CHAPTER 10

An Integrated and Inclusive SLCP Strategy for Asia

Recommended Policy and Institutional Reforms

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1 Introduction

The health, agriculture, and climate impacts of short-lived climate pollutants (SLCPs)—including black carbon, tropospheric ozone, and methane—are not only sizable but often interrelated.[1] Near-term climate changes, for instance, influence crop yields and food security. In addition, SLCPs often have varying yet underappreciated spatial and social impacts. In fact, women, children, and other vulnerable segments may suffer disproportionately from the impacts of SLCPs. Further, some SLCP control measures that offer the greatest potential to reduce these impacts may impose high costs and restrict the agency of key social groups (i.e. bans on open burning for farmers). Fortunately, the inverse of the above claim may also hold true: an effective SLCP response can yield multiple benefits for multiple stakeholders. While previous research features the potential benefits of sector-specific SLCP solutions, the broader policy and institutional reforms enabling their widespread implementation often fall to the margins of analyses.[2]

This chapter aims to bring policy and institutional considerations to the center of work on SLCPs. Its primary purpose is to suggest policy and institutional reforms needed for an integrated and inclusive SLCP strategy in Asia. The chapter begins by setting the context with a review of the interrelated yet varying impacts of SLCPs. It then underlines how work on 1) the science-policy-society interface; 2) multi-sectoral, multi-level governance; and 3) just

1 UNEP/WMO, 'Integrated Assessment of Black Carbon and Tropospheric Ozone: Summary for Decision Makers' (2011) <http://www.unep.org/dewa/Portals/67/pdf/Black_Carbon.pdf>; CCAC and UNEP, *Short-Lived Climate Pollutants Short-Lived Climate Pollutants in Latin America* (2018); UNEP, Asia Pacific Clean Air Partnership (APCAP) and CCAC, 'Air Pollution in Asia and the Pacific: Science-Based Solutions. United Nations Environment Programme' (2019) <https://www.ccacoalition.org/resources/air-pollution-asia-and-pacific-science-based-solutions-summary-full-report>.

2 Eric Zusman and others, 'One Atmosphere: Integrating Air Pollution and Climate Policy and Governance' (2021) 12 Atmosphere 1.

transitions can shed light on policy and institutional reforms underpinning an integrated and inclusive SLCP strategy. These reforms focus more attention on strengthening policy coherence, interagency coordination and vertical integration as well as opening compensatory programmes (for stakeholders adversely affected by SLCPs, in addition to control measures) and deliberative decision-making fora. Embedding key SLCP measures such as inspection/maintenance programmes, clean cookstoves and open burning of biomass residue in these broader institutional and policy reforms is critical for moving work on SLCPs forward in Asia and other regions.

The remainder of the chapter is divided into five sections. Section two focuses on the impacts of SLCPs on health, food production as well as varying impacts across social groups and space. Section three synthesizes research on the science-policy-society interface, multi-sector, multi-level governance, and just transitions to identify policy and institutional reforms supporting the implementation of SLCP measures. Section four applies insights from that research to three measures with significant potential in Asia: 1) inspection and maintenance programmes; 2) clean cookstoves; and 3) open burning of biomass. The final section concludes.

2 The Impacts of SLCPs

2.1 *Impacts Across Sectors*

The starting point for this chapter is the impact of SLCPs on health. It is difficult to overstate the health effects of many of the air pollutants labeled as SLCPs. According to the UN Environment Programme (2022), "air pollution is the greatest environmental threat to public health globally and accounts for an estimated 7 million premature deaths every year".[3] Other assessments using different indicators come to a comparable conclusion; annually, outdoor and indoor air pollution cause the loss of 215.5 million disability-adjusted life years.[4] The State of Global Air (2019) makes a similar point: air pollution was the fourth most important risk factor for death globally, following high blood pressure, tobacco, and diet.[5] The quality of air is of greater consequence for human mortality than many other causes—whether obesity in developed

3 UNEP, 'Air Pollution Note—Data You Need to Know' (2022) <https://www.unep.org/interactive/air-pollution-note/?fbclid=IwAR2KKH_zwwl9nDJFZkoyTny586HoI76dbswRKkuNoyBSJ6uystEHdXkEGLE>.

4 UNEP, APCAP and CCAC (n 1).

5 HFI, 'State of Global Air 2020' (2020).

countries or malnutrition and communicable diseases in less-developed countries.

When it comes to chronic exposure to air pollution, $PM_{2.5}$ (and its constitutive component of black carbon that is one of the key SLCPs) is most closely associated with mortality and other poor health outcomes.[6] The $PM_{2.5}$ exposure-related diseases include acute lower respiratory disease, heart disease, obstructive pulmonary disease, stroke, and lung cancer (WHO 2015, p.1). The first four of these were listed within the WHO's top 10 global causes of death in 2019 (WHO 2020). In addition, air pollution is also tied to other undesirable impacts such as type 2 diabetes and adverse birth outcomes (more on this later).[7] Ischemic heart disease rose from 4th in 1990 to 1st in both 2005 and 2014. Needless to say, air pollution remains an important factor when it comes to loss of healthy years of life.

SLCP's effects, however, do not begin nor end at human health but extend to the health of the planet.[8] In particular, SLCPs affect food systems, and therefore the health of populations, depending on what they eat. SLCPs impact food production in a number of ways: for instance, black carbon emissions impede sunlight required for photosynthesis.[9] In addition to black carbon, ozone pollution can lead to reduced yields of between 3% and 16% in rice, maize, wheat, and soybeans.[10] Air pollution also has serious implications for ecosystems and biodiversity.[11] Not surprisingly, a reduction in SLCPs will not only prevent crop losses, but advance other dimensions of sustainable development.[12]

SLCPs also have effects on the climate (see also Chapter 1).[13] Though recent studies have suggested the global climate impacts of black carbon may be more limited than once thought,[14] regional effects on cloud formation and

6 UNEP, APCAP and CCAC (n 1).

7 HFI (n 5).

8 Mark Elder and Christian Loewe, 'Introduction and Context' in UNEP (ed), *Global Environment Outlook—GEO6: Healthy Planet, Healty People* (United Nations Environment Programme 2019).

9 WHO, 'Reducing Global Health Risks: Through Mitigation of Short-Lived Climate Pollutants: Scoping Report for Policymakers' (2015).

10 ibid.

11 UNEP, 'Air Pollution Note' (n3).

12 Durwood Zaelke, 'Primer on Short-Lived Climate Pollutants' (2013) <http://www.igsd.org>.

13 TC Bond and others, 'Bounding the Role of Black Carbon in the Climate System: A Scientific Assessment.' (2013) 118 Journal of Geophysical Research: Atmospheres 5380.

