ACP ASIAN Co-benefits Partnership

Ministry of the Environment

IGES

Asian Co-benefits Partnership White Paper 2020

Implementing Solutions to Climate Change and Air Pollution in Asia

Mobilising Finance, Strengthening Policies and Building Capacities

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Printed in Japan

Acknowledgements

The preparation of the White Paper was overseen by the Institute of Global Environmental Strategies (IGES) in its capacity as a secretariat of the Asian Co-benefits Partnership (ACP).

Extensive peer reviews and suggestions from government agencies, research institutes, universities and regional organisations helped to improve earlier drafts of the White Paper. The ACP would like to recognise the following authors for their valuable contributions to those drafts: Kaye Patdu, Elsa Lefevre (UN Environment Programme), Arnico Kumar Panday (International Centre for Integrated Mountain Development), Bjarne Pederson, Dang Marviluz Espita (Clean Air Asia), Adelaida B. Roman (Regional Resource Centre for Asia and the Pacific, Asian Institute of Technology), Hooman Farzaneh (Kyushu University), Ittipol Pawarmart (Ministry of Natural Resources and Environment, Thailand), Supat Wangwongwatana (Thammasat University), Virender Duggal (Asian Development Bank), Zacharias Malik (World Bank), Chris O'Malley, Johan Kuylenstiern, Kevin Hicks (Stockholm Environment Institute York Centre), Markus Amann, Zbigniew Klimont, Janusz Cofala (International Institute for Applied Systems Analysis), Kentaro Takahashi, Temuulen Murun, Aditi Khodke, Kunihiro Ueno, Etsujiro Takai, Janardhanan Nandakumar, Kaoru Akahoshi (IGES) and Naoki Matsuo (Climate Experts, Ltd).

Every effort is taken to incorporate the technical comments from peer reviewers: Kanako Morita (Forestry and Forest Products Research Institute), Xinhao Huang (Policy Research Center for Environment and Economy, Ministry of Ecology and Environment, China), Miaojie Sun, Merlin Lao (International Council for Local Environmental Initiatives), Lars Nordberg, Didin Agustian Permadi (National Institute of Technology), Naoki Mori (IGES) and Frank Murray (Murdoch University). However, the secretariat remains responsible for any inaccuracies or mistakes made therein.

Valuable advice and inputs were received from Supat Wangwongwatana, Thammasat University and Takashi Ohmura, IGES as well as other members of the ACP Advisory Group members. This White Paper would not have been possible without their steadying hand and thoughtful feedback.

This White Paper was edited by Eric Zusman and So-Young Lee. Designing and printing was handled by Match-up Co. Ltd. Tomoko Yamashita provided administrative support.

Implementing Solutions to Climate Change and Air Pollution in Asia: Mobilising Finance, Strengthening Policies and Building Capacities
ACP White Paper 2020

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List of Acronyms

ACP	Asian Co-benefits Partnership
ADB	Asian Development Bank
AIT	Asian Institute of Technology
APCAP	Asia Pacific Clean Air Partnership
ASEAN	Association of Southeast Asian Nations
BRT	Bus Rapid Transit
CCAC	Climate and Clean Air Coalition
CDIA	Cities Development Initiative for Asia
CDM	Carbon Development Mechanism
CHP	Combined heat and power generation
CIFs	Climate Investment Funds
CO_2	Carbon dioxide
COP	Conference of Parties
CTCN	Climate Technology Network Centre
ESG	Environmental, social and governance investment
GCF	Green Climate Fund
GEF	Global Environmental Facility
GHG	Greenhouse gas
HFCs	Hydrofluorocarbons
HOB	Heat only boilers
ICIMOD	International Centre for Integrated Mountain Development
IGES	Institute for Global Environmental Strategies
IIASA	International Institute for Applied Systems
IPCC	Intergovernmental Panel on Climate Change
JC	Joint Committee
JCM	Joint Crediting Mechanism
JITMAP	Japan India Technology Matching Platform
LEAP	Long-range Energy Alternatives Planning system
MOEJ	Ministry of the Environment of Japan
MSMEs	Micro Small and Medium Enterprises
NDCs	Nationally Determined Contributions
NOx	Nitrogen oxides
ODB	On-board diagnostic system
PCD	Pollution Control Department (Thailand)
PDD	Project Design Document
PM	Particulate matter
PUC	Pollution under control
SDGs	Sustainable Development Goals
SDI	Sustainable Dialogue Institute
SEI	Stockholm Environment Institute
SLCPs	Short-lived climate pollutants
SDIP	Sustainable Development Implementation Plan
SMEs	Small and Medium Enterprises
SNAP	Supporting National Action and Planning on SLCPs
SO_2	Sulphur dioxide
TEEMP	Transport Emissions Evaluation Model for Projects
TEQUP	Technology UP-gradation Scheme
TERI	The Energy Resources Institute
TPEs	Third-party Entities
TSP	Total Suspended Particulates
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organisation

