a

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189. See Levit, *supra* note 186, at 129.

190. See *id.*

191. *Id.* at 181.

192. See *id.* at 126. TradeCard, Inc. “designs and develops supply chain management software.” *TradeCard Inc.*, BLOOMBERG, <https://www.bloomberg.com/profile/company/7623771Z:US> [https://perma.cc/89XJ-WU6T].

193. Levit, *supra* note 186, at 153.

194. *Id.* at 126–27.

statute into law or signing a treaty, legislating is pretty vacuous work—bills do not have any legal force of their own, after all. Once there is law or treaty, however, the rules the law or treaty embody have immediate, concrete, and full authority to constrain behavior.<sup>195</sup> One upshot is that law through a top-down lens is either there or it is not; it is never in between.<sup>196</sup>

Bottom-up governance approaches place emphasis precisely on the in-between of actual governance practice. In a private law setting, we are used to merchants dealing with each other outside of the firm strictures of classic contract law—such dealings gave us Cardozo’s *Lady Duff Gordon* and Llewellyn’s article 2 of the UCC.<sup>197</sup> We are perhaps less used to this kind of interaction in a public law setting. But the same kind of exchange takes place here, too. And this type of exchange is the focus of bottom-up governance, which is not on agreement on a formal, substantive legal norm.<sup>198</sup> Rather, it considers how one can channel the power of domestic regulators and diplomats, private enterprise, and civil society toward a common goal.<sup>199</sup>

Once one sees bottom-up governance in action, it is hard to unsee. Consider a domestic U.S. example: as of yet, there is no federal standard governing how much of the electricity generated and sold in the United States must come from renewable energy sources.<sup>200</sup> Despite this lack of federal mandate, “states began enacting RPS [renewable portfolio standard] laws primarily in the 1990s, and they now exist in thirty states.”<sup>201</sup> RPS laws “require electric utilities in the state to obtain a certain percentage of the electricity they sell to customers from renewable energy resources by a set date, such as 20 percent by 2025 or 15 percent by 2030.”<sup>202</sup> There is a discernible move toward such laws—and (within reason) toward

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195. See DAVID JENS OHLIN, *THE ASSAULT ON INTERNATIONAL LAW* 54 (2015).

196. See Anna di Robilant, *Genealogies of Soft Law*, 54 AM. J. COMP. L. 499, 505–06 (2006).

197. *Wood v. Lucy, Lady Duff Gordon*, 118 N.E. 214 (N.Y. 1917); Ingrid Michelsen Hillinger, *The Article 2 Merchant Rules: Karl Llewellyn’s Attempt to Achieve the Good, the True, the Beautiful in Commercial Law*, 73 GEO. L.J. 1141 *passim* (1985).

198. See Benedict Kingsbury et al., *supra* note 187, at 528–29.

199. *Id.*

200. Jesse M. Cross & Shelley Welton, *Making Federalism Work: Lessons from Health Care for the Green New Deal*, 55 U. RICH. L. REV. 765, 821 (2021).

201. Alexandra B. Klass & Shantal Pai, *The Law of Energy Exports*, 109 CAL. L. REV. 733, 793–94 (2021).

202. *Id.*

greater ambition within them all without a federal mandate.<sup>203</sup> Critically, once States started moving in that direction, they apparently influenced others to follow suit.<sup>204</sup> Renewable energy policy in the United States therefore is very much an example of bottom-up governance.<sup>205</sup> This is not a lone example.<sup>206</sup> Rather, governments frequently coalesce around common policy values on an apparently voluntary basis even when there is no realistic hope of achieving a top-down agreement on such common policies.<sup>207</sup> And frequently, one can even discern a momentum or influence such policies have on policies used by other governments.<sup>208</sup>

### *B. Assessing a Bottom-Up Approach*

There are two central and related benefits of such bottom-up governance. **First**, it can garner **truly broad participation**.<sup>209</sup> It is not yet necessary to sign up for fully binding commitments ahead of time. One can do something less—such as agree in principle while waiting to see whether that agreement will in fact yield the desired results.<sup>210</sup> That is, bottom-up governance is (to a point) governance by test balloon.<sup>211</sup> **Second**, and just as importantly, bottom-up governance therefore has a certain **legal economy**—it looks to mobilize agents with existing power to address a problem instead of insisting on reinventing the wheel from scratch.<sup>212</sup>

These two benefits track and address our flexibility and inclusion dilemma. Bottom-up governance is **genuinely**

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203. *Id.*

204. *See id.*

205. Hari M. Osofsky & Janet Koven Levit, *The Scale of Networks?: Local Climate Change Coalitions*, 8 CHI. J. INT'L L. 409, 416–17 (2008); Shelley Welton & Joel Eisen, *Clean Energy Justice: Charting an Emerging Agenda*, 43 HARV. ENV'T L. REV. 307, 325 (2019) (noting the bottom-up nature of current efforts as well as their limitations).

206. *See* Welton & Eisen, *supra* note 205, at 325.

207. *See* Levit, *supra* note 186, at 125–30.

208. *Id.*

209. Peter Lawrence, *International Relations Theory*, in THE OXFORD HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW 153, 162–63 (Lavanya Rajamani & Jacqueline Peel eds., 2021).

210. Frédéric G. Sourgens, *The Paris Paradigm*, 2019 U. ILL. L. REV. 1637, 1690–98.

211. *Id.*

212. Lawrence, *supra* note 209, at 162–63.



**inclusive.**<sup>213</sup> Because it governs by test balloon, it allows all participants to make proposals.<sup>214</sup> It then subjects these proposals to debate between participants in the governance process.<sup>215</sup> This debate in turn allows for a more intelligent formulation of policies because there is now more data from test balloons to see what actually works.<sup>216</sup> Bottom-up governance empowers participants to try their hand, demonstrate proof of concept, and continue to work toward common goals over time.<sup>217</sup> And this approach encourages the timely exchange of information to improve one's own governance response and convince others that one, in fact, has provided proof of concept.

In short, bottom-up governance avoids the inclusion problems associated with top-down approaches. No one person holds the regulatory pen at any one time. There is no active norm author and passive norm audience—rather, there are only diverse and yet more or less equal norm authors. That means that the dynamics of weak consents cannot easily develop. Similarly, top-down approaches see comments as potential detractors from a desired outcome. Bottom-up approaches, on the other hand, look at comments as engagement toward joint action and therefore welcome them far more readily.

At the same time, bottom-up governance is also far **more flexible**. It does not insist on any one approach and leaves a broad field of possible action by governance participants. Short of action that is patently inconsistent with broadly defined shared goals, it allows participants to float test balloons. It thus encourages flexibility—and allows fast action—far more readily than a top-down approach could.

Climate negotiations are a good example of how bottom-up governance overcame a flexibility-inclusion dilemma that had bedeviled climate law since the Kyoto Protocol.<sup>218</sup> Harold Koh, then legal adviser to the U.S. State Department, was part of the team that deployed this bottom-up approach in the context of climate negotiations.<sup>219</sup> These efforts culminated in the conclusion of the Paris Agreement.<sup>220</sup> This was a significant

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213. See Sourgens, *supra* note 210, at 1690–98.

214. *Id.*

215. *See id.*

216. *See id.*

217. *See supra* Section III.A.

218. Koh 2017, *supra* note 186, at 435.

219. *Id.* at 435.

220. *Id.*

achievement; the “Paris Agreement is the first universal agreement on climate change that is legally binding.”<sup>221</sup> It leverages the expertise of existing regulatory processes in member States to achieve global climate outcomes.<sup>222</sup> And the Agreement would have utterly failed to come to fruition had it insisted on following a top-down model.<sup>223</sup>

This development was purposeful. Koh noted in his tenure as legal adviser that “international legal engagement has become about far more than just treaties and executive agreements.”<sup>224</sup> Specifically, it deviated from the top-down approach to climate change prior to the Copenhagen climate conference in 2009 “to a much more informal, politically binding, bottom-up Copenhagen blueprint infused with stronger norms and with greater symmetry between the duties of developed and developing nations.”<sup>225</sup> Rather than mandating emissions quotas, this bottom-up approach engaged State decision-makers through voluntary contributions toward greenhouse gas emissions reductions.<sup>226</sup> It required that reductions become increasingly more ambitious over time.<sup>227</sup> It thus did on a global scale what happened in the context of renewable portfolio standards on the domestic scale: it leveraged bottom-up governance.

But what makes the Paris Agreement such a success is not just any kind of bottom-up governance approach. Rather, just as Levit predicted, traditional top-down framework instruments and bottom-up governance approaches are mutually reinforcing.<sup>228</sup> The mutual reinforcement between top-down and bottom-up approaches is clear—when comparing the Paris climate governance reports with renewable portfolio standards, the Paris Agreement accomplished goals that the portfolio standards have been unable to complete. It provided a clear mechanism for Paris Agreement members to work together

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221. Rafael Leal-Arcas & Antonio Morelli, *The Resilience of the Paris Agreement: Negotiating and Implementing the Climate Regime*, 31 GEO. ENV'T L. REV. 1, 3 (2018).

222. See DANIEL BODANSKY ET AL., INTERNATIONAL CLIMATE CHANGE LAW 209 (2017).

223. See Koh 2017, *supra* note 186, at 435.

224. Koh 2018, *supra* note 186, at 338.

225. Koh 2017, *supra* note 186, at 435.

226. See Koh 2018, *supra* note 186, at 352.

227. See *id.* at 360.

228. Levit, *supra* note 186, at 153.

toward a shared goal.<sup>229</sup> This mechanism used a traditional top-down governance instrument—a treaty—to create this additional momentum.<sup>230</sup> This combination strengthened the ambition of domestic climate action by providing a forum for coordination of such action on a global scale.<sup>231</sup> But there is no constitutional magic at work in the combination of top-down instruments like the Paris Agreement with bottom-up governance approaches. States, such as California, or cities, such as New York, could enter into similar agreements with each other without running afoul of constitutional limitations (and they have in fact begun to do so).<sup>232</sup> One strength of bottom-up governance is that it is flexible all the way down.

### C. *Bottom-Up Governance and SRM*

Bottom-up governance approaches are a helpful starting point for SRM governance. SRM governance requires a broad, global participation given the global impacts of SRM. Bottom-up governance permits us to get going on governance now, even before there is a formal, top-down multilateral instrument governing its use. The flexibility of bottom-up governance also makes it possible to build toward a consensus on SRM governance organically rather than requiring full buy-in on means and method before fully studying the various possible SRM approaches. As the example of renewable portfolio standards in the United States suggests, the process may well be messy and lead to inconsistent results at first.<sup>233</sup> But these results are likely to converge and bring new regulators in from the sidelines at a time when broadening participation is critical.<sup>234</sup>

Before moving to how to launch bottom-up SRM governance, a point of distinction is in order. The bottom-up governance approach discussed in this Section has important similarities, but also significant differences, to another style of governance

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229. See BODANSKY ET AL., *supra* note 222.

230. U.N. Framework Convention on Climate Change Conference of the Parties, Twenty-First Session, *Adoption of the Paris Agreement*, U.N. Doc. FCCC/CP/2015/L.9/Rev.1 (Dec. 12, 2015) [hereinafter *Paris Agreement*].

231. *Id.*

232. Frédéric G. Sourgens, *States of Resistance*, 14 DUKE J. CONST. L. & PUB. POL'Y 91, 133–34 (2019).

233. See sources cited *supra* notes 200–201.

234. *Id.*

that also has been labelled “bottom-up governance”—soft law governance. Soft law governance proposes a set of standards, typically developed by experts.<sup>235</sup> Examples include model contracts that, if adopted, set trade usage for their terms or model rules that can be consulted by relevant decision-makers in the exercise of their sound discretion even in the absence of ex ante agreement.<sup>236</sup> These standards on their face are nonbinding.<sup>237</sup> Yet, through their increased use by core stakeholders, these standards become the de facto rules governing a particular enterprise.<sup>238</sup>

In the SRM context, the 2015 *Draft Code of Conduct for Responsible Scientific Research Involving Geoengineering* is one such example.<sup>239</sup> In nineteen draft articles, this Code seeks to sketch not just how parties ought to communicate with each other.<sup>240</sup> It also sets substantive boundaries of precaution and use and sketches general principles to be followed.<sup>241</sup> Many of the procedural prescriptions on the importance of environmental assessments, public participation, and transparency are indeed central to any bottom-up governance approach.<sup>242</sup>

This is not what I mean by bottom-up governance. My bottom-up governance approach is far less substantively prescriptive. An example can help illustrate the distinction. The Code includes a strong precautionary principle; it requires the adoption of precautionary measures against harm from geoengineering.<sup>243</sup> The Code’s use of precaution proposes a value preference.<sup>244</sup> Our approach, on the other hand, leaves this value question of precaution open. Problematically for us, the

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235. Kenneth W. Abbott & Duncan Snidal, *Hard and Soft Law in International Governance*, 54 INT’L ORG. 421, 441–43 (2000).

236. *E.g.*, *Forms*, AAPL (2019), <https://www.landman.org/resources/contract-center-and-forms> [https://perma.cc/2WJP-ZZHW]; INT’L BAR ASS’N, IBA RULES ON THE TAKING OF EVIDENCE IN INTERNATIONAL ARBITRATION 5 (2020) (“The Rules provide mechanisms for the presentation of documents, witnesses of fact and expert witnesses, inspections, as well as the conduct of evidentiary hearings. The Rules are designed to be used in conjunction with, and adopted together with, institutional, ad hoc or other rules or procedures governing international arbitrations.”).