14 Toshihiko Takemura, 'Return to Different Climate States by Reducing Sulphate Aerosols under Future CO_2 Concentrations' (2020) 10 Scientific Reports.

precipitation patterns are still believed to be significant.[15] Further emissions from black carbon rich sources such as diesel vehicles may be particularly destabilizing.[16] In addition, there is also growing evidence of methane's substantial and even greater than previously estimated impacts.[17]

2.2 *Impacts Across Social Groups*

The main sources of SLCPs are directly connected to the specific groups who suffer from negative health and other impacts. Those most affected are often constrained by where they live and their social station—e.g. women cooking at home, the children they reside with and care for, and the elderly. Though some have drawn attention to these varied effects—suggesting "the burden of disease attributable to air pollution does not fall evenly across age groups"[18]—this can often be the exception that illustrates the rule. To exemplify this point, a 48-page 2016 report by the European Investment Bank considered SLCPs and included "impact of activities" in its title, but did not mention elderly, women, or children.[19] Given this lack of attention, it is critical to disaggregate impact assessments for particular groups.

The starting point for this more disaggregated perspective is people living at lower levels of development. Poor and vulnerable groups are more likely to be exposed to air pollution, and this holds both across and within countries.[20] In general, air pollution from SLCPs is more of a problem in less-developed countries since there are fewer regulations and limited enforcement capacities; the fact that their populations tend to live closer to the sources of pollution

15 Lai Nguyen Huy, Ekbordin Winijkul and Nguyen Thi Kim Oanh, 'Assessment of Emissions from Residential Combustion in Southeast Asia and Implications for Climate Forcing Potential' (2021) 785 Science of the Total Environment.

16 Nazar Kholod and Meredydd Evans, 'Reducing Black Carbon Emissions from Diesel Vehicles in Russia: An Assessment and Policy Recommendations' (2016) 56 Environmental Science and Policy 1.

17 IPCC, *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (R Yu and B Zhou Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi ed, 2021).

18 HFI p. 16 (n5).

19 European Investment Bank, 'Short-Lived Climate Pollutants (SLCPs): An Analysis of the EIB's Policies, Procedures, Impact of Activities and Options for Scaling up Mitigation Efforts' (2016).

20 T Failey, 'Poor Communities Exposed to Elevated Air Pollution Levels' (2016) <https://www.niehs.nih.gov/research/programs/geh/geh_newsletter/2016/4/spotlight/poor_communities_exposed_to_elevated_air_pollution_levels.cfm> accessed 6 December 2022.

adds another layer of complexity to the issue.[21] However, this is not simply a developed-developing country debate. More-developed economies also have income-related disparities when it comes to air pollution: those with lower socio-economic status are more likely to live in areas with dirtier air.[22]

Another differentiating dimension is gender. In general, air pollution from SLCPs in households is the greatest cause of non-communicable disease in women.[23] McDuffie et al. (2021) found that the disease burden related to $PM_{2.5}$ from the heating of and cooking in residences was associated with an estimated 770,000 deaths annually.[24] However, such gender-differentiated effects can often be relegated to the footnotes of research. The previously mentioned 2021 report to "provide the first comprehensive estimates of source contributions to exposure to $PM_{2.5}$ and cause-specific disease burden at global, regional, and national scales" actually does not refer to women specifically.[25]

A third at-risk population group to SLCPs is children. Research shows that exposure to air pollution at young ages leads to adverse outcomes at birth (babies born too early and with low weights),[26] and higher incidence of pneumonia-related deaths.[27] A fifth of infant mortality taking place in babies' first month is attributable to air pollution such as ambient $PM_{2.5}$ and ozone, as well as household cooking.[28] To put a firm number on this, globally nearly half a million newborns die annually due to air pollution.[29] Exposure to air pollution does not stop when they age. Exposing children to air pollution continues to burden them with respiratory and immune system difficulties as they move into adulthood.[30]

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21 UNEP, APCAP and CCAC (n 1).

22 Lara Cushing and others, 'Environmental Equity : Evidence from California's Cap-and-Trade Program' (2018) 15 plos Medicine 1; Anjum Hajat, Charlene Hsia and Marie S O'Neill, 'Socioeconomic Disparities and Air Pollution Exposure: A Global Review' (2015) 2 Current Environmental Health Reports 440 <https://pubmed.ncbi.nlm.nih.gov/26381684/> accessed 6 December 2022.

23 K Akahoshi and E Zusman, 'Bringing Clean Air to 4 Billion People in Asia' *The Diplomat* (23 September 2021) <https://thediplomat.com/2021/09/bringing-clean-air-to-4-billion-people-in-asia/> accessed 6 December 2022.

24 E McDuffie and others, 'Global Burden of Disease from Major Air Pollution Sources (GBD MAPS): A Global Approach' (2021) <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emexb&NEWS=N&AN=639091709> accessed 6 December 2022.

25 ibid.

26 HFI (n 5).

27 UNEP, APCAP and CCAC (n 1).

28 McDuffie and others (n 24).

29 HFI (n 5).

30 UNICEF, 'Clean Air for Children' (2016) <https://www.unicef.org/media/49966/file/UNICEF_Clear_the_Air_for_Children_30_Oct_2016.pdf> accessed 6 December 2022;

A final area where these effects vary involves the elderly. An increasing amount of scholarship looks at how air pollution is associated with diseases that affect older populations, particularly among seniors. Not only are these populations more vulnerable due to weakened immune systems, they have also been exposed to air pollutants for longer time periods. Clearly, chronic exposure is tied to pulmonary disease, asthma, as well as emphysema.[31] Even low exposure year after year leads to increased incidence of respiratory disease, heart attacks, and stroke.[32] In addition, there is an association between air pollution, dementia, and chronic kidney disease.[33]

2.3 *Impacts Across Scales and Regions*

SLCPs do not simply affect multiple dimensions of development or social groups; there are also geographic and spatial differences in their effects. Impacts on health, food and other development concerns vary across space for reasons owing to levels of development. In fact, air pollution exposure and its impacts are often connected to a country's level and style of development.[34] Those undergoing rapid development face a larger health burden[35] and differences in development play a part in disparities for both level of exposure and overall health.[36] Even though researchers understand much more about how health is negatively affected by air pollution, geographic disparities persist, with many areas lacking sufficient improvement.[37] There are also gaps in data for some regions, such as Africa.[38]

There are also regional variations within countries. Outdoor air pollution is particularly dangerous in rapidly expanding urban areas.[39] Urbanisation in

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UNICEF, 'Mongolia's Air Pollution Crisis: A Call to Action to Protect Children's Health' (2018) <https://reliefweb.int/sites/reliefweb.int/files/resources/Mongolia_air_pollution_crisis_ENG.pdf> accessed 6 December 2022; UNICEF, 'Child-Centred Clean Air Solutions: Guide for Asia and the Pacific Region' (2022).