Foreword

In recent years, many parts of Asia have confronted increasingly serious air pollution and climate change crises. Over the same period, a group of more than 100 experts produced a report entitled *Air Pollution in Asia and the Pacific: Science-based Solutions* that identified 25 solutions capable of mitigating these crises. This report has since generated considerable interest throughout Asia. Part of the reason for its widespread appeal is the report answered pressing questions facing Asia's policymakers—namely, what proven technical and non-technical measures can bring down air pollution and mitigate climate change in the region and what would be benefits of those reductions?

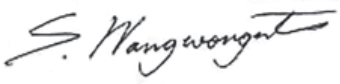
At the same time that the *Solutions Report* provided much-needed answers, it also raised new questions. One of the most urgent is what will take to implement the identified solutions? Implementation—or the translation of goals into action—is a critical next step for Asia. It is also the theme featured in this report, the Asian Co-benefits Partnership's (ACP) Fourth White Paper.

The ACP was formed in 2010 to help policymakers and other stakeholders mainstream co-benefits into a range of decision-making processes. After a decade of pursuing that goal, plans are underway to reorganise the ACP around implementing solutions that deliver co-benefits. This ACP's Fourth White Paper is therefore well-timed to offer a future vision for this decade-old initiative.

Much like the concept of co-benefits, the ACP's Fourth White Paper is intended to address two goals. On the one hand, it offers pragmatic suggestions on how to implement the solutions identified in the *Solutions Report*. On the other, it suggests how the ACP can work toward those ends. This ACP White Paper seeks to achieve these two goals by breaking up implementation into three action areas: 1) mobilising finance (for key technologies); 2) strengthening policies (and institutions); and 3) building capacities. As is argued in the first chapter of the White Paper, these three action areas are themselves interrelated. Mobilising finance and building capacity, for example, can strengthen policies need to implement the solutions. Similarly strengthening policies can mobilise resources and boost capacities.

Making the most of the interrelationship between these three action areas will nonetheless not happen at a desirable speed and pace without some help. Accelerating progress will require support and coordination from a network of dedicated and concerned policymakers, researchers and other stakeholders. In other words, it will require the involvement of the ACP. As the chairs of this important network, we therefore hope that the messages presented herein demonstrate a way forward for policymakers confronting air pollution and climate crises in Asia as well as for the ACP.

Supat Wangwongwatana
Co-Chair, ACP



Takashi Ohmura
Co-Chair, ACP

Executive Summary

Air pollution and climate change pose serious threats to the health and well-being of millions of people in Asia. The need for cost-effective solutions to these problems has prompted many of Asia's policymakers to seek interventions that control air pollution while mitigating climate change. The improved air quality and reduced climate risks resulting from these interventions are called "co-benefits". Co-benefits—or the multiple benefits from actions that mitigate climate change while meeting other sustainable development priorities—appear with growing frequency in policy discussions in Asia.