237. Abbott & Snidal, *supra* note 235, at 439.

238. *See* di Robilant, *supra* note 196, at 510.

239. *Code of Conduct*, *supra* note 39, at 9–10.

240. *Id. passim*.

241. *Id.* at arts. 5, 8, 9.

242. *Id.* at arts. 13–15, 18.

243. *Id.* at 43.

244. *See id.* at 43.

Code precisely prejudices a key question that requires deliberation: how does one resolve a clash between climate precaution counselling and SRM precaution?<sup>245</sup> Climate precaution would favor the rapid deployment of uncertain SRM technologies to forestall hitting uncertain but potentially catastrophic climate tipping points. SRM precaution would counsel against such deployment because the SRM technology itself might (but is not certain to) do significant harm in its own right. The Code has an *ex ante* answer: SRM precaution trumps climate precaution.<sup>246</sup> That is precisely the kind of debate that this bottom-up approach hopes to keep open for concrete, factual contestation, as opposed to *ex ante* predetermination.<sup>247</sup> This approach is bottom-up “all the way down.” The Code’s soft law approach is not.

This distinction is purposeful: I hope to provide a governance framework that imposes as few external substantive constraints on global SRM decision-making as possible. My point is that the way out of SRM governance deadlock is procedural rather than substantive. The process just needs to be prudently flexible and robustly inclusive. Approaches like the Code demand something else.

This is not to say that soft law approaches like the Code’s and the bottom-up governance approach could not work together. The research done by the Code’s working group is likely to prove instrumental within a bottom-up governance network once it has been formed, given the expertise of the Code’s expert group.<sup>248</sup>

But even then, use of the Code requires caution. The difference between thin and strong conceptions of consent and inclusivity turn exactly on the difference between passive assent and active deliberation.<sup>249</sup> Lobbying for the early acceptance of a soft law document like the Code runs a risk: it could hollow out consent. This risk is particularly acute in the SRM context because Global South States face an information deficit even though they are likely to be heavily impacted by SRM and climate change. The Code could cajole them into a passive

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245. *Id.*

246. *Id.*

247. See Sourgens, *supra* note 147.

248. *Code of Conduct*, *supra* note 39, at 2.

249. GETACHEW, *supra* note 157, at 50–71; see also PETTIT, *supra* note 170, at 90–92.

exercise of acceptance of the work of experts.<sup>250</sup> Nothing could be more dangerous for inclusivity.<sup>251</sup> The Code therefore cannot jump-start bottom-up governance. Jump-starting bottom-up governance requires a particular kind of State action. This leaves the questions of what kind of State action and how that State action can improve the quality of engagement and bottom-up governance—questions that I will address in the next Section.

#### *D. The Network Effect*

Bottom-up governance sounds like a great slogan—but how does it actually work? And how does we ensure that bottom-up governance is, in fact, a deliberative form of governance? Both of these questions are critical in assessing whether this governance approach is capable of overcoming the current problems faced by SRM governance. Can we get broad participation around meaningful standards that have been appropriately vetted and give a sufficient voice to those most directly affected by an SRM approach prior to them being subjected to its consequences?

Anne-Marie Slaughter is perhaps the leading voice on these fundamental questions.<sup>252</sup> Slaughter is also one of the most respected international legal academics in the United States, having served as president of the American Society of International Law and director of policy planning for the U.S. State Department.<sup>253</sup> Slaughter—like Koh and Levit—approaches questions of global governance as both an academic and an active participant in global governance processes.

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250. The expertise of the group skews heavily in favor of technical and international legal expertise and may be less well attuned to the perspective of developing States. *See Code of Conduct*, *supra* note 39, at 2.

251. GETACHEW, *supra* note 157, at 50–71; *see also* PETTIT, *supra* note 170, at 90–92.

252. *See* Itamar Mann, *Dialectic of Transnationalism: Unauthorized Migration and Human Rights, 1993-2013*, 54 HARV. INT'L L.J. 315, 323 (2013).

253. *Governance*, AM. SOC'Y INT'L L., <https://www.asil.org/about/governance> [<https://perma.cc/8JYP-QWYN>]; *Anne-Marie Slaughter*, NEW AM., <https://www.newamerica.org/our-people/anne-marie-slaughter/> [<https://perma.cc/22GV-TQ82>]. The position of director of policy planning has a rank comparable to an assistant secretary of state, and the director is tasked with providing independent policy analysis to the secretary of state. *See Director of Policy Planning*, U.S. DEPT OF STATE, <https://history.state.gov/departmenthistory/people/principalofficers/director-policy-planning> [<https://perma.cc/WQ8Q-HD2C>].

Slaughter's principal point is that bottom-up governance occurs in transnational networks.<sup>254</sup> Regulators meet up to exchange and discuss common problems they face.<sup>255</sup> At the most informal level, regulators compare notes and take what they have learned into account when exercising their respective domestic authority.<sup>256</sup> Something as informal as participation on a conference panel can have this effect: a regulator could hear their counterpart present how they were able to solve a particularly thorny issue and think, "I could try that!"<sup>257</sup>

Frequently, what happens in networks is more than an exchange of information. Regulators have an honest desire to exchange knowledge regarding common problems and find a way to coordinate their responses.<sup>258</sup> Here, the exchanges are no longer left to chance depending on what conference panel a regulator attends. There is a targeted attempt to compare regulatory approaches.<sup>259</sup> The idea is to find means to, where possible, make such approaches compatible so as to improve regulatory outcomes and to ease the regulatory burden on those affected by regulation.

Finally, regulators can back up multilateral diplomatic exchanges.<sup>260</sup> They can provide the necessary input for meaningful diplomatic advances on technical regulatory issues.<sup>261</sup> Here, regulators take a role that is almost that of a diplomat and work with their counterparts to find solutions to global problems consistent with their respective expertise.<sup>262</sup>

In all three modes of networked governance discussed above, the exchange between regulators is deliberative.<sup>263</sup> It is the exchange between different regulators that makes it possible

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254. SLAUGHTER, *supra* note 55. The approach has been developed further by Kal Raustiala. Kal Raustiala, *The Architecture of International Cooperation: Transgovernmental Networks and the Future of International Law*, 43 VA. J. INT'L L. 1, 17–26 (2002).

255. SLAUGHTER, *supra* note 55.

256. *Id.*

257. *See id.*

258. *Id.*

259. *See id.* at 173 (discussing examples of such exchanges between the U.S. SEC and U.S. EPA and international interlocutors).

260. *Id.* at 63–64.

261. *Id.*

262. *Id.*

263. For a discussion on the question of how deliberative such engagement is and whether such deliberation suffices to address a democracy deficit in global administrative exchanges, see Benedict Kingsbury et al., *The Emergence of Global Administrative Law*, 68 L. & CONTEMP. PROBS. 15, 50 (2005).

to find effective solutions to common problems. Bottom-up governance approaches in these networks live from the exchange of ideas between different States, regulators, and civil society representatives. Each of these actors contribute to deliberation by making concrete regulatory proposals. Each actor exposes these proposals to scrutiny from other actors. And not only do they provide a forum in which such proposals could be scrutinized in concrete detail, they also provide experiments or models against which proposals can be appraised.

### 1. Transnational Networks

Transnational networks work differently from international treaties and top-down governance approaches. Regulators in transnational networks think of themselves as having shared problems, and they discuss and coordinate solutions.<sup>264</sup> Network participants take in peer regulatory experiences and have critical conversations with each other about the ins and outs of different policy alternatives to solve their shared problem.<sup>265</sup> As they have those discussions, they internalize the approaches of their peers as their own and use their domestic discretion in a manner consistent with those approaches.<sup>266</sup> Networks work because regulators recognize, internalize, and implement joint solutions to shared problems in what becomes a form of dynamic regulatory coordination between network participants after the fact.<sup>267</sup>

The Paris Agreement again can help to shine a light on this process. In the last Section, I highlighted that the Paris Agreement is one of the success stories for bottom-up governance.<sup>268</sup> How did we get there? Prior to the negotiation round that led to the Paris Agreement, leading emitters coordinated their proposed emissions reductions in Intended Nationally Determined Contributions (INDCs).<sup>269</sup> For example, the U.S. commitment, consisting of the promise to pass and

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264. See SLAUGHTER, *supra* note 55, at 49.

265. See *id.* at 250.

266. Harold Koh, *Transnational Legal Process*, 75 NEB. L. REV. 181, 186 (1996).

267. See *id.*

268. See Lavanya Rajamni & Emmanuel Guérin, *Central Concepts in the Paris Agreement and How They Evolved*, in THE PARIS AGREEMENT ON CLIMATE CHANGE: ANALYSIS AND COMMENTARY 74, 77–78 (Daniel Klein et al. eds., 2017).

269. *Id.*



maintain domestic regulation including the Clean Power Plan, was made strategically so as to invite reliance and coordination.<sup>270</sup> U.S. action demonstrably did induce States, such as the China, to respond in kind.<sup>271</sup> The participation of China and the United States was instrumental to the success of the Paris Agreement overall.<sup>272</sup> What made the Paris Agreement work, then, was an exchange between regulators that gave meaning to diplomatic pledges to reduce greenhouse gas emissions. And this exchange occurred in a networked environment, as Anne-Marie Slaughter has succinctly demonstrated.<sup>273</sup>

Regulators who participate in transnational networks are trusted and effective go-betweens because they both have important subject matter expertise and appropriate investigatory resources. Take, for example, the EPA.<sup>274</sup> The EPA has significant regulatory expertise with regard to air and water pollution.<sup>275</sup> Foreign regulators seeking to solve air pollution problems can look to the EPA as a helpful conversation partner because the EPA has subject matter expertise.<sup>276</sup> Just as importantly, the EPA also has access to data and an ability to investigate environmental problems.<sup>277</sup> It can commission scientific research.<sup>278</sup> It can do field work with other agencies to establish the health and safety impact of, say, water

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270. Koh 2017, *supra* note 186, at 359.

271. Joint Statement-U.S.-China Announcement on Climate Change, 2014 Daily Comp. Pres. Doc. 852 (Nov. 12, 2014).

272. See SOPHIA KALANTZAKOS, THE EU, US AND CHINA TACKLING CLIMATE CHANGE, POLICIES AND ALLIANCES FOR THE ANTHROPOCENE 109 (2017) (discussing the global importance of U.S.-China climate collaboration).

273. Anne-Marie Slaughter, *How to Succeed in the Networked World*, FOREIGN AFF. (Nov./Dec. 2016), <https://www.foreignaffairs.com/articles/world/2016-10-04/how-succeed-networked-world> [<https://perma.cc/F6LE-X7ZQ>].

274. See Daniel A. Farber, *Triangulating the Future of Reinvention: Three Emerging Models of Environmental Protection*, 2000 U. ILL. L. REV. 61, 62–68 (discussing the EPA's historical model of environmental regulation).

275. *Id.*

276. *About the Office of Policy*, EPA (Oct. 5, 2022), <https://www.epa.gov/aboutepa/about-office-policy-op> [<https://perma.cc/ZS4P-PU6T>].

277. *Research Centers, Programs, and Scientific Advisory Organizations*, EPA (July 27, 2022), <https://www.epa.gov/aboutepa/research-centers-programs-and-science-advisory-organizations> [<https://perma.cc/S6LQ-6WX6>].

278. *Id.*

contamination from lead pipes.<sup>279</sup> In the context of the Paris Agreement, it was rulemaking and proposed rulemaking by the EPA, like the Clean Power Plan, that paved the way for the U.S. INDCs (and thus the process of coordination with China and others).<sup>280</sup>

## 2. Regulator Responsibilities

Just as importantly, regulators themselves are under constraints to act diligently as a matter of domestic law.<sup>281</sup> For example, the EPA must follow rigorous notice-and-comment procedures when it wishes to make a new environmental

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279. *Basic Information about Lead in Drinking Water*, EPA (May 25, 2022), <https://www.epa.gov/ground-water-and-drinking-water/basic-information-about-lead-drinking-water#regs> [<https://perma.cc/N8SV-DZYX>].

280. The United States of America, Nationally Determined Contribution: Reducing Greenhouse Gases in the United States; A 2030 Emissions Target, <https://unfccc.int/sites/default/files/NDC/2022-06/United%20States%20NDC%20April%202021%20Final.pdf> [<https://perma.cc/H9WM-U8R6>] [hereinafter First US NDC]. For a discussion of the role of the Clean Power Plan, see Jonathan B. Wiener, *Precaution and Climate Change*, in *THE OXFORD HANDBOOK OF INTERNATIONAL CLIMATE CHANGE LAW* 163, 172–75 (Cinnamon Carlarne et al. eds., 2016). This regulatory authority has been hamstrung by the *West Virginia v. EPA* decision. *West Virginia v. EPA*, 142 S. Ct. 2587 (2022). The decision ruled that “[c]apping carbon dioxide emissions at a level that will force a nationwide transition away from the use of coal to generate electricity may be a sensible ‘solution to the crisis of the day.’ But it is not plausible that Congress gave EPA the authority to adopt on its own such a regulatory scheme in Section 111(d). A decision of such magnitude and consequence rests with Congress itself.”