31 Marzia Simoni and others, 'Adverse Effects of Outdoor Pollution in the Elderly' (2015) 7 Journal of Thoracic Disease 34.

32 Mahdieh Danesh Yazdi and others, 'Long-Term Association of Air Pollution and Hospital Admissions among Medicare Participants Using a Doubly Robust Additive Model' (2021) 143 Circulation 1584.

33 McDuffie and others (n 24).

34 HFI (n 5).

35 UNEP, APCAP and CCAC (n 1).

36 HFI (n 5).

37 ibid.

38 UNEP, 'Integrated Assessment of Air Pollution and Climate Change in Africa 2020–2021' (2022).

39 UNEP, APCAP and CCAC (n 1).

these countries can take place quickly and without much planning, which is associated with more ambient air pollution from vehicles.[40] However, "air pollution is not just a problem in cities"; billions in rural areas face exposure to health-damaging $PM_{2.5}$ and more.[41]

The effects can also vary at the even smaller scales—notably the community level. To cite an example covered later in the chapter, a significant number of health problems are attributed to fuels rural populations often use for heating and cooking, ranging from wood, charcoal and coal, to animal dung.[42] Estimates from 2015 show that 2.7 billion people resided in conditions that exposed them to contaminated air.[43] The WHO also observes that "fuel combustion in residential and commercial buildings and transport together account for approximately 80% of anthropogenic black carbon emissions".[44]

Finally, there are regional differences. Generally, air pollution is most dangerous in the Asia-Pacific.[45] The vast majority (more than 90%) of people living in Asia are exposed to dirty air that exceeds WHO guidelines and leads to greater risk of illness and early death.[46] About 91% of premature deaths related to air pollution take place in middle-or lower-income countries, with sizable concentrations in Asia.[47] As a result of having large populations sizes and poor air quality, India and China account for a significant number of deaths caused by air pollution.[48] Due to the sizable impacts and potential benefits in Asia, much of the chapter will refer to examples in the region.

3 Toward an Integrated and Inclusive SLCP Strategy for Asia

The previous section highlighted the serious threat that SLCPs pose to health, food, and climate systems. It also underlined that those impacts are not uniform; they vary across sectors, social groups and locations. This section

40 Simoni and others (n 31).
41 UNEP, APCAP and CCAC (n 1).
42 HFI (n 5).
43 UNEP, APCAP and CCAC (n 1).
44 WHO, 'Reducing Global Health Risks: Through Mitigation of Short-Lived Climate Pollutants: Scoping Report for Policymakers' (n 9).
45 UNEP, APCAP and CCAC (n 1).
46 Elder and Loewe (n 8).
47 WHO, 'Ambient (Outdoor) Air Pollution' (22 September 2021) <https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health> accessed 24 May 2022.
48 HFI (n 5).

discusses policy and institutional reforms for a strategy that not only addresses the multiple impacts of SLCPs but captures a range of benefits in the process. To do so, the section draws on three strands of literature that could inform a more integrated and inclusive SLCP strategy: 1) the science-policy-society interface; 2) multi-sectoral, multi-level governance; and 3) just transitions.

3.1 *Strengthening the Science-Policy-Society Interface*

Research on the science-policy-society interface has evolved over three discrete stages. Beginning in the 1960s, the first of these stages implicitly subscribed to an almost "linear" and "unidirectional" view of "science informing policymaking". An arguably more accurate "interactive" second phase followed, emphasizing a science and policy interplay. Most recently, an even more nuanced "embedded" phase has underlined the need to include citizens and other stakeholders in decisions affecting their livelihoods, thereby ensuring greater scrutiny and legitimacy of those decisions. Over the course of this three-stage evolutionary development, there has also been a growing understanding of the factors and actors that support a dynamic interchange between science, policy and wider society.[49]

Table 10.1 summarizes literature on the actors and factors highlighted in relevant studies. In so doing, the table underlines some salient points that subsequently have been reflected in research and initiatives on SLCPs—though this research has a more general focus on society-policy interface. Connections between the findings of this literature and the science-policy-society interface as it relates to SCLPs are further discussed below.

First, Table 10.1 suggests that when it comes to the producers of scientific information, key characteristics of knowledge such as relevance, transparency, accessibility, and timeliness matter for influencing policy. Some of the most persuasive SLCP research has focused on developing clear, cogent, and accessible analyses of how much different mitigation measures deliver tangible benefits. Studies such as *Air Pollution in Asia and the Pacific: Science-based Solutions* has been able to gain traction among policymakers in Asia, in part, because it helps present a robust case for 25 measures that can bring health, food, and climate benefits to the region.[50]

Second, the table shows that work on SLCPs has also paid attention to decision-makers receiving scientific knowledge. This is not only evident in the studies that estimate the benefits of more integrated air pollution and climate

49 Nataliia Sokolovska, Benedikt Fecher and Gert G Wagner, 'Communication on the Science-Policy Interface: An Overview of Conceptual Models' (2019) 7 Publications.

50 UNEP, APCAP and CCAC (n 1).

TABLE 10.1 Science-policy-society interface

Actors	Featured subthemes
1. Producers of Scientific Information	Relevance of Information[a] Openness/Transparency[b] Accessibility[c] Timeliness[d] Inclusiveness[e]
2. Recipients of Scientific Information	Willingness to Accept Information[f] Institutional Capacity[g] Inclusiveness[h]
3. Role of Intermediaries and Co-design[i]	---

a Sharon A Jones, Baruch Fischhoff and Denise Lach, 'Evaluating the Science-Policy Interface for Climate Change Research' (1999) 43 Climatic Change 581; David W Cash and others, 'Knowledge Systems for Sustainable Development' (2003) 100 Proceedings of the National Academy of Sciences of the United States of America 8086; Michael J Spilsbury and Robert Nasi, 'The Interface of Policy Research and the Policy Development Process: Challenges Posed to the Forestry Community' (2006) 8 Forest Policy and Economics 193.

b ibid; Robert T Watson, 'Turning Science into Policy: Challenges and Experiences from the Science-Policy Interface' (2005) 360 Philosophical Transactions of the Royal Society B: Biological Sciences 471.

c Jones, Fischhoff and Lach (n a); Cash and others (n a); Spilsbury and Nasi (n a).

d Spilsbury and Nasi (n a).

e A Gupta and others, *Science Networks* (2012); Yulia Yamineva, 'Lessons from the Intergovernmental Panel on Climate Change on Inclusiveness across Geographies and Stakeholders' (2017) 77 Environmental Science and Policy 244 <http://dx.doi.org/10.1016/j.envsci.2017.04.005>.