The Asian Co-benefits Partnership (ACP) is partially responsible for the term's expanded use. The ACP was created in 2010 as an informal knowledge sharing and awareness raising platform for co-benefits. Last year an international group of scientists released a high-profile report entitled *Air Pollution in Asia and the Pacific: Science-based Solutions* (*Solutions Report*) that could help advance the ACP's objectives. Its potential to move those objectives forward reflects the fact many of the 25 identified solutions not only improve air quality but also mitigate near- and long-term climate change. This year's ACP White Paper concentrates on three areas that can spread those 25 solutions' implementation: 1) mobilising finance, 2) strengthening policies and 3) building capacities.

The ACP White Paper's Chapter 1 reviews key findings from the *Solutions Report*; noting that it identifies three categories of solutions (conventional controls, development priority and next stage solutions). It further observes that, by basing the choice of those solutions on exposure to $PM_{2.5}$, it helps unify views on co-benefits focusing on near- and long-term climate change. It finally argues that, though these solutions have been demonstrated in parts of Asia, more work needed is on implementing them at scale.

Chapter 2 maintains that international financing mechanisms, technology platforms and investment channels could help fill critical funding gaps for "development priority" solutions. It then reviews how and why different mechanisms, platforms and channels consider which kinds of co-benefits. Based on that review, it recommends that international partners work toward standardising and harmonising co-benefit assessment methods and clarify key stakeholder's incentives for adopting progressively more rigorous methods.

Chapter 3 draws upon three diverse case studies to argue that policymakers need to consider greater policy coherence, multiple policy instruments, accounting for social impacts and adopting a systems perspective in their efforts to implement the solutions at scale. It also contends that supplying policymakers with a set of options for addressing each of these need areas would enhance the enabling environment for co-benefits in Asia.

Chapter 4 reviews factors behind the success of capacity programmes of key organisations working on co-benefits or related themes in Asia. It demonstrates some of the main success factors are ensuring programmes are 1) demand-driven, 2) tied to concrete policy objectives and 3) employ experiential learning. It also suggests that those leading the capacity building play more of a brokering than teaching role, enabling stakeholders to learn from each other. Last but not least, improving coordination across capacity building programmes, especially programmes targeted at co-benefits from greenhouse gases (GHGs) and short-lived climate pollutants (SLCPs), is much needed.

The White Paper is not only meant to pick up where the *Solutions Report* left off but also provide a vision for a reorganised ACP to move forward. In recommending efforts to standardise more rigorous assessment methods, provide options for policy design and improve coordination across capacity building programmes, the White Paper identifies several areas where the ACP can work over the next decade.

Chapter 1
Opening a New Chapter on Co-benefits in Asia

Key Messages

- Many of Asia's policymakers are struggling with air pollution crises while facing a climate emergency. Solutions that can address both of these problems are an urgent need in Asia.
- In 2019, a group scientists and experts helped address this need by publishing a high-profile report entitled *Air Pollution in Asia and the Pacific: Science-based Solutions (the Solutions Report)*.
- Most of the 25 solutions identified in this report could improve air quality while mitigating near- or long-term climate change. In other words, they could deliver co-benefits.
- The *Solutions Report* helped unify perspectives on co-benefits focusing on near- or long-term climate change. It also provided concrete examples of the 25 solutions' implementation in parts of Asia.
- Asia's policymakers and other stakeholders will nonetheless require additional guidance on how to implement the solutions on a wider scale.
- The Fourth Asian Co-benefits Partnership (ACP) White Paper focuses on three sets of factors potentially contributing to this widespread implementation: mobilising finance, strengthening policies and building capacities.
- These three areas can complement each other. For example, more finance can bolster relevant policies and capacities. Well-designed policies can attract finance and boost capacities.
- Effective coordination across organisations working to mobilise finance, strengthen policies and build capacities for co-benefits can help to achieve the *Solutions Report*'s ambitious projections.
- These three areas can also help frame the future activities of the ACP as it pursues the widespread implementation of solutions to air pollution and climate change in Asia.

1.1 Introduction

In 2010, the Asian Co-benefits Partnership (ACP) was established as an informal and interactive platform for information sharing and awareness raising on co-benefits in Asia. Over the past decade, the ACP has helped policymakers and other stakeholders broaden and deepen their knowledge of co-benefits. It has further enabled policymakers to use this knowledge to achieve the climate and other sustainable development benefits that lie at the core of definitions of co-benefits (See Box 1.1 for a selection of definitions). One the main vehicles to help spread this knowledge is the ACP White Paper (ACP, 2014; 2016; 2018).