*Id.* at 2616 (internal citation omitted). The decision applied the “major questions doctrine” to reach this result. *Id.* at 2610–14. The decision did not overrule *Massachusetts v. EPA* giving the EPA authority to regulate CO<sub>2</sub> emissions in the first place—reading between the lines of the decision, CO<sub>2</sub> emissions are within the scope of EPA authority so long as it regulates emissions in a manner that requires existing sources to operate more cleanly. “Prior to 2015, EPA had always set emissions limits under Section 111 based on the application of measures that would reduce pollution by causing the regulated source to operate more cleanly.” *Id.* at 2610. This would suggest that geoengineering approaches such as carbon capture utilization and storage may still present a viable option under existing statutory law. I will develop this point in later Article. For a discussion of what authority otherwise remains, see Amber X. Chen, ‘A Serious Setback:’ *Supreme Court Sides with West Virginia in West Virginia v. EPA*, *DAILY CALIFORNIAN* (July 4, 2022), <https://www.dailycal.org/2022/07/04/a-serious-setback-supreme-court-sides-with-west-virginia-in-west-virginia-v-epa> [<https://perma.cc/KC9S-5XFH>].

281. David S. Rubenstein, *Administrative Federalism as Separation of Powers*, 72 *WASH. & LEE L. REV.* 171, 231–35 (2015).

administrative rule or determination.<sup>282</sup> Administrative processes, in fact, frequently require regulators to engage actively with local stakeholders affected by an administrative decision.<sup>283</sup> In the energy context, this typically requires that regulators solicit input from affected communities and affirmatively share data with those communities at the earliest possible point in time.<sup>284</sup> The Clean Power Plan at the heart of the U.S. INDCs went through such a rigorous notice-and-comment process.<sup>285</sup>

The discourse between different global regulators, therefore, provides a source for subject matter expertise about, say, greenhouse gas emissions reductions. It also provides a means to hold decision-making accountable to those affected by regulation, either within the regulatory process itself or thereafter when regulation is challenged in the courts. Administrative agencies must follow administrative process and consult with affected communities.<sup>286</sup> And agencies are accountable because other political actors (legislatures, the executive more broadly, and the courts) will hold administrative agencies to account if they fail to do so.<sup>287</sup> The Clean Power Plan is one example of such accountability—its repeal was a campaign promise of then-candidate Trump, and its implementation was halted by the courts prior to a hearing of a full substantive challenge to the regulation.<sup>288</sup> Given these control models, and the incentives they set, administrative agencies have expertise in governance design as much as they have expertise in technical subject matters.<sup>289</sup> For example, the

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282. See Daniel A. Farber, *Regulatory Review in Anti-Regulatory Times*, 94 CHI.-KENT L. REV. 383, 419–22 (2019) (discussing the Clean Power Plan and its later rollback).

283. See, e.g., *Quechan Tribe of the Fort Yuma Indian Rsrv. v. U.S. Dep't of the Interior*, 755 F.Supp.2d 1104 (discussing approval of a new solar energy project).

284. *Id.*

285. See BLAKE EMERSON, *THE PUBLIC'S LAW: ORIGINS AND ARCHITECTURE OF PROGRESSIVE DEMOCRACY* 201–03 (2019).

286. Rubenstein, *supra* note 281, at 231–35.

287. David S. Rubenstein, "Relative Checks Towards": *Optimal Control of Administrative Power*, 51 WM. & MARY L. REV. 2169, 2223–40 (2010).

288. For a discussion of litigation surrounding the Clean Power Plan, see Sourgens, *supra* note 129, at 190–91.

289. See Jean Chemnick, *Biden Won't Revive Obama's Clean Power Plan. So Now What?*, CLIMATEWIRE (Feb. 9, 2021, 7:00 AM), <https://subscriber.politicopro.com/article/eenews/1063724547> [<https://perma.cc/W9XZ-D2BT>].

Biden Administration's pick to lead the EPA stated that he would not revive the Clean Power Plan as such and would look for other means to implement its goals indicating an adjustment to governance design.<sup>290</sup> The decision by the U.S. Supreme Court in *West Virginia v. EPA*, therefore, is not the body blow to climate regulation as it might at first appear.<sup>291</sup>

In fact, when different regulators interact with each other, they cannot simply adopt the approach of a foreign counterpart.<sup>292</sup> Rather, regulators will need to follow their respective domestic public law processes in place for the making of regulation.<sup>293</sup> Doing so ties coordinated global responses and shared problems firmly into existing public law accountability mechanisms and therefore lends legitimacy to coordinated global administrative decision-making.

Centrally, this form of global coordination provides greater accountability than ordinary treaty making. Administrative rulemaking, it is true, suffers its own accountability deficit.<sup>294</sup> But this accountability deficit is even greater in the context of traditional, top-down rulemaking by means of international treaties.<sup>295</sup> Treaties are traditionally negotiated by diplomats.<sup>296</sup> They are then approved wholesale, for example, by means of domestic ratification procedures.<sup>297</sup> In practice, this means that there is reasonably limited civil society input into the rules included in international treaties, with only informal avenues available in most instances.<sup>298</sup>

### 3. Law in Action

Networked, bottom-up governance has the benefit of enlisting domestic public law processes directly in global administrative action. This means that civil society actors have

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290. *Id.*

291. *Id.*

292. See Rubenstein, *supra* note 281, at 231–35.

293. See *id.*

294. David S. Rubenstein, *Delegating Supremacy?*, 65 VAND. L. REV. 1125, 1184–85 (2012).

295. Vasan Kesavan, *The Three Tiers of Federal Law*, 100 NW. U. L. REV. 1479, 1613–14 (2006).

296. See Timothy Meyer, *From Contract to Legislation: The Logic of Modern Lawmaking*, 14 CHI. J. INT'L L. 559, 569 (2014) (contrasting the traditional role of a diplomatic conference to bilateral prescriptive approaches).

297. See Kesavan, *supra* note 295, at 1613–14.

298. See *id.* at 1613.

a greater ability to interrogate decision-making earlier than in the traditional treaty context.<sup>299</sup> And they have an ability to steer conversations on specific points of contention rather than having to adopt or reject a finished treaty wholesale; they can, for instance, provide record evidence and legal and policy arguments in notice-and-comment procedures in a targeted manner.<sup>300</sup> The evidentiary record civil society actors created would then form the basis for administrative decision-making in a concrete manner that more directly impacts the process of global coordination.<sup>301</sup>

This leaves the question of how networked governance can lead to successful and effective global cooperation even in the absence of a top-down, treaty-based approach (or indeed any substantive *ex ante* agreement). Here, networks help explain how bottom-up governance works in much the same way as what we know from our private law experience. The exchange of apparently naked promises between merchants (and that such arrangements typically are met by performance) is not infrequent.<sup>302</sup> Justice Cardozo famously gave legal force to such arrangements in *Lady Duff-Gordon*, noting that “the law has outgrown its primitive stage of formalism when the precise word was the sovereign talisman, and every slip was fatal.”<sup>303</sup> The reason that such arrangements tend to be performed—and are

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299. For a discussion of potential for exclusion of civil society in the traditional treaty making paradigm, see Nahuel Maisley, *The International Right of Rights? Article 25(a) of the ICCPR as a Human Right to Take Part in International Law-Making*, 28 EUR. J. INT’L L. 89, 91–95 (2017). Maisley argues that article 25(a) of the International Covenant on Civil and Political Rights granting individuals a right to participate in public affairs also includes a right to participation in international lawmaking. *Id.* at 95–113. Maisley makes this argument in the traditional context of treaty making. *Id.* at 107–13. Networked governance would provide an intriguing alternative for the implementation of a right and would provide a more or less direct implementation of such a view as it treats international lawmaking as analogous to administrative rulemaking.

300. Thomas Lorenzen, *Undoing the Clean Power Plan: What Awaits President Obama’s Signature Environmental Regulation?*, 2017 NO. 1 RMMLF-INST 11, 11–9 (discussing notice-and-comment requirements in the context of the rollback of the Clean Power Plan); EMERSON, *supra* note 285, at 201–03 (discussing the notice-and-comment process by the Obama EPA in promulgating the Clean Power Plan).

301. Michael Barsa & David Dana, *Regulating During Emergencies*, 116 NW. U. L. REV. ONLINE 223, 227–29 (2021).

302. John E. Murray, *The Revision of Article 2: Romancing the Prism*, 35 WM. & MARY L. REV. 1447, 1456–57 (1994).

303. *Wood v. Lucy, Lady Duff-Gordon*, 118 N.E. 214, 214 (N.Y. 1917).

enforced by the courts when they are not—comes back to the good faith protection of reasonable reliance interests.<sup>304</sup>

Global networks function in much the same way. Regulators participate in networks and coordinate with their peers because they rely on the continued coordination and collaboration by others in return.<sup>305</sup> As they do so, they must filter this coordination and collaboration through their own respective domestic administrative law processes to secure buy-in for the policy and see to its domestic enforceability.<sup>306</sup> This, in turn, strengthens the buy-in of regulators because they can see that others are, in fact, moving to implement the result of networked governance decisions.

We can see this dynamic at work in the context of the Paris Agreement: once there was enough momentum behind INDCs, it became possible for other States to rely on the Paris process.<sup>307</sup> Those States found ways to make their own INDCs in reliance on the action of first movers.<sup>308</sup> This, in turn, paved the way for the Paris Agreement itself (including its temperature goal compromise).<sup>309</sup> Yet, the Paris Agreement relied crucially on the networks of environmental regulators leading the way in INDCs to set the stage on which the formulation of a meaningful international treaty was in fact possible.<sup>310</sup> Climate dialogue after the Paris Agreement now takes place in a truly networked regulatory dialogue.<sup>311</sup> The centralized exchange of INDCs provides a platform for the dynamic coordination of climate change efforts.<sup>312</sup> INDCs create

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304. See, e.g., Brian Bix, *Bargaining in the Shadow of Love: The Enforcement of Premarital Agreements and How We Think About Marriage*, 40 WM. & MARY L. REV. 145, 189 (1998) (discussing good faith and reasonable reliance jurisprudence in the context of premarital agreements).

305. SLAUGHTER, *supra* note 55, at 49.

306. Rubenstein, *supra* note 281, at 231–35.

307. Frédéric G. Sourgens, *Climate Commons Law: The Transformative Force of the Paris Agreement*, 50 N.Y.U. J. INT'L L. & POL. 885, 928–44 (2018).

308. *Id.*

309. See Fiona Harvey, *Paris Climate Change Agreement: The World's Greatest Diplomatic Success*, GUARDIAN (Dec. 14, 2015, 2:51 PM), <https://www.theguardian.com/environment/2015/dec/13/paris-climate-deal-cop-diplomacy-developing-united-nations> [https://perma.cc/26JJ-RMBD].

310. *Id.*

311. Sourgens, *supra* note 210, at 1690–98.

312. See Implementing the Paris Agreement—Issues at Stake in View of the COP 22 Climate Change Conference in Marrakesh, PARL. EUR. DOC. (PE 537.319) 18 (2016) [hereinafter European Parliament Report] (“These Parties played an important role in the preparation of the Paris Agreement, China and the United States *inter alia* through coordinated statements on their mitigation plans and the

reliance interests and incentives for more ambitious INDCs and create conduits for technology and knowledge transfer to implement these new approaches.<sup>313</sup>

This *resilience* (significantly) holds even in the face of a withdrawal of the United States from the Paris Agreement under the Trump Administration.<sup>314</sup> The withdrawal did provide a jolt to global climate negotiations.<sup>315</sup> But crucially, U.S. cities and states jumped into the breach to make their own pledges to keep the United States on track with its original climate commitments.<sup>316</sup> Although COVID-19 complicates any meaningful systemic assessment, U.S. emissions in 2020 were down 21 percent against 2005 levels, thus exceeding the 17 percent reduction target agreed on during the 2009 Copenhagen negotiations and keeping the 26–28 percent reductions of the first U.S. INDC within sight.<sup>317</sup> This suggests that action by these stakeholders had a measurable impact on U.S. greenhouse gas emissions even at the height of Trump Administration rollbacks of Obama-era climate policies.

The U.S. withdrawal from the Paris Agreement also shows another surprising feature of networked governance. Networked governance—and its reliance on domestic administrative processes—improves governance *quality*. Current EPA data suggests that U.S. CO<sub>2</sub> emissions from electricity generation in 2019 were approximately 30 percent below 2005 levels.<sup>318</sup> The

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European Union e.g. by establishing a coalition of countries supporting a strong mechanism to increase ambition under the Paris Agreement.”).

313. *See id.*

314. *See* Sourgens, *supra* note 210 (discussing the United States’s withdrawal from the Paris Agreement).

315. Emily Holden, *Trump Begins Year-Long Process to Formally Exit Paris Climate Agreement*, GUARDIAN (Nov. 4, 2019, 10:21 PM), <https://www.theguardian.com/us-news/2019/nov/04/donald-trump-climate-crisis-exit-paris-agreement> [<https://perma.cc/CV8F-G4AB>].

316. *See* Sourgens, *supra* note 232, at 114–17; KENT E. CALDER, GLOBAL POLITICAL CITIES: ACTORS AND ARENAS OF INFLUENCE IN INTERNATIONAL AFFAIRS 176 (2021).

317. Kate Larsen et al., *Preliminary US Greenhouse Gas Emissions Estimates for 2020*, RHODIUM GRP. (Jan. 12, 2021), <https://rhg.com/research/preliminary-us-emissions-2020> [<https://perma.cc/TL7F-Z2P5>]; *see also* Trevor Houser & Hannah Pitt, *Preliminary US Emissions Estimate for 2019*, RHODIUM GRP. (Jan. 7, 2020), <https://rhg.com/research/preliminary-us-emissions-2019> [<https://perma.cc/NH3E-FMN4>] (noting that 2019 figures put U.S. emissions “[a]t roughly 12% below 2005 levels”). Notably, in 2019, “[c]oal-fired power generation fell by a record 18% year-on-year to its lowest level since 1975.” *Id.*

318. *Greenhouse Gas Inventory Data Explorer*, EPA (Mar. 15, 2022), <https://cfpub.epa.gov/ghgdata/inventoryexplorer/#electricitygeneration/entiresecto>

Clean Power Plan sought to reduce CO<sub>2</sub> emissions by “32 percent below 2005 levels” once the regulation “is fully in place in 2030.”<sup>319</sup> It therefore appears that mechanisms replacing the Clean Power Plan achieved some top line of the goals of the plan earlier than expected and with greater social acceptability, even at a time of a reasonably skeptical administration.