f Dhanush Dinesh and others, 'Learning from Failure at the Science–Policy Interface for Climate Action in Agriculture' (2021) 26 Mitigation and Adaptation Strategies for Global Change.

g ibid; Zoë Heritage and Geoff Green, 'European National Healthy City Networks: The Impact of an Elite Epistemic Community' (2013) 90 Journal of Urban Health 154.

h N Castells and J Ravetz, 'Science and Policy in International Environmental Agreements' (2001) International Environmental Agreements: Politics, Law and Economics 405; André Derek Mader and others, 'Country Representatives' Perceptions of the Biodiversity Science-Policy Interface' (2021) 1 Conservation 73; Watson (n b).

i David H Guston, 'Boundary Organizations in Environmental Policy and Science: An Introduction' (2001) 26 Science, Technology, & Human Values 399; Spilsbury and Nasi (n a); GD Gooch and others, 'The Science–Policy–Stakeholder Interface in Sustainable Water Management: Creating Interactive Participatory Scenarios Together with Stakeholders', Science, Policy and Stakeholders in Water Management (Routledge 2010); Lisa Dilling and Maria Carmen Lemos, 'Creating Usable Science: Opportunities and Constraints for Climate Knowledge Use and Their Implications for Science Policy' (2011) 21 Global Environmental

TABLE 10.1 Science-policy-society interface (*cont.*)

Change 680; M Jacob and T Hellström, 'Reviewing the Science-Policy Relationship: The Policy as Theory Alternative (PAST)' (1998) 25 Science and Public Policy 218; Kai Wan and others, 'Science-Policy Interplay on Air Pollution Governance in China' (2020) 107 Environmental Science and Policy 150 <https://doi.org/10.1016/j.envsci.2020.03.003>.

controls; it is also apparent in efforts to build the capacity of decision-makers to use that information. For instance, the Climate Change and Clean Air Coalition (CCAC)—a global network of more than 100 state and non-state partners that was formed more than a decade ago to catalyze action on SLCPs—has offered funding for in-country capacity building work on SLCPs and sought to assure that is consistent with regional and national needs. Many countries have been responsive to this approach; for example, in Asia the Maldives developed SLCP action plans, while Cambodia integrated SLCPs into its clean air initiatives.

Third, there has been an active effort to use intermediaries and co-design to help mainstream SLCPs into national and local planning processes. This is again readily apparent when looking at the work of the CCAC as well as regional initiatives such as the Asia Pacific Clean Air Partnership and Clean Air Asia; all three of these initiatives and organizations have made considerable efforts to mediate between science, policy and wider society in order to demonstrate the multiple benefits achieved by implementing the aforementioned 25 clean air measures.[51]

One of the strengths of research and initiatives on SLCPs is that they have generated estimates of narrow measures that make it easier to communicate and build capacities of policymakers and other stakeholders. An important caveat, however, is that these activities have often paid less attention to the policy and institutional reforms needed to work across sectors and social groups for effectively implementing such measures at scale. The next section will argue that research on multi-sectoral, multi-level governance and just transitions could complement work on science-policy-society because it pays more attention to these intersectoral and multi-stakeholder dynamics. Bringing in insights from this complementary work stands to not only strengthen relevant research. It can also bridge institutional divides and harness stakeholder energies in ways that drive the widespread implementation of narrower SLCP measures.

51 ibid.

3.2 *Toward an Integrated Strategy: Bringing in Multi-sector, Multi-level Governance*

A line of work that can offer insights into policy and institutional reforms supporting widespread implementation comes from studies on governance. A longstanding observation within this field is that government agencies with different remits may fail to work together even if it is in a country's (broadly conceived) interest to do so.[52] These cross-agency challenges can stem from issues ranging from differences in budgeting allocation formulas to variations in organisational cultures. There have nonetheless been some efforts to bridge these institutional divides. For example, a sizable literature has concentrated on how policies can be made more coherent or integrated by, to illustrate, requiring that environmental considerations are included in economic policies.[53] Other studies have underlined the importance of institutional changes such as interagency coordination mechanisms or multiagency task forces that can lead to more coherent policies.[54] Such institutional changes may also entail data sharing protocols or tagging of public budgets so they reflect impacts on climate, health, and other development needs.

Another coordination challenge concerns aligning actions across different administrative levels. A core insight from work on multi-level governance—sometimes framed as vertical integration—is that local governments often find it easier than national governments to formulate responses to climate and other global challenges.[55] This is, in part, because local governments are better positioned to recognize ways that strategic responses align with other development needs. It may also be because local authorities often find it easier to navigate interagency turf wars and break down the siloes that impede integrated responses in larger and inherently more complex national level organizational

52 B Guy Peters, 'The Challenge of Policy Coordination' (2018) 1 Policy Design and Practice 1 <https://doi.org/10.1080/25741292.2018.1437946>; B Guy Peters, 'Managing Horizontal Government: The Politics of Co-Ordination' (1998) 76 Public Administration 295.

53 ibid; Åsa Persson and others, 'Editorial: Environmental Policy Integration: Taking Stock of Policy Practice in Different Contexts' (2018) 85 Environmental Science & Policy 113.

54 B Guy Peters (n52).

55 Michele M Betsill and Harriet Bulkeley, 'Cities and the Multilevel Governance of Global Climate Change' (2006) 12 Global Governance 141; Jan Corfee-Morlot and others, 'Cities, Climate Change and Multilevel Governance' (2009) Cushing L and others, 'Environmental Equity : Evidence from California's Cap-and-Trade Program' (2018) 15 PLOS Medicine 1; Barry G Rabe, 'Beyond Kyoto : Climate Change Policy in Multilevel Governance Systems' (2007) 20 423.

settings.[56] At the same time, local governments are naturally smaller-scale, and face some limitations in their capacity to effectively organize. They also may have specific interests that conflict with broader measures to address pollution. It therefore merits highlighting that national governments can play a critical role in response. For instance, they may offer fiscal and other incentives to help forward-looking local governments advance more integrated responses to climate and other development concerns.[57] They can similarly provide support and resources to local governments that are further behind the learning curve, enabling them to extract and adapt experiences from elsewhere. Provided that there is alignment across levels, international and regional organizations can also offer technical assistance and afford national and local governments a platform for demonstrating integrated actions. This alignment is moreover increasingly important given the need for coordination across different spatial scales to maximize the benefits from solutions.