Box 1.1: Definitions of Co-benefits

The positive effects that a policy or measure aimed at one [climate] objective might have on other [sustainable development] objectives, thereby increasing the total benefits for society or the environment. Co-benefits are often subject to uncertainty and depend on local circumstances and implementation practices, among other factors. Co-benefits are also referred to as ancillary benefits (IPCC, 2018).

The added benefits we get when we act to control climate change, above and beyond the direct benefits of a more stable climate. They are sometimes referred to as "multiple benefits" or "synergies". They do not include the direct benefits of climate policy arising from a more stable climate (Smith, 2013).

The additional benefits related to the reduction of greenhouse gas emissions that are not directly related to climate change, such as air quality improvement, technological innovation or employment creation (Markandya et al, 2018).

[The] potentially large and diverse range of collateral benefits that can be associated with climate change mitigation policies in addition to the direct avoided climate impact benefits (Bollen et al., 2009).

Source: Authors

The ACP publishes the White Paper once every two years to share information on co-benefits with policymakers and other stakeholders (ACP, 2014; 2016; 2018). Each ACP White Paper focuses on a timely theme. The First ACP White Paper 2014 highlighted an air pollution perspective on co-benefits, noting short-lived climate pollutants (SLCPs) and other pollutants merited more attention in Asia (ACP, 2014). In 2016, the Second ACP White Paper offered policymakers and other stakeholders case studies of how co-benefits could be achieved in the transportation, energy and waste management sectors (ACP, 2016). The Third ACP White Paper 2018 introduced policymakers to different tools and models that could be used to quantify co-benefits in Asia (ACP, 2018).

In this, the Fourth ACP White Paper, the theme is the *implementing* solutions to air pollution and climate change in Asia. For the remainder of this White Paper, implementation refers to a *process* of "adopting various projects and programmes to translate goals and objectives into actions" (Khan, 2016). While many factors could help convert goals into actions, three stand out as critical to ensuring climate and other sustainable development benefits are explicitly considered and acted upon in decision-making processes: 1) mobilising finance, 2) strengthening policies and 3) building capacities.

The first of these factors, mobilising finance, is often the difference between action and non-action. There is growing need to ensure flows of domestic and international climate and development financial resources are available to invest in technologies and motivate other behavioural changes. A second set of factors is well-designed policies. Policies (and supportive institutions) are vitally important in aligning the interests of government, business and other stakeholders around not only one-off projects but enabling wider scale changes. A third set of factors is building capacities. Achieving multiple benefits necessitates that those involved in implementing co-benefits solutions have sufficient knowledge and skills to design policies and mobilise resource to drive action at scale. The ACP White Paper 2020's three main objectives relate to these three sets of factors:

1. To recommend reforms that increase funding for solutions that deliver co-benefits in Asia (Chapter 2);

2. To recommend how national and local policies can be designed to implement these solutions at scale (Chapter 3); and

3. To recommend how the capacities of policymakers and other stakeholders can be built to implement these solutions at scale (Chapter 4).

1.2 Setting the Context

The focus on the three stated objectives—mobilising finance, strengthening policies and institutions, and building capacities—is well-

timed for several reasons. One such reason is that coincides with interest from many countries in implementing pledged responses to the Paris Agreement (articulated in recently updated nationally determined contributions (NDCs)) (Pauw et al., 2017). A related reason is that the White Paper's content overlaps with expanding interests in finding synergies between NDCs (or related climate policies) and the Sustainable Development Goals (SDGs) (often outlined in voluntary national reviews (VNRs)) (TERI, 2017; UN, 2019). Policymakers in Asia are seeking guidance on the tools and experiences can help realise these synergies. And more than thirty years of experience with research on co-benefits can offer that much-needed guidance (Pearce, 2000). Further a decade of working on these issues in the ACP means the initiative is also uniquely positioned to contribute to and share that guidance (Miyatsuka and Zusman, 2010).