In sum, by filtering coordinated action immediately through the administrative process, it is possible to get an early check on whether coordinated action is in fact possible because of the domestic regulatory processes that must be followed in each coordinating State. Once a statement of intent by a regulator (or diplomat) crosses that threshold to firm regulatory action, it is far more likely to “stick”—and continued coordination and collaboration is far more likely to have lasting results.<sup>320</sup> We have seen that this is the case even if the specific regulatory approach implementing these goals changes because political accountability mechanisms (the election of President Donald Trump and the earlier injunction enjoining the implementation of the Clean Power Plan) work to rollback a specific approach to implement globally shared goals (greenhouse gas emissions reductions).<sup>321</sup> Global institutions, such as the International Energy Agency (IEA), confirmed these conclusions; it measures carbon emission pathways in emission reduction pledges in much the same way.<sup>322</sup> That is, once a regulation is in place, this pledged reduction counts toward IEA energy transition pathways and trajectories.<sup>323</sup>

In short, networked governance shows how bottom-up international lawmaking functions and how it improves both the resilience and quality of international efforts to solve shared global problems. We have seen that this is the case even in the

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r/allgas/category/all [https://perma.cc/SSR2-32JW] (listing emissions in 2005 as 2400.06 million metric tons of CO<sub>2</sub> and in 2019 as 1606.02 million metric tons of CO<sub>2</sub>).

319. *Fact Sheet: Overview of the Clean Power Plan; Cutting Carbon Pollution from Power Plants*, EPA (Jan. 19, 2017), <https://archive.epa.gov/epa/cleanpowerplan/fact-sheet-overview-clean-power-plan.html> [https://perma.cc/JVT6-YPZ5].

320. See Koh 2018, *supra* note 186, at 415 (“These internalized rules create default patterns of international law-observant behavior for all participants in the process. Those default patterns become routinized [and] ‘sticky’ . . .”).

321. See Sourgens, *supra* note 129, at 190–91.

322. See, e.g., INT’L ENERGY AGENCY, WORLD ENERGY OUTLOOK 2021, at 117–18 (Edmund Hosker ed., 2021) (discussing China’s net-zero pledge).

323. *Id.*



context of highly charged problems such as climate change and energy transition.<sup>324</sup> We have also seen that this is the case even to the extent that there is a political check on the means of implementation of a particular approach to global coordination—global networks manage to incorporate the input from that check in future decision-making.<sup>325</sup> And we have seen that this check serves to improve the governance design and record basis for shared regulatory goals.<sup>326</sup> That is, we can conclude that networked, bottom-up governance is qualitatively up to the task of addressing complex problems requiring technical and governance expertise.

Further, it is able to address these problems in a manner that provides a more granular solution to the flexibility-inclusivity dilemma. What networked, bottom-up governance provides is *inclusivity as flexibility*. An ongoing regulatory dialogue makes inclusivity and flexibility possible *at the same time*.<sup>327</sup> This regulatory dialogue means that information exchanges are in fact meaningful—they are communicated to the right people and in reasonably prompt intervals.<sup>328</sup> And they are communicated to solve a shared problem—that is, inclusivity and flexibility become part of the same toolkit.<sup>329</sup> The reason that a regulator networks a solution to a shared problem is that no one regulator believes that it is up to the task of resolving the problem on its own—something that is also the case in the SRM arena.<sup>330</sup> That means that regulatory flexibility is built in to a networked governance approach as a starting point for governance to proceed.

We now also know how networked, bottom-up governance can resolve an important blind spot in the weak consent paradigms we encountered in Part II.<sup>331</sup> The problem of thin conception of consent paradigms was that regulators did not sufficiently involve affected persons in their own domestic regulatory processes.<sup>332</sup> That is, they allowed comments from affected persons without truly providing a means for these

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324. See *supra* Section II.A.

325. See *supra* Subsection III.D.iii.

326. See *supra* Subsection III.D.ii.

327. See SLAUGHTER, *supra* note 55, at 49.

328. *Id.*

329. See *id.*

330. See Horton, *supra* note 42, at 175–80.

331. See *supra* Section II.B.

332. See *supra* Section II.B.

affected persons to enter into a regulatory dialogue.<sup>333</sup> Networked, bottom-up governance provides an answer for how to overcome this problem: put regulators in touch with each other to solve regulatory problems together. In other words, the solution to the domestic administrative blind spot is to link domestic processes together on a global scale.

#### 4. Preliminary Conclusions on Network Effects

We can also now see that what many fear as the worst-case scenario for SRM governance<sup>334</sup>—unilateral action by the United States and China—can, in fact, be exactly what is needed. Bottom-up, networked governance needs to get started by a regulator. In the context of the Paris Agreement, we have seen the extraordinary power of U.S. regulators as first movers.<sup>335</sup> It is precisely that engagement between U.S. regulators and their Chinese counterparts that was able to build momentum and bring other network players to the table.<sup>336</sup> This apparently unilateral conduct by the United States and China in the context of the Paris Agreement did not override, overpower, or oppress the voices of less powerful States.<sup>337</sup> To the contrary, it empowered them to speak due to the genuine momentum toward solving a shared problem.<sup>338</sup> Emulating the success of bottom-up, inclusive, networked governance leading to the Paris Agreement therefore means leaning on U.S. unilateral leadership to jump start the SRM governance network. Part IV will discuss how the United States could do so.

##### *E. Remaining Problems*

Of course, networking domestic regulators is not a cure all. It, too, has a critical blind spot. It makes a silent assumption: each domestic regulator is, in fact, appropriately responsive to

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333. See *supra* Section II.B.

334. See Irvine & Keith, *supra* note 43.

335. See Sourgens, *supra* note 210, at 1646–56 (discussing U.S. commitments regarding the Paris Agreement).

336. Press Release, White House Off. of the Press Sec’y, U.S.-China Joint Announcement on Climate Change (Nov. 11, 2014), <https://obamawhitehouse.archives.gov/the-press-office/2014/11/11/us-china-joint-announcement-climate-change> [<https://perma.cc/5WSB-QD52>].

337. See Sourgens, *supra* note 210, at 1646–56.

338. *Id.*

affected groups *within* its own jurisdiction. As the relationship between Indigenous Peoples and the U.S. government has shown, this assumption does not always hold true.<sup>339</sup>

Truly inclusive, bottom-up governance therefore must do more than network. It must also strengthen the inclusivity of decision-making in the domestic setting. Critically, this does not require each regulator to follow strong global consent principles for ordinary domestic regulatory purposes, even in the context of SRM, if that regulator also participates in global governance networks. As we have seen, much of the benefit of strong conceptions of consent comes as a matter of those global governance networks.<sup>340</sup> But there is an important exception to this rule. Inclusive governance does require *each regulator* to solicit input from traditionally marginalized groups *wherever they might be located* to the extent that impact on these groups is readily foreseeable. This point is a matter of logic—a traditionally marginalized group is traditionally marginalized *because* domestic regulatory processes do not include and protect the group as a matter of course.<sup>341</sup> Consequently, it is logically insufficient for one regulator to rely on those peer processes affecting these groups—one simply cannot be sure that these processes protect the groups in question now when they did not do so before. Strong conception of consent requirements then demand that regulators address this known blind spot.<sup>342</sup> For example, Canadian regulators cannot take for granted that U.S. regulators will appropriately consult Indigenous Peoples and vice-versa.

This requirement is particularly important in the context of SRM. SRM has the potential to affect a host of natural phenomena.<sup>343</sup> Not only that—it is likely the repercussions of SRM will vary within individual countries.<sup>344</sup> This means that

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339. See Warner et al., *supra* note 163, at 1152–54.

340. See *supra* Subsection II.D.ii, Section III.A.

341. See Benjamin G. Bishin et al., *Elite Mobilization: A Theory Explaining Opposition to Gay Rights*, 54 LAW & SOC'Y REV. 233, 233–34 (2020) (“While the barriers to political incorporation take many forms, laws preventing acceptance of and participation by traditionally marginalized groups like gays and lesbians gradually continue to fall . . . . The public plays a large role in advancing or impeding minority rights by supporting referenda and rewarding candidates who support their views. As a result, those defending the status quo often appeal to public opinion to prevent advances in minority rights.”).

342. See *supra* Part II.

343. See *supra* Part I.

344. See *id.*

marginalized groups may in fact have interests that do not always squarely align with the interests of those who have a government's ear. Strong conception of consent principles therefore will become a particularly important concern as SRM networks form.

A bottom-up, networked governance process that is attuned to such blind spots improves global governance across the board. If each invites the comments from affected native communities irrespective of territorial boundaries, it is more likely to provide a check for exclusive domestic governance. This check allows States to tailor their own responses to the comments from those communities. And it can bring these concerns into global networks and thereby suggest to other States to follow suit.

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Bottom-up, networked governance is not a perfect solution. It still has inclusivity gaps. And its flexibility is not always harnessed in the service of solving a shared global problem. But bottom-up, networked governance can take these concerns seriously and incorporate them into decision-making processes. It avoids the many inclusivity problems of truly unilateral or top-down regulation. It thus presents a hopefully viable candidate for SRM governance if implemented correctly. Such correct implementation, as I will argue below, could benefit from current U.S. leadership.

#### IV. U.S. DARK SUN NETWORKING

Can the United States realistically take a leadership role in setting up a networked SRM governance paradigm? In Part III, we saw that a bottom-up governance approach is in principle capable of solving the global SRM governance problem.<sup>345</sup> We also saw that not all bottom-up governance approaches are created equal. This Part IV takes stock of current U.S. SRM efforts and develops how the United States can take on a critical leadership role by thoughtfully deploying existing regulatory processes in furtherance of U.S. SRM policy.

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345. *See supra* Part III.

### A. Ongoing U.S. SRM Efforts

U.S. SRM regulatory efforts are at a comparatively early stage. As *Nature* reported in April 2021, “So far, the US Congress’s most significant investments in federal geoengineering research are at [the National Oceanic and Atmospheric Administration], which has received some \$13 million over the past two years to advance basic-science studies of the stratosphere.”<sup>346</sup> Congress began funding initial research in 2019.<sup>347</sup> With this funding, Congress instructed the National Oceanic and Atmospheric Administration (NOAA) to begin “modeling, assessments, and, as possible, initial observations and monitoring of stratospheric conditions and the Earth’s radiation budget . . . .”<sup>348</sup>

These efforts are likely to increase radically. The National Academies of Sciences, Engineering, and Medicine called upon the U.S. government to further study and to invest more in the research of SRM as a response to worsening climate change in March 2021.<sup>349</sup> These recommendations outline an integrated research agenda and governance approach.<sup>350</sup> They focus further on developing the context and goals for SRM research in close engagement with the impacts and technical dimensions of SRM approaches (“atmospheric processes, climate response, other impacts”) and the social dimensions of SRM approaches (“public perception, political and economic dynamics, governance and ethics”).<sup>351</sup> This call by the National Academies is likely to resonate with U.S. government stakeholders—

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346. Jeff Tollefson, *US Urged to Invest in Sun-Dimming Studies as Climate Warms*, NATURE (Mar. 29, 2021), <https://www.nature.com/articles/d41586-021-00822-5> [<https://perma.cc/3KRP-V7T3>].

347. Charles R. Corbett, “*Extraordinary*” and “*Highly Controversial*”: *Federal Research of Solar Geoengineering Under NEPA*, 115 NW. U. L. REV. ONLINE 240, 243 (2021).

348. *Id.* (quoting H. COMM. ON RULES, 116TH CONG., JOINT EXPLANATORY STATEMENT SUBMITTED BY MRS. LOWEY, CHAIRWOMAN OF THE HOUSE COMMITTEE ON APPROPRIATIONS REGARDING H.R. 1158: CONSOLIDATED APPROPRIATIONS ACT, 2020, DIVISION B - COMMERCE, JUSTICE, SCIENCE, AND RELATED AGENCIES APPROPRIATIONS ACT, 2020 17-18 (Dec. 17, 2019), <https://docs.house.gov/billsthisweek/20191216/BILLS-116HR1158SA-JES-DIVISION-B.pdf> [<https://perma.cc/3PKU-JVE7>]).

349. NAT’L ACAD. OF SCIS., ENG’G & MED., REFLECTING SUNLIGHT: RECOMMENDATIONS FOR SOLAR GEOENGINEERING RESEARCH AND RESEARCH GOVERNANCE (2021).

350. *Id.* at 193.