3.3 *Toward an Inclusive Approach: Bringing in Just Transitions*

Another potentially revealing piece of work on just transitions suggests supporting the implementation of key measures and requires recognizing that impacts and benefits may not only be distributed across different spatial scales but also between different social groups. Research in this area grows from the understanding that some climate policies may leave select groups and regions worse off even if they generate considerable aggregate benefits. This has led to consideration of some remedial policy actions targeting those who suffer employment and other losses due to the closure of industries and sectors. While some of this work highlighted specific kinds of compensatory policies and programmes (i.e. retraining programmes), others have pointed to the need for more expansive social dialogues and interactive discussion among those who are adversely affected, including on efforts to arrive at the compensatory policies.[58]

A related line of work has suggested the need for participatory and deliberative (institutional) fora to advance more sustainable and just transitions. This inclusion could occur at several different entry points—from the local to the

56 Edgardo Bilsky, Anna Calvete Moreno and Ainara Fernández Tortosa, 'Local Governments and SDG Localisation: Reshaping Multilevel Governance from the Bottom Up' (2021) 22 Journal of Human Development and Capabilities 713.

57 M Mohieldin and others, 'The Role of Local and Regional Governments in the SDGs: The Localization Agenda', *Business, Government and the SDGs* (Palgrave Macmillan 2023).

58 Béla Galgoczi, 'From Paris to Katowice: The EU Needs to Step Up Its Game on Climate Change and Set Its Own Just Transition Framework' [2018] SSRN Electronic Journal.

national level. There are a few concrete options that might have relevance in this regard. For example, in countries such as Ghana, the government has instituted gender quotas to ensure that women have a seat and voice at the table.[59] Other studies have also pointed to the important role small scale or what some call mini-public deliberative fora can play in increasing the quantity as well as the quality of inputs from affected stakeholder groups.[60] These fora could be built into existing decision-making processes where there are clearly differentiated impacts as well as benefits for key stakeholder groups.

4 Three Measures Where Integration and Inclusion Matter in Asia

The consideration of the above lines of work is particularly relevant to this chapter. As noted previously, SLCPs have not only cross-sectoral but differential impacts across regions and social segments; thus, effective implementation of priority mitigation measures requires additional consideration among the broader set of policies and institutions that drive implementation. This section concentrates on policy and institutional reforms that can support the implementation of three measures that have sizable benefits in Asia. Table 10.2 summarizes some of those main recommendations for a key transport measure, namely the inspection and maintenance programmes for on-the-road vehicles as well as clean cookstoves (see also Chapter 9) and open burning of biomass, all of which are described in the text that follows.

4.1 *Inspection and Maintenance Programmes*

One of the key solutions that cannot only significantly reduce emissions of black carbon but may also have sizable impacts on the well-being of poorer populations is an effective inspection and maintenance (I&M) programme. I&M programmes are critical for controlling SLCPs because they help to curb emissions from a segment of the transportation fleet that contributes disproportionately to pollution. This narrow segment is made of vehicles known as "super-emitters" (such as trucks that are more than 20 years old). Data on

59 Nathan J Cook, Tara Grillos and Krister P Andersson, 'Gender Quotas Increase the Equality and Effectiveness of Climate Policy Interventions' (2019) 9 Nature Climate Change 330 <http://dx.doi.org/10.1038/s41558-019-0438-4> accessed 6 December 2022.

60 Graham Smith and Maija Setälä, 'Mini-Publics and Deliberative Democracy' in Andre Bächtiger and others (eds), *The Oxford Handbook of Deliberative Democracy* (2018) <https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780198747369.001.0001/oxfordhb-9780198747369-e-27> accessed 12 June 2022.

TABLE 10.2 Examples of policy and institutional reforms enabling the implementation of key SLCP measures in Asia

	Integration		Inclusion	
	Policy	**Institutional**	**Policy**	**Institutional**
Inspection and Maintenance (I&M) Programmes	Include I&M in climate and air pollution policies	Strengthen interagency coordination between transport and environmental/ climate agencies	Provide subsidies/ compensation for low income drivers of older vehicles for repairs or new vehicles	Create deliberative fora that enable vehicle users to participate in design and implementation of I&M programmes
Residential Energy and Clean Cooking	Include clean cooking programmes in climate and air pollution policies	Strengthen interagency coordination between energy (especially rural energy divisions) and environmental/ climate agencies	Provide subsidies/ compensation for low-income users of traditional stoves to transition to cleaner stoves or fuels	Create deliberative fora that enable vehicle users to participate in design and implementation of cookstove programmes
Open Burning of Agricultural Residue and Biomass	Include open burning prevention in climate and air pollution policies	Strengthen interagency coordination between energy (especially rural energy divisions) and environmental/ climate agencies	Provide subsidies/ compensation for small scale farmers to purchase control technologies or transition to more circular models of crop residue use	Create deliberative fora that enable vehicle users to participate in design and implementation of cookstove programmes

the performance of older and poorly maintained vehicles bears this out: in many developing countries, a small share of 5% to 10% of the total vehicle fleet contributes between 50% to 80% of total vehicle emissions. At the same time, studies have shown that in rapidly motorizing cities such as Bangkok, investments in improving these programmes would deliver benefits that far outweigh the costs.[61]

Though there is growing awareness of this cost-benefit calculus, effective implementation of I&M programs is challenging. Part of the difficulty is technical in nature: testing equipment needs to be compatible with varied driving conditions. However, many of the key challenges involve issues pertaining to wider policy and institutional issues.[62] For instance, there is a need to ensure coherence between climate, air quality and transport policies; often inspection and maintenance is not featured in climate or air quality policies. Furthermore, there may also be a need to support greater governmental coordination between environmental and transport agencies. In addition, mechanisms that support the transfer of funds to local governments can help in strengthening monitoring of implemented programmes. In a similar fashion, I&M programmes would arguably benefit from compensatory measures that, among others, subsidize automotive repairs among low-income groups. A similarly motivated set of reforms could involve fostering opportunities for low-income drivers and advocacy groups to participate in fora where decisions are made over programme implementation.

4.2 *Residential Energy and Clean Cooking*

Another key SLCP measure involves residential energy and cookstoves. In energy-scarce and rural areas, traditional cook stoves are powered by firewood, dung, biomass, and coal. Beyond low levels of combustion, the lack of ventilation from traditional stoves leads to high levels of emissions that contribute to worsening air quality.[63] The knowledge of these adverse impacts has led governments and the international development community to promote a variety

61 Ying Li, 'Evaluating and Improving the Effectiveness of Vehicle Inspection and Maintenance Programs: A Cost-Benefit Analysis Framework' (2017) 08 Journal of Environmental Protection 1541.

62 ibid; Ying Li and Douglas J Crawford-Brown, 'Assessing the Co-Benefits of Greenhouse Gas Reduction: Health Benefits of Particulate Matter Related Inspection and Maintenance Programs in Bangkok, Thailand' (2011) 409 Science of the Total Environment 1774 <http://dx.doi.org/10.1016/j.scitotenv.2011.01.051>.