Another reason focusing on mobilising finance, strengthening policies and institutions, and building capacities is much-needed are planned changes to the ACP. As the ACP moves past its first decade of existence, the initiative has contributed to growing awareness of co-benefits in Asia. After ten years, however, the ACP needs to devote more effort to promoting *implementation*. This White Paper is designed to not only work on that goal, but provide insights into how to reorganise the ACP around implementing solutions.

A third reason for focusing on these three areas is that the individuals and institutions working with the ACP took a step toward with the publication of report mentioned in the key messages *Air Pollution in Asia and the Pacific: Science-based Solutions (Solutions Report)*. That report identified 25 technical and non-technical solutions that could lead to significant air quality and public health improvements in Asia while mitigating near- and long-term climate change and achieving other SDGs (UNEP APCAP CCAC, 2019). As detailed below, the *Solutions Report* has helped to change the optics on co-benefits by *unifying climate and air pollution perspectives* on co-benefits. This unified view can pave the way for wider scale implementation.

1.3 Unifying Climate and Air Pollution Perspectives on Co-benefits

The concept of "co-benefits" originated in the early 1990s. At that time, researchers working on co-benefits defined the term as the additional development benefits of climate mitigation policies (such as a carbon tax) in mostly developed countries (Morgenstern, 1991). The demonstration of these benefits helped researchers argue that the climate policies could both prevent warmer temperatures in the long-term as well as save lives and money in the short-term (Krupnick et al., 2000). As such, co-benefits could offset the costs of climate change, thereby allaying policymaker concerns about the key constraint on climate action (Uchida and Zusman, 2008). The standard approach for making this offsetting argument was to use a set of economic, energy, air pollution and health models to quantify air quality and health benefits from a hypothetical climate policy. In many instances, the magnitude of the health benefits were greater than the costs of implementing the analysed policy. Co-benefits helped demonstrate that many climate policies, at least in developed countries, made good economic sense (Pearce, 2000).

Over the past three decades, work on co-benefits diversified. A key change has been a greater focus on analysing co-benefits from *developing* countries. The greater availability of data and increased flexibility of models showed co-benefits made even more economic sense in developing countries—in part, because they could have larger marginal impacts on the environment and human health (i.e. this was often since, the same policy is likely to have bigger impact in areas with heavier air pollution). Another significant shift has been consideration of both a broader range of benefits from a more diverse mix of policies and actions (IPCC, 2014; Ürge-Vorsatz et al., 2014) (See Table 1.1). An additional change that been the emergence of different perspectives on co-benefits. These can be broadly be framed as an air pollution and climate change perspective.