351. *Id.*

particularly as climate events will increasingly threaten the economic, environmental, and physical security in large parts of the United States.<sup>352</sup>

To the extent that SRM research and development moves ahead in the United States, it will be subject to multiple regulatory regimes. Most immediately, any U.S. governmental SRM action is subject to the National Environmental Policy Act (NEPA).<sup>353</sup> Just as importantly, SRM would also fall under the EPA's traditional regulatory purview under the Clean Air Act.<sup>354</sup> It would do so because SRM would likely emit pollutants into the air that are themselves environmentally harmful (think sulfite spraying). Not only that, but these substances also affect climate change.<sup>355</sup> And (on the dominant reading of *Massachusetts v. EPA* at least), any emissions into the air that impact the climate are subject to EPA regulation.<sup>356</sup> In addition to being subject to the Clean Air Act, SRM is also subject to the same statutory regimes that govern large (energy) project developments including the Endangered Species Act, the National Historic Preservation Act, and others.<sup>357</sup>

A substantive review of each of these regimes is beyond our current scope. What matters for this inquiry is the way in which such regulation could and should be networked and how such networking supports strong conceptions of global consent and a development-driven approach to energy transition. As we will

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352. See Alexander C. Kaufman, *Geoengineering the Climate Just Became More of a Real Possibility in the U.S.*, HUFFPOST (Mar. 25, 2021, 11:56 AM), [https://www.huffpost.com/entry/solar-geoengineering-climate-change\\_n\\_605c765dc5b67593e055ff9d](https://www.huffpost.com/entry/solar-geoengineering-climate-change_n_605c765dc5b67593e055ff9d) [https://perma.cc/6B2X-TEZK] (addressing foundations like the McArthur Foundation). Other stakeholders are similarly likely to be moved by such a call by virtue of the influence of the National Academies in their own right. For one example of the influence of the Academies, see Barbara Natterson-Horowitz & Amelia Reynolds, *Beyond the Laboratory: Emerging Landscape of Animal Studies – the Influence of the National Academies of Sciences Activities and Publications*, 62 ILAR J. 310 (2022).

353. See Corbett, *supra* note 347, at 244–45.

354. For a discussion of the ways in which the Clean Air Act and other U.S. environmental legislation can apply to SRM projects, see Tracy Hester, *Remaking the World to Save It: Applying U.S. Environmental Laws to Climate Engineering Projects*, in CLIMATE CHANGE GEOENGINEERING: PHILOSOPHICAL PERSPECTIVES, LEGAL ISSUES AND GOVERNANCE FRAMEWORKS 263 (Will Burns & Andrew Strauss eds., 2013).

355. See *supra* Part I.

356. *Massachusetts v. EPA*, 549 U.S. 497 (2007).

357. Albert Lin, *U.S. Law*, in CLIMATE ENGINEERING AND THE LAW REGULATION AND LIABILITY FOR SOLAR RADIATION MANAGEMENT AND CARBON DIOXIDE REMOVAL 154 (Michael B. Gerrard & Tracy Hester eds., 2018).

see, U.S. SRM policy and regulation can and should be networked. And such networking can in fact achieve the goal of a flexible and inclusive approach to SRM governance as one tool to secure a just energy transition.

### *B. NEPA Plus: Global SRM Diligence*

The first step to building a robust governance network is diligence. Diligence provides the information needed for decision-making.<sup>358</sup> Civilian U.S. SRM programs are subject to significant *environmental diligence obligations*. This diligence is principally *governed by NEPA*.<sup>359</sup>

Pursuant to NEPA, federal agencies must establish the environmental consequences—and related social and economic consequences—of new programs.<sup>360</sup> NEPA diligence follows a three-step process. *First*, the agency proposing a particular action must conduct an *environmental assessment*.<sup>361</sup> This initial assessment outlines the proposed action, alternatives, and anticipated environmental consequences.<sup>362</sup> On the basis of this environmental assessment, the agency determines whether a particular action is likely to lead to significant environmental impacts.<sup>363</sup> *Second*, if it makes such a determination, the agency must then proceed to an *environmental impact statement* (EIS).<sup>364</sup> For significant policies, NEPA review can take the form of a *programmatic EA (PEA) or programmatic EIS (PEIS)* that considers the big picture consequences of a policy across federal actions.<sup>365</sup> An EIS begins with the publication of a notice in the Federal Register.<sup>366</sup> After publication of the notice, the agency engages the public to

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358. Sourgens, *supra* note 12, at 437–46.

359. NEPA is codified at 42 U.S.C. § 4331 (2020).

360. *Id.*

361. 40 C.F.R. §§ 1501.3, 1501.5 (2020).

362. *Id.* § 1501.5.

363. *Id.* § 1501.3.

364. See Lin, *supra* note 37, at 2556–57; see also Albert C. Lin, *Revamping Our Approach to Emerging Technologies*, 76 BROOK. L. REV. 1309, 1335 (2011).

365. See Corbett, *supra* note 347, at 253; Lin, *supra* note 37, at 2557; 40 C.F.R. § 1502.4 (2020); CEQ, EFFECTIVE USE OF PROGRAMMATIC NEPA REVIEWS (2014), [https://ceq.doe.gov/docs/ceq-regulations-and-guidance/Effective\\_Use\\_of\\_Programmatic\\_NEPA\\_Reviews\\_Final\\_Dec2014\\_searchable.pdf](https://ceq.doe.gov/docs/ceq-regulations-and-guidance/Effective_Use_of_Programmatic_NEPA_Reviews_Final_Dec2014_searchable.pdf) [<https://perma.cc/Q4WX-WPKA>] [hereinafter CEQ-PEA].

366. *Environmental Impact Statement Filing Guidance*, EPA (Oct. 6, 2022), <https://www.epa.gov/nepa/environmental-impact-statement-filing-guidance> [<https://perma.cc/6F5F-MLUE>].

determine the appropriate scope of environmental review and proceeds to draft an environmental impact statement.<sup>367</sup> This statement is then subject to review and comment.<sup>368</sup> Only after the agency has addressed all relevant comments can it publish a final EIS.<sup>369</sup> *Finally*, agencies have to *monitor* the actual environmental impacts of new programs or policies.<sup>370</sup>

SRM governance likely requires a broad interpretation of NEPA's main relevant tools—PEAs and PEIS—to be effective.<sup>371</sup> Governmental modelling efforts *themselves* do not yet pass the threshold of significant environmental impacts.<sup>372</sup> A narrow view of NEPA therefore would conclude that a PEA or a PEIS is not yet required.<sup>373</sup>

Charles Corbett has convincingly argued that such a narrow view misses the unique governance challenges posed by SRM.<sup>374</sup> One purpose of NEPA is to assess environmental impacts before we choose a policy path precisely to avoid path dependence.<sup>375</sup> NEPA requires that PEIS in particular *consider alternatives* to a proposed policy to force consideration of other options early.<sup>376</sup> In the context of SRM, alternatives to potential approaches need to be discussed early at the modelling stage to meaningfully guide future development.<sup>377</sup> Consequently,

367. *See id.*

368. *See id.*

369. 40 C.F.R. § 1503.1 (2020).

370. Final Guidance for Federal Departments and Agencies on the Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact, 76 Fed. Reg. 3,843, 3,849–50 (Jan. 21, 2011) (to be codified at 40 C.F.R. §§ 1500, 1501, 1502, 1505, 1506, 1507, 1508); S. Miano, *Managing an Environmental, Health and Safety Crisis*, in DUE DILIGENCE HANDBOOK: CORPORATE GOVERNANCE, RISK MANAGEMENT AND BUSINESS PLANNING 188, 190 (Linda S. Spedding ed., 2009).

371. *See* Corbett, *supra* note 347, at 255–58.

372. *Id.*

373. *Id.*; *see also* Lin, *supra* note 364, at 1336–38 (discussing the evolution of a narrow view of NEPA by federal agencies and courts).

374. *See* Corbett, *supra* note 347, at 258; *see generally* Kenta Tsuda, *Administrative Bulkheads*, 51 ENV'T L. 1, 34 (2021) (“[N]on-localized impacts to natural systems would be per se in the scope of NEPA review and would be subject to a rebuttable presumption of significance—in other words, they would be due full administrative scrutiny, with attendant public notice and comment.”).

375. *See* 40 C.F.R. § 1501.2 (2020) (“Agencies should integrate the NEPA process with other planning and authorization processes at the earliest reasonable time to ensure that agencies consider environmental impacts in their planning and decisions, to avoid delays later in the process, and to head off potential conflicts.”).

376. 40 C.F.R. §§ 1502.14, 1502.17 (2020); CEQ-PEA, *supra* note 365, at 17.

377. *See, e.g.*, S. Kalidindi et al., *Modeling of Solar Radiation Management: A Comparison of Simulations Using Reduced Solar Constant and Stratospheric*



progressing to an EIS only after modelling is completed is likely too late to meet NEPA's statutory purpose.<sup>378</sup> As federally funded and licensed research into SRM will likely commence in earnest soon, an EIS process at this early stage would therefore be desirable.<sup>379</sup> This EIS process would particularly need to lay out the baselines for modelling and the direction of SRM research in order to solicit early buy in for the future trajectory for SRM research within the United States.<sup>380</sup>

### C. *The Global Networked SRM Response*

A robust engagement through the EIS process is not just critical for U.S. policymaking; it is also ***critical for networked SRM governance***. An EIS provides a baseline to engage fellow global regulators.<sup>381</sup> An EIS creates a meaningful early record of the specific environmental, social, and cultural problems to be resolved by way of SRM governance through an interdisciplinary perspective.<sup>382</sup> Without such a record, it would be comparatively difficult to engage in a regulatory dialogue about how to balance competing values in the context of SRM development. Insisting on an EIS therefore fulfills more than a domestic function.<sup>383</sup> It

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*Sulphate Aerosols*, 44 CLIMATE DYNAMICS 2909, 2909 (2014). Here, a PEA/PEIS approach arguably is needed because of the effect of modelling on future action, meaning that current NOAA research is the first step in the “approving multiple actions” category of PEA/PEIS review. CEQ-PEA, *supra* note 365, at 14. For discussion of which alternatives need to be considered in a PEA/PEIS, see *id.* at 21–22.

378. See 40 C.F.R. § 1501.2 (2020).

379. See Corbett, *supra* note 347, at 259.

380. See *id.*; CEQ-PEA, *supra* note 365, at 10 (discussing the value of PEAs/PEISs).

381. See Mayer, *supra* note 31, at 479–80. For a discussion of how environmental impact assessments serve this purpose in environmental governance of the Arctic in a cross-governmental dialogue, see FINNISH MINISTRY OF THE ENV'T, GUIDELINES FOR ENVIRONMENTAL IMPACT ASSESSMENT (EIA) IN THE ARCTIC 9 (Terry Forster ed., 1997).

382. 40 C.F.R. § 1502.6 (2020).

383. See Convention on Environmental Impact Assessment in a Transboundary Context art. 4, Feb. 25, 1991, 1989 U.N.T.S. 309 [hereinafter Espoo Convention] (providing for international environmental collaboration using environmental impact assessments); Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters art. 6(2), June 25, 1998, 2161 U.N.T.S. 447 [hereinafter Aarhus Convention]. For a discussion of these conventions, see Maria L. Banda, *Regime Congruence: Rethinking the Scope of State Responsibility for Transboundary Environmental Harm*, 103 MINN. L. REV. 1879, 1905 n.90 (2019).

fulfills a global function by booting up a regulatory network in which bottom-up governance processes can begin to take hold.<sup>384</sup>

But booting up a global network also requires that U.S. regulators actually involve foreign regulators in SRM NEPA efforts. As we have seen in Part III, networks form through communication.<sup>385</sup> A domestic approach to SRM diligence by definition does not communicate with foreign regulators. Consequently, calls for a traditional ***domestic NEPA assessment are not enough*** (nor is it what scholars should be understood to advocate).<sup>386</sup> Rather, any diligence effort capable of fostering a global networked response must be global in scope.

Since the promulgation of Executive Order 12,114 in 1979 by President Carter, U.S. law has suggested taking such a broader, global approach in developing EIS and, thus, SRM EIS.<sup>387</sup> The order applies to major federal policies and programs “having significant effects on the environment outside the geographical borders of the United States.”<sup>388</sup> SRM activities would certainly have such effects.<sup>389</sup> Executive Order 12,114 instructs federal agencies conducting NEPA diligence to prepare an ***independent EIS*** for action “significantly affecting the

384. See John H. Knox, *Assessing the Candidates for a Global Treaty on Transboundary Environmental Impact Assessment*, 12 N.Y.U. ENV'T. L.J. 153, 163 (2003) (“[T]he Espoo Convention takes a bottom-up approach to prevention of transboundary harm.”).

385. See *supra* Part III.

386. See Corbett, *supra* note 347, at 259.

387. See Exec. Order No. 12,114, 44 Fed. Reg. 1,957 (Jan. 4, 1979) [hereinafter EO 12,114]. For a discussion of the political difficulty leading to the compromises made in the order, see Tara Leigh Grove, *Presidential Laws and the Missing Interpretive Theory*, 168 U. PA. L. REV. 877, 905 (2020). For a more detailed discussion of the Executive Order in practice, see Browne C. Lewis, *It's A Small World After All: Making the Case for the Extraterritorial Application of the National Environmental Policy Act*, 25 CARDOZO L. REV. 2143, 2150 (2004); Kevin A. Ewing & Erik E. Petersen, *Significant Environmental Challenges to the Development of LNG Terminals in the United States*, 2 TEX. J. OIL GAS & ENERGY L. 5, 19 (2007). For a negative view that the order is little more than window dressing, see David Young, *The Application of Environmental Impact Statements to United States Participation in Multinational Development Projects*, 8 AM. U. J. INT'L L. & POL'Y 309, 320–22 (1992). NEPA itself further requires taking into account extraterritorial effects of U.S. policies and programs to the extent that those policies and programs are otherwise subject to NEPA review. See CEQ, GUIDANCE ON NEPA ANALYSES FOR TRANSBOUNDARY IMPACT (1997) [hereinafter CEQ-TRANSBOUNDARY IMPACT] (“CEQ has determined that agencies must include analysis of reasonably foreseeable transboundary effects of proposed actions in their analysis . . .”).