63 WHO, 'Increasing Access to Clean Cooking through Subsidies' (2022) <https://www.householdenergypolicies.org/assets/subsidies.pdf?sfvrsn=6a5a5a19_5> accessed 6 December 2022.

of solutions. Several solutions involve technical measures like improved cookstoves with fans, electrification, switching to liquified petroleum gas, and biodigesters that generate alternative lower emission fuels.[64]

There have nonetheless been challenges to the widespread uptake of cleaner options. Some of the barriers are again technical in nature, such as a lack of access to cleaner fuels. However, many would benefit from paying greater attention to work across sectors and involving key stakeholders. For instance, residential energy systems do not always fit into climate or even air pollution strategies. Another part of why these issues are often relegated to the margins of policy decisions relates to the absence of key agencies and divisions in relevant discussions. For these reasons, cleaner stove and fuel programmes stand to gain more traction with greater engagement between national, local and even community level governments.[65] Similarly, such programmes would find greater support from targeted subsidy programmes aimed at helping lower-income groups shift to less polluting fuels and technologies;[66] in much the same way, the creation of decision-making fora that enable the meaningful participation of stove users and purchasers would also be useful.[67]

4.3 *Open Burning of Agricultural Residue and Biomass*

A third key SLCP measure involves open burning of agricultural residues. With growing pressures to accelerate planting and harvesting cycles, farmers in many parts of the world often use fire to clear residue (such as rice stalks) from fields. Though expedient, this technique leads to higher emissions of

64 K Thoday and others, 'The Mega Conversion Program from Kerosene to LPG in Indonesia: Lessons Learned and Recommendations for Future Clean Cooking Energy Expansion' (2018) 46 Energy for Sustainable Development 71; Kaoru Akahoshi and others, 'Overcoming Barriers to Clean Cooking in Thailand: A Quantitative Assessment' (2022) April-June Asia Pacific Tech Monitor <https://apctt.org/sites/default/files/attachment/2022-09/06_Cookstove_Article_rev10_AB_Edited_DM.pdf>; Huy, Winijkul and Kim Oanh (n 15).

65 Putti Venkata Ramana and others, 'The State of the Global Clean and Improved Cooking Sector' [2015] ESMAP and GACC 1 <https://openknowledge.worldbank.org/bitstream/handle/10986/21878/96499.pdf>.

66 WHO, 'Increasing Access to Clean Cooking through Subsidies' (n 72).

67 So-Young Lee and Eric Zusman, 'Participatory Climate Governance in Southeas Asia: Lessons Learned from Gender-Responsive Mitigation' in Tahseen Jafry (ed), *Routledge Handbook of Climate Justice* (Routledge 2019); Adeladza Kofi Amegah and Jouni JK Jaakkola, 'Household Air Pollution and the Sustainable Development Goals' (2016) 94 Bulletin of the World Health Organization 215; WHO, 'Increasing Access to Clean Cooking through Subsidies' (n 72).

carbonaceous aerosols (both black and organic carbon) that contribute significantly to seasonal air pollution episodes.[68]

Although policymakers and farmers are aware of the combination of factors that contribute to burning, changing the practices runs into a number of difficulties. Some hurdles are technical such as a lack of equipment that can turn residue into mulch or fertilizer. However, similar to the examples cited above, many of the challenges stem from the need for more integrated and inclusive polices and institutions. To illustrate, there is a clear need to ensure that policies promoting increased crop yields and climate mitigation and air pollution control do not operate at cross-purposes. Likewise, institutions focusing on food production and climate protection will require mechanisms facilitating the exchange of knowledge, data and perhaps even funding. Moreover, comparable to previous cases, multi-level cooperation can help to ensure that local governments have the resources they need to monitor burning while rewarding communities for conceiving and making use of alternatives. In line with some of the other solutions, there may also be opportunities to advance more inclusive solutions to burning by bringing farmers into the decision-making process. For instance, climate field schools could help identify workable solutions to climate-related agricultural challenges that could then be adjusted to build consensuses around alternatives to the practices.[69] Similarly, there may be opportunities to build and expand enterprises that convert crop residues into furniture or other products. Building a strong value chain for these products—focused on creating a reliable a sustainable income stream for farmers—would help remedy the impacts.

5 Conclusion

In most policy areas, the more information the better, but at this point it is evident that action to address the harms of SLCPs is also necessary. As UNEP stated in 2019, it is clear "that there is now sufficient evidence for action to

68 Danutawat Tipayarom, Nguyen Thi and Kim Oanh, 'Effects from Open Rice Straw Burning Emission on Air Quality in the Bangkok Metropolitan Region' (2007) 33 339; Kim Oanh N. T, NP Dong and DA Permadi, 'Emissions of Toxic and Climate Forcer Pollutants from Crop Residue Open Burning in Southeast Asia', *A&WMA's 109th Annual Conference & Exhibition* (2016).

69 Matthew Hengesbaugh, Eric Zusman and Peter King, 'Growing Support for Climate-Smart Agriculture by Scaling Up Farmer and Climate Field Schools: Recommended Policy and Institutional Reforms' (2020) <https://www.iges.or.jp/en/publication_documents/pub/policy/en/11007/PB_42_E_1005.pdf>.

reduce the impacts of air pollution on human health in Asia and the Pacific".[70] Appropriate policy response can make a significant difference, and the stakes are high, with hundreds of thousands—even millions—of lives at risk. There is little excuse for inaction. However, there is still scope to ensure that policies and institutions are in place that can drive implementation of those actions.

More specifically, what must be done in terms of enacting these policies? A major step forward would be the comprehensive and well thought out integration of strategies and plans to simultaneously address air pollution and climate change, and their concomitant positive effect on health outcomes. There is overlap between actions in these areas, with the clear potential for mutually beneficial results, whether through steps by national governments and companies that even partially reduce SLCP's contribution to global warming,[71] or at least some reduction in the more than 7 million annual premature deaths tied to air-pollution, not to mention the millions of disability-adjusted life years lost.[72]

Imagining this as a win-win-win solution for air quality, climate and health could motivate action not only by environmental and health experts, but other stakeholders like businesses or politicians focused on cost-effective spending (as well as their re-election to office). Although not explicitly discussed above, the economic motivations and probable net positive economic benefits of reducing pollution for action are worth considering in future research. While any improvements that reduce polluting processes, or even hasten the transition away from reliance on fossil-fuel energy and industrial processes that produce SLCPs may be costly at the outset, there are likely measurable benefits in the reduction of climate-related and improved health outcomes, not to mention long-term financial savings.