Table 1.1: Summary of Co-benefits Studies 2014-Present

Type of policy and sectoral focus	Health benefits	Environmental benefits	Socioeconomic benefits (jobs, energy security, other benefits)	Climate benefits	Source(s)
Global/regional climate policies that run to 2100 (based on IPCC scenarios)	Annual reductions in premature mortality and morbidity	Reductions in multiple air pollutants (with emphasis on fine particulate and ozone) lead to improved air quality	–	Achievement of the 2°C and 1.5°C Paris Agreement targets (with some of the benefits aimed at moving from 2°C to 1.5°C); some recognition of possible increases in warming from reductions in cooling sulphates that accompany climate policies	Markandya et al. (2018); Shindell et al. (2017)
National climate policies (often aligned with NDCs running to 2030 or medium-term mitigation strategies running to 2050) or integrated national level air pollution and climate policies	Annual reductions in premature mortality and morbidity	Reductions in multiple air pollutants (with emphasis on fine particulate and ozone); lead to improved air quality	Reductions in fossil fuel dependencies (in Mtoe of oil or lower demands for oil and gas) and creation of green jobs (in the renewable energy sector) provide additional benefits	Achievement of NDC targets (with some estimates of increased ambition beyond those targets and some estimates tied to carbon intensity as opposed to overall targets)	NewClimate Institute (2015a; 2015b; 2015c; 2015d; 2015e; 2015f); Li et al. (2018); Xing et al. (2018)
Subnational climate policies (such as state level carbon tax/fee; low carbon plans; technology promotion policies; structural changes to city's economy)	Quantified estimates of annual reductions in premature mortality and morbidity (including disability adjusted life years (DALY))	Reductions in multiple air pollutants (with emphasis on PM, SO_2 and NOx) lead to improved air quality	Creation of green jobs, improvement in infrastructure and land use as additional benefits	Achievement of subnational climate targets (such as low carbon city emission targets or state level policies)	Jiang et al. (2016); Ruth et al. (2017); Buonocore et al. (2018)
Climate finance projects (in multiple sectors)	Number of people enjoying cleaner air increases	Reductions in multiple forms of pollution	Moderate increase in the number of people experiencing less time spent in traffic, and improved education	Reductions in CO_2 varying in magnitude depending upon the scale of the project	ADB (2017)
Clean energy policies	Annual reductions in premature mortality and morbidity	Reductions in multiple air pollutants but also possible that environmental problems arising from manufacture of clean energy technologies or from lifecycle emissions offset savings	–	Reductions in multiple air pollutants but also possible that environmental problems arising from manufacture of clean energy technologies or from lifecycle emissions offset savings	Xue et al. (2015); Tham et al. (2018)

Energy efficiency policies (often in heavy industries such as cement or steel)	–	Modest to significant reduction in multiple air pollutants (with emphasis on PM, SO_2 and NOx) result in slight improvements in air quality	–	Modest to significant reduction in CO_2 or CO_{2eq} achieved	Zhang et al. (2014); Zhang et al. (2015)
Policies promoting healthier diets and lifestyles	Annual reductions in premature mortality and morbidity and quantified estimates of DALYs or other measures of disease	–	Healthier and more active lifestyles (with varying units of measurement)	Reductions in GHGs (from both CO_2 saved from moving and growing food and methane from avoided decomposition in landfill or open dump)	Chang et al. (2017); Quam et al. (2017)
Wastewater/ waste to energy policies/projects, including projects that use natural ecosystems to help treat wastewater	–	Improved waste water efficiencies provide important benefits that also save energy	Access to additional energy resource (biogas) offer significant benefits for rural communities; the citing of waste water facilities does not reduce property values or negatively affect quality of life	Modest reductions in GHGs (from the reuse of methane for energy)	Hagen et al. (2017); Laramee et al. (2018)
Waste management/3Rs policies (including community based waste management [in developing countries] or recycling of home appliances such as washing machines, refrigerators, air conditioners and televisions [developed countries]) with some alignment with NDCs			Increases in reutilization rates of waste, saving in landfill costs (including the capital costs of construction of landfills), and increases in land for other productive purposes besides landfill	Modest to significant reductions in GHGs (CO_2 reductions for recycling appliances and methane reductions for reducing organic waste)	Menikpura et al. (2013); Menikpura et al. (2014) Challcharoenwattana and Pharino (2015); Mittal et al. (2017)
Low carbon/ green/sustainable buildings policies	–	Improvements in energy use intensity reduce stress on energy system	Cost savings from reduced energy use in building offers additional benefits	Modest reductions in GHGs (not quantified)	Balaban and de Oliveira (2017)
Transport policies (including multi-modal strategies as well as improvements in vehicle technologies, shifting to public transport, more active lifestyles, changes in urban design, reliance on information and communication systems)	Annual reductions in premature mortality and morbidity and quantified estimates of DALYs	Significant reduction in multiple pollutants (with emphasis on $PM_{2.5}$ and NOx) lead to improved air quality	Significant reductions in oil demand offer additional benefits	Modest reductions in GHGs	Dhar and Shukla (2015); Xia et al. (2015); Kim et al. (2016); Dhar et al. (2017); Kim et al. (2017); Mittal et al. (2017)