388. EO 12,114, *supra* note 387, § 2-1.

389. See *supra* Part I.

environment of the *global commons* outside the jurisdiction of any nation (e.g., the oceans or Antarctica).<sup>390</sup> The Order further instructs federal agencies conducting diligence to conduct “*bilateral or multilateral environmental studies*, relevant or related to the proposed action, by the United States and one [or] more foreign nations”<sup>391</sup> to the extent the action significantly affects “the environment of a foreign nation not participating with the United States and not otherwise involved in the action.”<sup>392</sup> Communication is initially liaised through the State Department.<sup>393</sup> Yet, to draft bilateral or multilateral environmental studies, relevant agencies will need to work together, out of necessity, on a networked interagency basis given that the State Department lacks subject matter expertise with regard to the specific federal action. At this point, the State Department becomes a partner merely to set up and administer “a program for exchange on a continuing basis of information concerning the environment.”<sup>394</sup>

Beginning a NEPA process to conduct SRM diligence therefore likely will be the *first step* in setting up a *global networked response*.<sup>395</sup> It will require agencies to work with the State Department to identify foreign governmental and international organization counterparties to participate in such a study of extraterritorial SRM effects.<sup>396</sup> This, in turn, will allow the very networked governance approach we developed so far to coalesce.<sup>397</sup> The facially small, domestic step to commence a NEPA analysis within NOAA (and the EPA) therefore will have significant, positive global governance consequences by nurturing a needed bottom-up, SRM governance network.

Importantly, the United States is in a better legal position to commence building such a network than many other States (as a matter of applicable law, at least). Similar international cooperation is, in principle, mandated by an international

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390. EO 12,114, *supra* note 387, §§ 2-3(a), 2-4(a)(i), 2-4(b)(i) (emphasis added). Relevantly, this provision also applies to space-based programs. S. M. Mousavi Sameh, *Suborbital Flights: Environmental Concerns and Regulatory Initiatives*, 81 J. AIR L. & COM. 65, 86 (2016).

391. EO 12,114, *supra* note 387, § 2-4(a)(ii) (emphasis added).

392. *Id.* § 2-3(b).

393. *Id.* § 3-2.

394. *Id.* § 2-2.

395. See CEQ-TRANSBOUNDARY IMPACT, *supra* note 387.

396. EO 12,114, *supra* note 387, §§ 2-2, 2-3(b), 2-4(a)(ii), 2-4(b)(ii).

397. See *supra* Section III.C.

treaty, the 1991 Espoo Convention.<sup>398</sup> Article 3 of the Espoo Convention requires notification of foreign States affected by likely transboundary environmental harm as early as possible and provides a means for the affected foreign States to participate in the environmental impact assessment process.<sup>399</sup> Following notification, the Espoo Convention sets the requirements for multilateral cooperation on the drafting and approval of environmental impact assessments.<sup>400</sup>

Problematically, it is far less clear that the Espoo Convention would apply to all types of SRM activities.<sup>401</sup> The Espoo process starts with the notification requirement set out in article 3.<sup>402</sup> But this requirement is facially limited to specific activities included in Appendix I.<sup>403</sup> SRM is not specifically listed in Appendix I.<sup>404</sup> Further, depending upon the SRM approach, SRM may not easily fall within the type of activities listed in Appendix I.<sup>405</sup> Consequently, the Espoo Convention may be *too rigid to start* a regulatory SRM networking process.<sup>406</sup> That being said, the Espoo Convention provides important international standards for *how to proceed* once a State kick-starts the Espoo process for an SRM activity.<sup>407</sup>

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398. See Espoo Convention, *supra* note 383. The U.S. has signed but not ratified the Espoo Convention. For the status of Espoo Convention ratification, acceptance, approval, or accession, see UNTC, [https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg\\_no=XXVII-4&chapter=27&clang=\\_en](https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-4&chapter=27&clang=_en) [<https://perma.cc/Y33G-K4C9>]. For a discussion on the “fit” between the Espoo Convention and EO 12,144, see Tseming Yang, *The Emergence of the Environmental Impact Assessment Duty as a Global Legal Norm and General Principle of Law*, 70 HASTINGS L.J. 525, 566 (2019).

399. See Espoo Convention, *supra* note 383, at arts. 3(1)–3(3).

400. See *id.* at art. 4–6.

401. For an argument that the Espoo Convention does apply to SRM, see Jesse L. Reynolds, *International Law*, in CLIMATE ENGINEERING AND THE LAW: REGULATION AND LIABILITY FOR SOLAR RADIATION MANAGEMENT AND CARBON DIOXIDE REMOVAL 57, 93–94 (Michael B. Gerrard & Tracy Hester eds., 2018). Arguably, this gap has been filled by the Kyiv Protocol to the Espoo Convention. Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context, May 21, 2003, 2685 U.N.T.S. 140. Even there, Annex I does not obviously cover SRM. *Id.* at Annex I. It is therefore in the catch-all provisions in articles 4(2) and 5(1) of the Protocol. *Id.* at arts. 4(2), 5(1). For a discussion of the applicability of the Kyiv Protocol to geoengineering, see Lin, *supra* note 37, at 2564.

402. See Espoo Convention, *supra* note 383, at arts. 3(1)–3(3).

403. See *id.* at art. 3(1), app. 1.

404. See *id.* at app. 1.

405. See *id.*

406. See *id.*

407. See *id.* at arts. 4–6.

Consequently, the more flexible U.S. legal framework may well be a better starting point for such a process. U.S. leadership and U.S. action ahead of any global solution to SRM governance, therefore, is a critical feature to get started the governance mechanism discussed throughout this Article.

Even so, both the U.S. framework under Executive Order 12,114 and the Espoo Convention continue to have an inclusivity blind spot that remains to be remedied.<sup>408</sup> Executive Order 12,114 sets up an intergovernmental process or a process involving an international organization.<sup>409</sup> Similarly, the Espoo Convention sets up a process between State parties to the Espoo Convention.<sup>410</sup> Consequently, neither framework involves nongovernmental civil society actors in the environmental due diligence process.

As we have noted in Part III, the exclusion of civil society groups from networked governance creates significant issues for inclusivity.<sup>411</sup> This inclusivity problem can only be solved to the extent that civil society groups are consulted as early as possible in the diligence process. We therefore need to supplement the process outlined in Executive Order 12,144 and the Espoo Convention to meet the inclusivity demands of networked SRM governance.

There are two paths to solve this problem—one premised in NEPA and the other premised in international legal instruments, like the Aarhus Convention regulating transparency of environmental information, discussed below. If we assume that the United States will, in fact, jump start a networked SRM governance approach through NEPA/Executive Order 12,114 diligence, it would need to involve domestic civil society actors as part of its NEPA review. Regulations implementing NEPA on their face identify the kind of groups whose input an agency conducting a NEPA review must solicit once it has completed a draft EIS: “[a]ppropriate . . . Tribal . . . agencies” and “[t]he public, affirmatively soliciting comments in a manner designed to inform those persons or organizations who may be interested in or affected by the proposed action.”<sup>412</sup> To

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408. See Espoo Convention, *supra* note 383, at arts. 3(1), 5; EO 12,114, *supra* note 387, §§ 2-3(b), 2-4(a)(ii), 2-4(b)(ii).

409. EO 12,114, *supra* note 387, §§ 2-3(b), 2-4(a)(ii), 2-4(b)(ii).

410. Espoo Convention, *supra* note 383, at arts. 3(1), 5.

411. See *supra* Part III.

412. 40 C.F.R. § 1503.1(2)(ii) (2020); see also CEQ-PEA, *supra* note 365, at 23–26.

be inclusive, a U.S. *NEPA review* should *solicit input* from relevant *global Indigenous Peoples' representatives* and should further seek to identify relevant *foreign civil society organizations* affected by the proposed SRM approach. This may include environmental nongovernmental organizations. But it may also involve groups representing particular interests (e.g., farmers who may be affected by changing rain patterns). An inclusive networked approach therefore should interpret NEPA guidance broadly to capture particularly marginalized foreign groups that are in a position like domestic groups whom an agency would have to consult.<sup>413</sup>

On the international front, the Aarhus Convention provides further guidance, at least for large SRM field tests.<sup>414</sup> The Aarhus Convention requires that member States to the Convention make relevant information publicly available and permit public participation in decision-making.<sup>415</sup> Like in the NEPA context, this transparency obligation is an obligation vis-à-vis domestic civil society.<sup>416</sup> It is not an obligation with regard to global civil society as a whole.<sup>417</sup> The Aarhus Convention thus codifies an approach to civic participation that is broadly consistent with (if not entirely the same as) NEPA implementing

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413. CEQ guidance on this point is ambiguous. On the one hand, “[a]gencies do have a responsibility to undertake a reasonable search for relevant, current information associated with an identified potential effect. However, the courts have adopted a ‘rule of reason’ to judge an agency’s actions in this respect.” CEQ-TRANSBOUNDARY IMPACT, *supra* note 387. Given the emphasis on agency responsibility, this part of the guidance would support a broad reading of NEPA for which I advocate here. But the same guidance document also states, “Additionally, in the context of international agreements, the parties may set forth a specific process for obtaining information from the affected country which could then be relied upon in most circumstances to satisfy agencies’ responsibility to undertake a reasonable search for information.” *Id.* Consultation with foreign governments therefore would be deemed sufficient to meet NEPA requirements. To apply, this sufficiency requires the presence of an international agreement between the U.S. and the foreign government in question governing the information exchange. Further, the guidance uses the permissive “may” and “could.” It thus, at the very least, does not preclude a broader scope of federal inquiry. This should be particularly true when the foreign governmental representations directly affect impacts on a marginalized group within its territory, and the U.S. State Department has noted foreign governmental oppressive conduct with regard to that marginalized group.

414. Jesse L. Reynolds, *Climate Engineering Field Research: The Favorable Setting of International Environmental Law*, 5 WASH. & LEE J. ENERGY, CLIMATE & ENV'T 417, 470 (2014).

415. Aarhus Convention, *supra* note 383, at arts. 1, 2(5).

416. *Id.*

417. *Id.*

regulations.<sup>418</sup> But what a truly inclusive networked approach to SRM needs is more than that—it needs to make each State stakeholder in global environmental impact assessment review a site for global contestation of environmental impacts. An inclusive networked approach to SRM needs to network Aarhus Convention transparency with Espoo Convention cooperation.

#### *D. Practical Responses Within the United States*

That being said, if the United States begins the process of a PEIS soon, much can be accomplished for ***inclusive networked governance*** at this current early stage. While it is likely not possible to force the Biden Administration to undertake such an EIS, the Biden Administration (NOAA and the EPA) could commence such a process on their own motion.<sup>419</sup> This would support inclusive decision-making at the domestic level as the relevant agencies would solicit broad-based civil society participation as part of the NEPA process. Such a step would therefore be domestically inclusive.<sup>420</sup>

If the Biden Administration combined such a NEPA review with diligence pursuant to Executive Order 12,114, it would take a meaningful step toward ***inclusivity*** on a ***global stage***.<sup>421</sup> Such a step would solicit input from affected foreign regulators (which in the case of SRM would draw in the entire world community). If the Biden Administration commences a NEPA PEIS process, it is on the whole implausible not to also start a global diligence process under Executive Order 12,114, as SRM is known to have global impacts.<sup>422</sup> Consequently, the first step of a NEPA PEIS would have significant positive global repercussions for inclusive governance: regulators would commence the information sharing that is so critical for bottom-up, networked governance to take off.

The final step the Biden Administration would need to take in order to meet the requirements of inclusivity set out in Part II and Section III.B is to engage broadly with foreign civil society actors and not just foreign regulators.<sup>423</sup> Again, there is no way

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418. See 40 C.F.R. § 1503.1 (2020).

419. See Corbett, *supra* note 347, at 258–60.

420. See 40 C.F.R. § 1503.1 (2020).

421. See EO 12,114, *supra* note 387, §§ 2-3(b), 2-4(a)(ii), 2-4(b)(ii).

422. See *supra* Part I.

423. See *supra* Sections II.A, II.C.

to force the Biden Administration to do so. Such a step would be beyond the purview of Executive Order 12,114, NEPA, or NEPA regulations.<sup>424</sup> But it is again a step that the Biden Administration *can* take on its own. And if it took such a step, the information gathered through the U.S. process would again flow globally through the intergovernmental diligence exchange and thus be amplified with each foreign counterparty's further inquiry with regard to specific civil society input and as part of its own diligence process.<sup>425</sup>

In other words, it is entirely within our grasp to set the stage for truly inclusive SRM governance today—without need for additional legislation, rulemaking, treaty instruments, or diplomatic negotiations. All it takes is for one State like the United States to start the EIS process. And starting this process might appear to be unilateral conduct bringing SRM within the purview of purely domestic regulation. But it need not be. Rather, it can be the beginning of multilateral, networked, bottom-up decision-making.

Just as importantly, this approach does not take away any flexibility. All an EIS process would do is coordinate information and scope what future research should be conducted and what impacts to watch out for. Cooperating on diligence does not tie any hands of any participating regulator. That is, the United States still has every SRM path open to it even if it engages in the kind of diligence outlined in this Section. That flexibility is a strong reason to engage in such diligence globally and together. It increases the number of regulators considering potential impacts and thus is likely to result in better impact statements. And better understanding SRM impacts leads to better domestic decision-making, no matter what decision one ends up taking in the end.