This chapter has argued that it is vital that future SLCP strategies focus not only on maximizing benefits, but who benefits (and loses) from those changes. In using a slightly different lens, it may be possible to refine both the policies intended to minimize the health and other impacts of SLCPs as well as mitigate SLCP emissions. Adopting this lens will require more efforts to bring different agencies and stakeholder groups into the modelling, design and implementation of concrete interventions. A final point merits highlighting when thinking about this interface. Moving forward, it will also be useful to more explicitly consider how "inclusiveness" affects the adoption and implementation of different interventions in modelling scenarios. For instance,

70 UNEP APCAP and CCAC (n 1).

71 UNEP/WMO (n 1).

72 McDuffie and others (n 24).

the timing of adoption or diffusion rates of key technologies could be slowed by a failure to understand the needs and concerns of users. A more accurate accounting of the influence of those concerns on benefit estimates may also prompt the research community and policymakers to better understand what inclusiveness means for their work.

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Bibliography

Akahoshi K and others, 'Overcoming Barriers to Clean Cooking in Thailand: A Quantitative Assessment' (2022) April-June Asia Pacific Tech Monitor <https://apctt.org/sites/default/files/attachment/2022-09/06_Cookstove_Article_rev10_AB_Edited_DM.pdf>.

Akahoshi K and Zusman E, 'Bringing Clean Air to 4 Billion People in Asia' *The Diplomat* (23 September 2021) <https://thediplomat.com/2021/09/bringing-clean-air-to-4-billion-people-in-asia/>.

Amegah AK and Jaakkola JJ, 'Household Air Pollution and the Sustainable Development Goals' (2016) 94 Bulletin of the World Health Organization 215.

Betsill MM and Bulkeley H, 'Cities and the Multilevel Governance of Global Climate Change' (2006) 12 Global Governance 141.

Bilsky E, Moreno AC and Tortosa AF, 'Local Governments and SDG Localisation: Reshaping Multilevel Governance from the Bottom Up' (2021) 22 Journal of Human Development and Capabilities 713.

Bond TC and others, 'Bounding the Role of Black Carbon in the Climate System: a Scientific Assessment.' (2013) 118 Journal of Geophysical Research: Atmospheres 5380.

Cash DW and others, 'Knowledge Systems for Sustainable Development' (2003) 100 Proceedings of the National Academy of Sciences of the United States of America 8086.

Castells N and Ravetz J, 'Science and Policy in International Environmental Agreements' [2001] International Environmental Agreements: Politics, Law and Economics 405.

CCAC and UNEP, *Short-Lived Climate Pollutants Short-Lived Climate Pollutants in Latin America* (2018).

Cook NJ, Grillos T and Andersson KP, 'Gender Quotas Increase the Equality and Effectiveness of Climate Policy Interventions' (2019) 9 Nature Climate Change 330 <http://dx.doi.org/10.1038/s41558-019-0438-4>.

Corfee-Morlot J and others, 'Cities, Climate Change and Multilevel Governance' (2009).

Cushing L and others, 'Environmental Equity : Evidence from California ' s Cap-and-Trade Program' (2018) 15 PLOS Medicine 1.

Danesh Yazdi M and others, 'Long-Term Association of Air Pollution and Hospital Admissions among Medicare Participants Using a Doubly Robust Additive Model' (2021) 143 Circulation 1584.

Dilling L and Lemos MC, 'Creating Usable Science: Opportunities and Constraints for Climate Knowledge Use and Their Implications for Science Policy' (2011) 21 Global Environmental Change 680.

Dinesh D and others, 'Learning from Failure at the Science–Policy Interface for Climate Action in Agriculture' (2021) 26 Mitigation and Adaptation Strategies for Global Change.

Elder M and Loewe C, 'Introduction and Context' in UNEP (ed), *Global Environment Outlook—GEO6: Healthy Planet, Healty People* (United Nations Environment Programme 2019).

European Investment Bank, 'Short-Lived Climate Pollutants (SLCPs): an Analysis of the EIB's Policies, Procedures, Impact of Activities and Options for Scaling up Mitigation Efforts' (2016).

Failey T, 'Poor Communities Exposed to Elevated Air Pollution Levels' (2016) <https://www.niehs.nih.gov/research/programs/geh/geh_newsletter/2016/4/spotlight/poor_communities_exposed_to_elevated_air_pollution_levels.cfm>.

Galgoczi B, 'From Paris to Katowice: the EU Needs to Step Up Its Game on Climate Change and Set Its Own Just Transition Framework' [2018] SSRN Electronic Journal.

Gooch GD and others, 'The Science–Policy–Stakeholder Interface in Sustainable Water Management: Creating Interactive Participatory Scenarios Together with Stakeholders', *Science, Policy and Stakeholders in Water Management* (Routledge 2010).

Gupta A and others, *Science Networks* (2012).

Guston DH, 'Boundary Organizations in Environmental Policy and Science: an Introduction' (2001) 26 Science, Technology, & Human Values 399.

Hajat A, Hsia C and O'Neill MS, 'Socioeconomic Disparities and Air Pollution Exposure: a Global Review' (2015) 2 Current Environmental Health Reports 440 <https://pubmed.ncbi.nlm.nih.gov/26381684/> accessed 6 December 2022.

Hausker K, 'Vehicle Inspection and Maintenance Programs: International Experience and Best Practices' (2004).

Hengesbaugh M, Zusman E and King P, 'Growing Support for Climate-Smart Agriculture by Scaling Up Farmer and Climate Field Schools: Recommended Policy

and Institutional Reforms' (2020) <https://www.iges.or.jp/en/publication_documents/pub/policy/en/11007/PB_42_E_1005.pdf>.

Heritage Z and Green G, 'European National Healthy City Networks: the Impact of an Elite Epistemic Community' (2013) 90 Journal of Urban Health 154.

HFI, 'State of Global Air 2020' (2020).

Huy LN, Winijkul E and Kim Oanh NT, 'Assessment of Emissions from Residential Combustion in Southeast Asia and Implications for Climate Forcing Potential' (2021) 785 Science of the Total Environment.

IPCC, *Climate Change 2021: the Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (R Yu and B Zhou Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi ed, 2021).

Jacob M and Hellström T, 'Reviewing the Science-Policy Relationship: the Policy as Theory Alternative (PAST)' (1998) 25 Science and Public Policy 218.

Jones SA, Fischhoff B and Lach D, 'Evaluating the Science-Policy Interface for Climate Change Research' (1999) 43 Climatic Change 581.

Kholod N and Evans M, 'Reducing Black Carbon Emissions from Diesel Vehicles in Russia: an Assessment and Policy Recommendations' (2016) 56 Environmental Science and Policy 1.

Kim Oanh N. T, Dong NP and Permadi DA, 'Emissions of Toxic and Climate Forcer Pollutants from Crop Residue Open Burning in Southeast Asia', *A&WMA's 109th Annual Conference & Exhibition* (2016).

Lee S-Y and Zusman E, 'Participatory Climate Governance in Southeas Asia: Lessons Learned from Gender-Responsive Mitigation' in Tahseen Jafry (ed), *Routledge Handbook of Climate Justice* (Routledge 2019).

Li Y, 'Evaluating and Improving the Effectiveness of Vehicle Inspection and Maintenance Programs: a Cost-Benefit Analysis Framework' (2017) 08 Journal of Environmental Protection 1541.

Li Y and Crawford-Brown DJ, 'Assessing the Co-Benefits of Greenhouse Gas Reduction: Health Benefits of Particulate Matter Related Inspection and Maintenance Programs in Bangkok, Thailand' (2011) 409 Science of the Total Environment 1774 <http://dx.doi.org/10.1016/j.scitotenv.2011.01.051>.

Mader AD and others, 'Country Representatives' Perceptions of the Biodiversity Science-Policy Interface' (2021) 1 Conservation 73.

McDuffie E and others, 'Global Burden of Disease from Major Air Pollution Sources (GBD MAPS): a Global Approach' (2021) 1 <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emexb&NEWS=N&AN=639091709>.

Mohieldin M and others, 'The Role of Local and Regional Governments in the SDGs: the Localization Agenda', *Business, Government and the SDGs* (Palgrave Macmillan 2023).

Persson Å and others, 'Editorial: Environmental Policy Integration: Taking Stock of Policy Practice in Different Contexts' (2018) 85 Environmental Science & Policy 113.

Peters BG, 'The Challenge of Policy Coordination' (2018) 1 Policy Design and Practice 1 <https://doi.org/10.1080/25741292.2018.1437946>.

Peters G, 'Managing Horizontal Government: the Politics of Co-Ordination' (1998) 76 Public Administration 295.

Rabe BG, 'Beyond Kyoto : Climate Change Policy in Multilevel Governance Systems' (2007) 20 423.

Simoni M and others, 'Adverse Effects of Outdoor Pollution in the Elderly' (2015) 7 Journal of Thoracic Disease 34.

Smith G and Setälä M, 'Mini-Publics and Deliberative Democracy' in Andre Bächtiger and others (eds), *The Oxford Handbook of Deliberative Democracy* (2018) <https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780198747369.001.0001/oxfordhb-9780198747369-e-27> accessed 12 June 2022.

Sokolovska N, Fecher B and Wagner GG, 'Communication on the Science-Policy Interface: an Overview of Conceptual Models' (2019) 7 Publications.

Spilsbury MJ and Nasi R, 'The Interface of Policy Research and the Policy Development Process: Challenges Posed to the Forestry Community' (2006) 8 Forest Policy and Economics 193.

Takemura T, 'Return to Different Climate States by Reducing Sulphate Aerosols under Future CO_2 Concentrations' (2020) 10 Scientific Reports.

Thoday K and others, 'The Mega Conversion Program from Kerosene to LPG in Indonesia: Lessons Learned and Recommendations for Future Clean Cooking Energy Expansion' (2018) 46 Energy for Sustainable Development 71.

Tipayarom D, Thi N and Oanh K, 'Effects from Open Rice Straw Burning Emission on Air Quality in the Bangkok Metropolitan Region' (2007) 33 339.

UNECE, 'Air Pollution, Ecosystems and Biodiversity' (2022) <https://unece.org/air-pollution-ecosystems-and-biodiversity> accessed 5 October 2022.

UNEP, 'Air Pollution Note—Data You Need to Know' (2022) <https://www.unep.org/interactive/air-pollution-note/?fbclid=IwAR2KKH_zwwl9nDJFZk0yTny586H0I76dbswRKkuN0yBSJ6uystEHdXkEGLE>.

UNEP/WMO, 'Integrated Assessment of Black Carbon and Tropospheric Ozone: Summary for Decision Makers' (2011) <http://www.unep.org/dewa/Portals/67/pdf/Black_Carbon.pdf>.

UNEP/WMO, 'Integrated Assessment of Air Pollution and Climate Change in Africa 2020–2021' (2022).

UNEP, APCAP and CCAC, 'Air Pollution in Asia and the Pacific: Science-Based Solutions. United Nations Environment Programme' (2019) <https://www.ccacoalition.org/resources/air-pollution-asia-and-pacific-science-based-solutions-summary-full-report>.

UNICEF, 'Mongolia's Air Pollution Crisis: a Call to Action to Protect Children's Health' (2018) <https://reliefweb.int/sites/reliefweb.int/files/resources/Mongolia_air_pollution_crisis_ENG.pdf>.

UNICEF, 'Child-Centred Clean Air Solutions: Guide for Asia and the Pacific Region' (2022).

United Nations International Childrens' Emergency Fund (UNICEF), 'Clean Air for Children' (2016) <https://www.unicef.org/media/49966/file/UNICEF_Clear_the_Air_for_Children_30_Oct_2016.pdf>.

Venkata Ramana P and others, 'The State of the Global Clean and Improved Cooking Sector' [2015] ESMAP and GACC 1 <https://openknowledge.worldbank.org/bitstream/handle/10986/21878/96499.pdf>.

Wan K and others, 'Science-Policy Interplay on Air Pollution Governance in China' (2020) 107 Environmental Science and Policy 150 <https://doi.org/10.1016/j.envsci.2020.03.003>.

Watson RT, 'Turning Science into Policy: Challenges and Experiences from the Science-Policy Interface' (2005) 360 Philosophical Transactions of the Royal Society B: Biological Sciences 471.

WHO, 'Reducing Global Health Risks: Through Mitigation of Short-Lived Climate Pollutants: Scoping Report for Policymakers' (2015).

WHO, 'Ambient (Outdoor) Air Pollution' (22 September 2021) <https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health> accessed 24 May 2022.

WHO, 'Increasing Access to Clean Cooking through Subsidies' (2022) <https://www.householdenergypolicies.org/assets/subsidies.pdf?sfvrsn=6a5a5a19_5> accessed 6 December 2022.

Yamineva Y, 'Lessons from the Intergovernmental Panel on Climate Change on Inclusiveness across Geographies and Stakeholders' (2017) 77 Environmental Science and Policy 244 <http://dx.doi.org/10.1016/j.envsci.2017.04.005>.

Zaelke D, 'Primer on Short-Lived Climate Pollutants' (2013) <http://www.igsd.org>.

Zusman E and others, 'One Atmosphere: Integrating Air Pollution and Climate Policy and Governance' (2021) 12 Atmosphere 1.