### 1. Notice-and-Comment Plus: Global Regulatory Dialogue

Obviously, even programmatic NEPA review of current SRM modelling efforts and early tests in their own right are not enough to provide a robust governance framework for SRM

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424. See 40 C.F.R. § 1503.1; EO 12,114, *supra* note 387, §§ 2-3(b), 2-4(a)(ii), 2-4(b)(ii).

425. See EO 12,114, *supra* note 387, §§ 2-3(b), 2-4(a)(ii), 2-4(b)(ii); Espoo Convention, *supra* note 383, at arts. 3(1), 5.



development and deployment. Such NEPA review does not itself license any SRM methods or providers, does not set parameters within which SRM could be developed or deployed, and generally does not itself curtail governmental or private SRM conduct.<sup>426</sup> NEPA review does not determine which policy, program, or licensing decisions must be taken.<sup>427</sup> A regulator conducting a NEPA review does not need to choose the least environmentally destructive path—it just needs to explain why it did not choose that path if it proceeds along a different route.<sup>428</sup> It simply needs to take NEPA findings into account in its own program decisions.<sup>429</sup> NEPA findings of a significant environmental impact do not themselves have to sound the starter gun for further regulatory action.<sup>430</sup>

As we consider the global regulation of SRM, this may sound like a discouraging conclusion. It need not be. Rather, given that each SRM approach will bring its own environmental impacts, it is on the whole likely that each of these impacts in turn will trigger other regulatory obligations outside of NEPA.

One statute that is likely to be implicated is the Clean Air Act.<sup>431</sup> Consider one of the simplest methods of SRM: sulfate spraying.<sup>432</sup> To spray sulfates is to emit a pollutant into the air.<sup>433</sup> In the case of sulfates, the traditional consequences of increased acid rain mean that this type of emission would fall under traditional EPA regulatory authority under the Act for pollution.<sup>434</sup> *West Virginia v. EPA* on its face does not displace

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426. 42 U.S.C. § 4331 et seq. (2020).

427. See Steven Ferrey, *Null Climate Federalism: State Frustration of Federal Renewable Energy Entitlements*, 39 VA. ENV'T L.J. 1, 66 (2021) (noting the comparative lack of NEPA bite); but see Richard A. Epstein, *The Many Sins of NEPA*, 6 TEX. A&M L. REV. 1, 11–14 (2018) (arguing that NEPA review still too burdensome and slow).

428. CEQ-PEA, *supra* note 365, at 38–39.

429. See *id.*

430. See *id.*

431. See Hester, *supra* note 354, at 890 (current case law presents “climate engineering proponents with a Hobson’s choice: either risk public nuisance liability by arguing that the Clean Air Act does not apply to climate engineering projects, or accept the prospect of Clean Air Act permitting obligations”).

432. See NAT’L RSCH. COUNCIL, DIV. OF EARTH & LIFE STUD., *supra* note 22, at 381.

433. Zora F. Franicevic, *Engineering Our Climate: A Comprehensive Legal Framework that Captures the Harmful Effects of Geoengineering Approaches*, 30 CORNELL J.L. & PUB. POL’Y 587, 600–03 (2021).

434. *Id.* This would set up the regulatory fight whether the use of aircrafts to spray sulfates, rather than cannons, would move the same SRM method beyond the scope of Clean Air Act regulation as aircrafts may not be stationary sources. *Id.*

this authority but in fact uses the EPA's acid rain efforts as an example of the EPA acting in its traditional authority.<sup>435</sup>

But just as importantly, the fact that an emission has climate consequences makes that emission “pollution” under the Clean Air Act by virtue of the logic of *Massachusetts v. EPA*.<sup>436</sup> The key move by the *Massachusetts v. EPA* majority was to ask first if CO<sub>2</sub> was in fact emitted and, if yes, if once emitted CO<sub>2</sub> had negative climate consequences.<sup>437</sup> It answered “yes” to both questions.<sup>438</sup> The emission of sulfates (or in fact any other substance) would face a similar fate—sulfates are “emissions” in that they are particles released into the air.<sup>439</sup> And the emissions of these substances affect the climate—that is the purpose for releasing the particles in the first place.<sup>440</sup> Consequently, the EPA should have regulatory authority (and regulatory duties) under the Clean Air Act for all substances emitted into the air in order to change the climate.<sup>441</sup>

This leaves the question whether the “major questions doctrine” might block regulation of SRM under the Clean Air Act. If triggered, the major questions doctrine, in a nutshell, allows the courts to strike down administrative rules even if an agency, on a literal reading of a statute, would be permitted to promulgate that regulation.<sup>442</sup> The major questions doctrine has been described as “a potential nuclear bomb that can be aimed not merely at a particular rule, but at crippling an agency’s ability to regulate at all.”<sup>443</sup> The central U.S. Supreme Court

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This regulatory evasion maneuver can likely be addressed through acid rain related regulations under the Clean Air Act. *Id.*

435. 142 S. Ct. 2587, 2615 (2022).

436. 549 U.S. 497, 506 (2007).

437. *Id.* at 528–32.

438. *Id.* at 530. Importantly, *West Virginia v. EPA* did not overrule or distinguish *Massachusetts v. EPA* for stationary sources. *West Virginia*, 142 S. Ct. at 2587.

439. *Massachusetts*, 549 U.S. at 529 (“[T]he definition embraces all airborne compounds of whatever stripe, and underscores that intent through the repeated use of the word ‘any.’”).

440. *See id.* at 528 (“Because EPA believes that Congress did not intend it to regulate substances that contribute to climate change, the agency maintains that carbon dioxide is not an ‘air pollutant’ within the meaning of the provision. The statutory text forecloses EPA’s reading.”).

441. *See id.* at 534–35.

442. Jonas J. Monast, *Major Questions About the Major Questions Doctrine*, 68 ADMIN. L. REV. 445, 447 (2016).

443. Harvey Reiter, *Expanding ‘Major Questions Doctrine’ Risks Regulatory Stability*, BLOOMBERG L. (July 12, 2022, 2:00 AM),

decision eliciting the comparison to a nuclear bomb was *West Virginia v. EPA*.<sup>444</sup>

The Court applied the major questions doctrine to determine that the EPA lacked authority to promulgate the Clean Power Plan under section 111(d) of the Clean Air Act.<sup>445</sup> The major questions doctrine may appear murky. Still, on closer analysis of *West Virginia*, it can be stated with reasonable clarity. Thus, one can break down the major questions doctrine in *West Virginia* into three elements. **First**, the major questions doctrine applies to types of **measures** as opposed to the question of whether an agency is authorized to deal with a particular subject matter at all (referred to below as **element 1**). **Second**, the measure in question must **depart from past regulatory practice** under the same statutory basis (referred to below as **element 2**). **Third**, if allowed to stand, the measure would have **far-reaching, structural consequences** for American society (referred to below as **element 3**). These three elements are present in *West Virginia* as well as the three core decisions on which it relies in its explanation of the doctrine: *Utility Air v. EPA*, *Gonzalez v. Oregon*, and *National Federation of Independent Business v. OSHA*.<sup>446</sup> Viewing these cases together, the major questions doctrine seeks to ensure that regulatory measures that affect a large number of people in an unexpected and significant fashion allow for an additional layer of legislative participation.<sup>447</sup>

In *West Virginia* and the Clean Power Plan, the question was not whether the EPA had any authority to regulate greenhouse gases under the Clean Air Act as such (i.e., the decision did not overrule *Massachusetts v. EPA*).<sup>448</sup> *West Virginia* concerned the specific measure adopted under section 111 of the Clean Air Act, namely the Clean Power Plan (**element 1**).<sup>449</sup> The Court's majority further reasoned that "[p]rior to 2015, EPA had always set emissions limits under

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<https://news.bloomberglaw.com/environment-and-energy/expanding-major-questions-doctrine-risks-regulatory-stability> [<https://perma.cc/X5QS-D8QK>].

444. *Id.*; see also *West Virginia v. EPA*, 142 S. Ct. 2587, 2608–09 (2022) (holding that in extraordinary cases there may be reason to hesitate before accepting a reading of a statute that would assert substantial power over the national economy through a government agency).

445. *West Virginia*, 142 S. Ct. at 2613.

446. *Id.* at 2608–09.

447. *Id.* at 2610.

448. *Id.* at 2609; see also *Massachusetts v. EPA*, 549 U.S. 497, 530 (2007).

449. *West Virginia*, 142 S. Ct. at 2609–10.

Section 11 based on the application of measures that would reduce pollution by causing the regulated source to operate more cleanly” (**element two**).<sup>450</sup> The Chief Justice finally notes the effect of the measure was to “substantially restructure the American energy market” (**element three**).<sup>451</sup>

Similarly, with regard to **element 1**, the Chief Justice used *Utility Air* as precedent because *Utility Air* challenged specific permitting authority with regard to greenhouse gases (rather than authority over greenhouses gas emissions in general).<sup>452</sup> He used *Gonzales* because it challenged the attorney general’s “assertion that he could rescind the license of any physician who prescribed a controlled substance for assisted suicide, even in a state where such action was legal.”<sup>453</sup> The Chief Justice relied on *National Federation of Independent Business* because it challenged a vaccine mandate (as opposed to any responses to a pandemic in the workplace).<sup>454</sup> With regard to **element 2**, the Chief Justice cited to *Utility Air* because the relevant objects of regulation “had never before been subject to such [permitting] requirements.”<sup>455</sup> He relied on *Gonzales* because the rescission of licenses on this basis was “unusual” in that it was not consistent with past practice.<sup>456</sup> He finally pointed to *National Federation of Independent Business* because OSHA had not applied a similar vaccine mandate (or similarly sweeping public health regulation) “in its half century of existence.”<sup>457</sup> The Chief Justice also highlighted, with regard to **element 3**, that *Utility Air* concerned a permitting requirement that would have affected “millions of small sources, such as hotels and office buildings.”<sup>458</sup> In *Gonzalez*, similarly, the exercise of authority would affect federalism by crippling state efforts to exercise their

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450. *Id.* at 2610.

451. *Id.*

452. *Id.* at 2608 (citing *Util. Air Regul. Grp. v. EPA*, 573 U.S. 302, 310 (2014)); see also Barry G. Rabe & Adrianna Pita, *What Does the Supreme Court’s EPA Ruling Mean for Climate Regulation?*, BROOKINGS (July 1, 2022), <https://www.brookings.edu/podcast-episode/what-does-the-supreme-courts-epa-ruling-mean-for-climate-regulation> [<https://perma.cc/9YYPG-DQGP>] (discussing the implications of *West Virginia v. EPA* and potential next steps for legislatures).

453. *West Virginia*, 142 S. Ct. at 2608 (citing *Gonzalez v. Oregon*, 546 U.S. 243, 297 (2006)).

454. *Id.* at 2608–09 (citing *Nat’l Fed’n of Indep. Bus. v. OSHA*, 142 S. Ct. 661, 668 (2022)).

455. *Id.* at 2608 (citing *Util. Air Regul. Grp.*, 573 U.S. at 310).

456. *Id.* (citing *Gonzalez*, 546 U.S. at 297).

457. *Id.* at 2608–09 (quoting *Nat’l Fed’n of Indep. Bus.*, 142 S. Ct. at 666).

458. *Id.* at 2608 (quoting *Util. Air Regul. Grp.*, 573 U.S. at 310).

constitutional competences.<sup>459</sup> Finally, *National Federation of Independent Business* concerned a measure that affected “84 million Americans” in their ability to make healthcare decisions or to face significant financial burdens due to weekly testing requirements.<sup>460</sup>

The regulation of SRM does not meet any of these requirements. It concerns a broad authority as opposed to a specific measure (**element 1**). Further, the EPA has imposed limitations on the manner of emission of similar air pollutants in the past (**element 2**). Finally, the measure itself is not directed at a large, existing, structural component of American society or the American economy but rather at new SRM operators (**element 3**). In fact, the regulation of SRM is precisely what permits a more gradual approach to climate mitigation and, as such, protects the kinds of interests that the Chief Justice was concerned should not be upset by regulatory fiat alone but only by a combination of legislative process and regulatory implementation of clearly delegated power.

Once we have determined that there is a duty to regulate both environmental and climate impacts of SRM under the Clean Air Act, any earlier NEPA findings of such impacts take on a different importance. Now, they become part of the record of what regulatory approach the EPA must take into account in responding to airborne pollutants.<sup>461</sup> The EPA now must make a decision that can be supported by a record which centrally includes this diligence.<sup>462</sup> NEPA diligence thus can guide the

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459. See *id.* at 2608 (citing *Gonzalez*, 546 U.S. at 270).

460. *Id.* at 2608–09 (quoting *Nat’l Fed’n of Indep. Bus.*, 142 S. Ct. at 665).

461. 42 U.S.C. § 7607 (2020) (dictating the administrative proceedings and judicial review standard for the prevention and control of air pollution).

462. See *Guidance on the Consideration of Past Actions in Cumulative Effects Analysis*, CEQ (June 24, 2005), [https://ceq.doe.gov/docs/ceq-regulations-and-guidance/regs/Guidance\\_on\\_CE.pdf](https://ceq.doe.gov/docs/ceq-regulations-and-guidance/regs/Guidance_on_CE.pdf) [<https://perma.cc/8C5Z-3EYN>]. One (imperfect) example is the case of guidance issued (then withdrawn and now to be reissued) on greenhouse gas emissions. For the 2016 guidance, see *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Review*, CEQ (Aug. 1, 2016), [https://ceq.doe.gov/docs/ceq-regulations-and-guidance/nepa\\_final\\_ghg\\_guidance.pdf](https://ceq.doe.gov/docs/ceq-regulations-and-guidance/nepa_final_ghg_guidance.pdf) [<https://perma.cc/3PVD-V75N>]. For the draft guidance issued by the Trump Administration to replace the 2016 guidance, see *Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions*, 84 Fed. Reg. 30,097 (June 26, 2019). The 2016 version is currently subject to updating. *Guidance on Consideration of Greenhouse Gases*, CEQ, [https://ceq.doe.gov/guidance/ceq\\_guidance\\_nepa\\_ghg.html](https://ceq.doe.gov/guidance/ceq_guidance_nepa_ghg.html) [<https://perma.cc/F87W-K788>]. On the impact of the social cost of carbon (and the

regulator's hands even and, in particular, in the context of other statutory schemes.<sup>463</sup> The same logic would apply in the context of other statutes such as the Endangered Species Act.<sup>464</sup>

The key remaining question is whether, in a purely domestic regulatory process under the Clean Air Act, the EPA may—or even must—take into account known foreign impacts of different regulatory approaches. The answer is “yes” on both counts. In the first place, the EPA takes foreign impacts into account as a matter of course; the Clean Power Plan is only one such example.<sup>465</sup> The EPA, therefore, certainly may take foreign impacts into account in promulgating a rule.<sup>466</sup>

Whether the EPA *must* do so is a more complicated question—but not by much. To understand why the EPA must act on such known foreign impacts, consider what would happen if the EPA did not do so. In that case, the EPA would knowingly not prevent harmful foreign environmental impacts (that is what our assumption means after all). The next question is whether the EPA could have prevented the negative environmental impact. If the EPA did not consider and act on known foreign environmental harm, it would be hard for the EPA to disprove such an allegation—logically, all a foreign State would have to show is one means of avoiding the foreign environmental harm. For instance, the EPA could simply have prohibited the particular type of SRM at issue. It is blackletter law that a State's authorization of conduct that causes transboundary environmental harm is internationally wrongful—it violates the no-harm principle of international environmental law.<sup>467</sup>

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impact of guidance documents), see Zoe Palenik, *The Social Cost of Carbon in the Courts: 2013-2019*, 28 N.Y.U. ENV'T L.J. 393, 398–404 (2020).

463. This is the case particularly in the context of PEA/PEIS. CEQ-PEA, *supra* note 365, at 26 (“The purpose and need statement and the proposed action for the programmatic NEPA review are critical for determining the compliance requirements under other applicable laws and regulations, such as the Endangered Species Act (ESA), National Historic Preservation Act (NHPA), and Clean Water Act.”).

464. *Id.*; For the applicability of the Endangered Species Act to SRM, see generally Hester, *supra* note 354, at 294–96.

465. See Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units; Final Rule, 80 Fed. Reg. 64,661, 64,682, 64,688, 64,914 (Oct. 23, 2015).

466. See *id.*

467. See SANDS & PEEL, *supra* note 121, at 206–10. In many instances, issues of proof can bog down litigation pursuant to the no-harm principle. See Case Concerning Pulp Mills on the River Uruguay (Arg. v. Urug.), Judgment, 2010 I.C.J.

This leads to a statutory construction question. The EPA may only act within the bounds of its delegated authority under statutes such as the Clean Air Act.<sup>468</sup> But what does the Clean Air Act require of the EPA? One fundamental rule of U.S. statutory construction is that a statute may not be interpreted in a manner that violates international law if an interpretation consistent with U.S. international legal obligations is possible absent clear congressional intent to violate the international law rule in question.<sup>469</sup>

The EPA, therefore, must interpret the Clean Air Act in a manner consistent with the U.S. obligations under international law.<sup>470</sup> This relevantly includes the obligation not to cause transboundary harm.<sup>471</sup> In our hypothetical, the EPA is aware of the transboundary harm potential due to its diligence efforts. It cannot now turn a blind eye to this harm without running afoul of a recognized rule of international law (and thus the

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14 (Apr. 20). For a discussion of this case, see Frédéric G. Sourgens, *Truths in Translation*, 44 FORDHAM INT'L L.J. 101, 108–09 (2020).

468. See EPA v. EME Homer City Generation, L.P., 572 U.S. 489, 513 (2014); Jonathan S. Masur & Eric A. Posner, *Toward A Pigouvian State*, 164 U. PA. L. REV. 93, 113 (2015); Rubenstein, *supra* note 281, at 219–20, 254–55.

469. Murray v. Schooner Charming Betsy, 6 U.S. (2 Cranch) 64, 118 (1804). The *Charming Betsy* canon provides that the laws of the United States will be read so as to comply with international law to the extent one such reading remains possible. See Curtis A. Bradley & Jack L. Goldsmith, *Presidential Control over International Law*, 131 HARV. L. REV. 1201, 1205 (2018) (“Courts apply international law directly as domestic law or indirectly when interpreting statutes or regulations in accordance with the Charming Betsy canon, and in both contexts often give presidential interpretations of international law substantial deference.”). The *Charming Betsy* canon forms part of the broader canon of constitutional avoidance. Richard H. Fallon, Jr., *Facial Challenges, Saving Constructions, and Statutory Severability*, 99 TEX. L. REV. 215, 221 n.37 (2020).

470. Warren v. EPA, 159 F.3d 616, 624 (D.C. Cir. 1998) (holding that the court’s consideration of a congressional statute must not violate international law); see also Roger P. Alford, *Federal Courts, International Tribunals, and the Continuum of Deference*, 43 VA. J. INT’L L. 675, 738–39 (2003) (discussing Warren).

471. The Council on Environmental Quality (the U.S. government instrumentality tasked with the implementation of NEPA) emphatically agrees with this assessment of the no-harm rule, stating that “[i]t has been customary law since the 1905 Trail Smelter Arbitration that no nation may undertake acts on its territory that will harm the territory of another state. This rule of customary law has been recognized as binding in Principle 21 of the Stockholm Declaration on the Human Environment and Principle 2 of the 1992 Rio Declaration on Environment and Development. This concept, along with the duty to give notice to others to avoid or avert such harm, is incorporated into numerous treaty obligations undertaken by the United States. Analysis of transboundary impacts of federal agency actions that occur in the United States is an appropriate step toward implementing those principles.”

CEQ-TRANSBOUNDARY IMPACT, *supra* note 387, at 3.

*Charming Betsy* canon).<sup>472</sup> Consequently, it must engage with foreign stakeholders and continue on the path already taken in the diligence context.<sup>473</sup> This result brings forward the ***benefits of inclusivity from the EIS process to the regulatory process***. It forces involvement of foreign stakeholders and consideration of foreign impacts at the regulatory stage. This, in turn, further strengthens the network effect; each regulator will communicate with its peers about how best to avoid transboundary harm. Bottom-up, networked governance is thus given a boost.

This approach displaces adventurist unilateralism in favor of inclusivity. Regulatory action with regard to SRM requires meaningful engagement with foreign stakeholders. This meaningful engagement puts forward the kind of networked discussion we have seen in the diligence context.

## 2. Additional Inquiries

This leads to the question: Does this boost in inclusivity come at the cost of flexibility? The answer is “no.” To understand why, we must return to why the EPA would be at the root of an internationally wrongful act if it did not consider foreign impacts in its own domestic regulatory process. That reason was the no-harm principle.

The no-harm principle would only limit flexibility in any meaningful sense if it were a strict liability rule. That is, if a State, by virtue of being harmed, could always demand that harmful conduct cease. But the no-harm principle is not a strict liability rule.<sup>474</sup> It is a principle that emerged first and foremost from the law of nuisance.<sup>475</sup> The law of nuisance looks to the reasonableness of the offending use vis-à-vis the person suffering the infringement.<sup>476</sup> A regulation would thus not

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472. *Id.*; *Charming Betsy*, 6 U.S. (2 Cranch) at 64; *Warren*, 159 F.3d at 624. See also sources cited *supra* note 469.

473. See CEQ-TRANSBOUNDARY IMPACT, *supra* note 387, at 3.

474. For scholarship regarding how international law influences the no-harm principle, see SANDS & PEEL, *supra* note 121, at 206–10.

475. *Trail Smelter (U.S. v. Can.)*, 3 R.I.A.A. 1905 (1941). For the genealogy of the development of the principle from *Trail Smelter*, see EDITH BROWN WEISS, ESTABLISHING NORMS IN A KALEIDOSCOPEIC WORLD 203 (2020).

476. See Jill M. Fraley, *Liability for Unintentional Nuisances: How the Restatement of Torts Almost Negligently Killed the Right to Exclude in Property*, 121 W. VA. L. REV. 419, 457–58 (2018) (discussing the potential for balancing within the elements of nuisance and how such actions move away from strict liability



violate the no-harm principle (even though it had transboundary effects) if the underlying regulatory response was reasonable.<sup>477</sup>

While reasonableness is a nearly impossible concept to pin down in the abstract, what is reasonable in the SRM context is more straightforward. Here, one would have to compare the price of inaction with the price of the particular SRM proposal. If the environmental harm from unabated climate change is equal to or greater than the harm from SRM, the SRM proposal would meet one straightforward reasonableness requirement. But that is not enough. After all, amputating a person's arm after the person was bitten by a venomous spider may not be reasonable even if the bite (left untreated) would have been lethal. It may be true that amputation was one way to prevent the venom from spreading. But the intuitive question would be: What other ways would have been available? If it would have been straightforward and inexpensive to administer an antivenom, it would be unreasonable to amputate the arm. The same is true in the SRM context: the question is whether there were other SRM methods available that, viewed globally, would be reasonably certain to do less harm, all things considered. That is likely not the case—all SRM methods will have negative impacts. Which negative impact to choose, therefore, will be a question as to which different regulators may come to different preliminary conclusions.

One might ask, “Is this flexibility a recipe for disaster?” Realistically, the answer, once more, is “no.” Before deployment of any one application of SRM would be authorized, there would be a significant number of studies. These studies could go forward even if they have some harmful effects. But once these studies conclude, networked governance will again take over; regulators are in touch to solve common problems. This means that examples of successful approaches are likely to be shared, adopted, and coordinated. And it means that any one approach that is disproportionately harmful to any one constituency is likely to be excluded. Flexibility in the real world will move toward convergence. This is not a wild theorem. Rather, it is a

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nuisance law); *see generally* Joseph A. Schremmer, *Getting Past Possession: Subsurface Property Disputes as Nuisance*, 95 WASH. L. REV. 315 (2020).

477. SANDS & PEEL, *supra* note 121, at 206–10; *see also* JUTTA BRUNNÉE, *PROCEDURE AS SUBSTANCE IN INTERNATIONAL ENVIRONMENTAL LAW* 64 (2020) (“More starkly put, it is lawful for a State to cause even significant transboundary harm to another State if it took reasonable steps, but nonetheless failed, to forestall the harm.”).

matter of common experience. Tapes displaced 8-tracks. VHS displaced Betamax. Microsoft Word displaced any number of word processing programs. And they did so not because the government mandated the adoption of one over the other but because of the power of convergence once successful approaches have reached a viability point.

The critical question is whether regulatory processes to get to that point can be made inclusive and flexible—not whether that flexibility will remain in place forever. And in the case of SRM technology, we have seen how such inclusivity and flexibility could naturally coexist in a bottom-up, networked governance approach.

### CONCLUSION

Much has been written about the threat of unilateral SRM action—particularly if the unilateral actor is the United States. We have seen that, under the right conditions, this concern is not only over-blown—it is entirely wrongfooted. Unilateral U.S. SRM action is a much-needed exercise of U.S. leadership with regard to a critical global governance challenge. U.S. SRM leadership is not a threat to be feared because such leadership can begin booting up a global SRM governance network by following existing statutory programmatic diligence regimes. These regimes will be better able to bring to bear global engagement on this issue than existing international environmental mechanisms. This diligence will, in turn, lead to networked regulatory governance that will take these benefits of networked diligence to a global, bottom-up governance approach to SRM.

This networked governance approach has several key benefits. The first of these advantages is the flexibility it offers. Given that we are still at an early stage in SRM governance, there is a need for significant regulatory learning. This learning can occur best when different regulators remain free to pursue their own pathways while communicating with their peers about potential impacts and actual results. A top-down governance approach would not provide the same advantage because it would grate against and seek to file down the natural, national differences in approaches to SRM governance. A bottom-up approach, on the other hand, can leverage that very same difference to build needed expertise quickly by sharing

information and allowing meaningful comment and engagement from the earliest possible time.

Second, as we have seen, networked SRM governance can also achieve strongly inclusive decision-making. This inclusivity is in part due to the flexibility of bottom-up SRM governance; every regulator is allowed to hold the regulatory pen and is therefore not reduced to a passive vote in favor of someone else's (hegemonic) approach. The flow of information from other regulators further helps regulators overcome learning curves quickly to catch up to current scientific and engineering knowledge. Networked governance further secures that each regulator is fully heard at an early stage in SRM development and program-building and is therefore able to influence the direction of SRM programs of its peers away from particularly dangerous pathways.

The main blind spot we have identified concerns the voice of marginalized groups in SRM decision-making. There, we found that U.S. leadership again can play a helpful part due to the significant experience of civil society engagement under NEPA. While such engagement needs to increase significantly to do justice to the governance challenge posed by SRM, NEPA provides a blueprint for how to do so. U.S. leadership, therefore, can be helpful in overcoming a State-based Achilles heel of international legal processes toward greater civic inclusion in global SRM decision-making.