Source: Authors

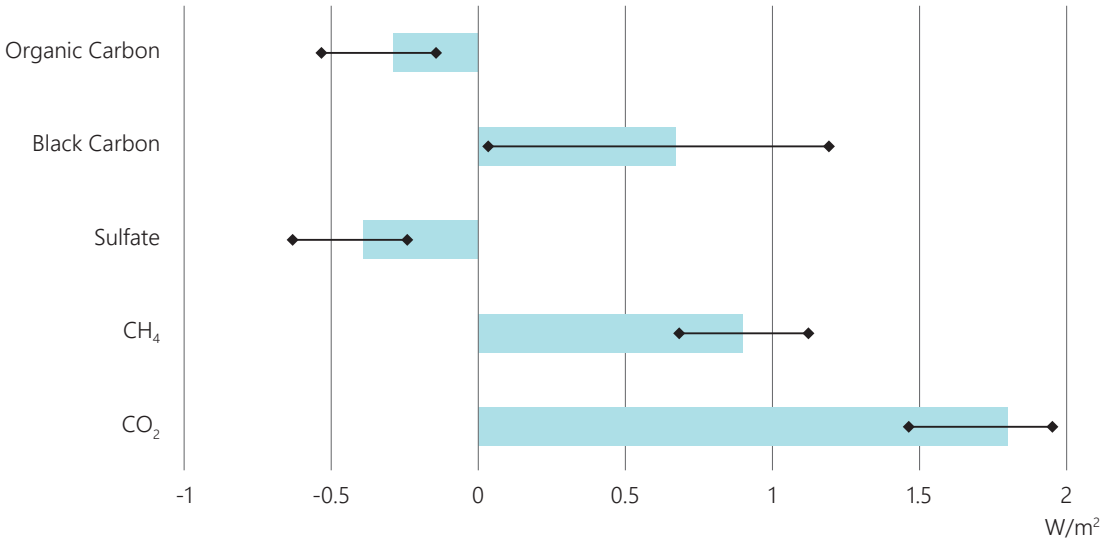
A climate change perspective on co-benefits focuses chiefly on actions that mitigate greenhouse gases (GHGs) while reducing other pollutants (or achieving other development goals). The starting point for this view is often a climate or sectoral policy (especially an energy policy) that mitigates carbon dioxide (CO_2) at the same time it controls conventional air pollutants. Though there are debates about whether the primary benefit from this approach is climate or development benefit—with the answer depending on context—there is a consensus that one of the benefits comes from mitigating GHGs (Miyatsuka and Zusman, 2010).

An air pollution perspective on co-benefits focuses chiefly on air pollutants known as short-lived climate pollutants (SLCPs). SLCPs such as black carbon can have significant near-term warming effects on the atmosphere while also polluting the air and threatening public health. Other SLCPs with both climate and development impacts include tropospheric ozone, methane (also considered a GHG) and hydrofluorocarbons (HFCs). A key distinction is that many of the SLCP sources (such as diesel engines, brick kilns and burning rice straw) are different from fossil fuel consuming sources that are more commonly targeted in a climate perspective on co-benefits (UNEP WMO, 2011)

The above points are important for recognising not merely the differences but complementarities between the air pollution and climate perspective on co-benefits. One of those complementarities involves pollutants such organic carbon or sulphur dioxide (SO_2) that cool the atmosphere. In what may seem like a paradox, the removal of these cooling pollutants can actually lead to more warming in the near-term (von Schneidemesser et al., 2013). One way to prevent this warming is to avoid reducing cooling pollutants. However, keeping these cooling pollutants in the atmosphere would harm public health, reduce crop yields and degrade ecosystems (Schmale et al, 2014). A more sustainable approach would be to combine strategies that reduce cooling pollutants with those that mitigate SLCPs thereby using the reductions in SLCPs to offset the added warming from removing cooling pollutants. Because many of the climate perspective on co-benefits can lead to the removal of cooling pollutants, a pragmatic way forward is to combine options from an air pollution and climate perspective on co-benefits. There is hence a need to integrate these perspectives (Zusman et al., 2012) (See Figure 1.1).

A related reason for acting on both perspectives involves the already high and rising costs of climate change. Much of Asia is already experiencing

Figure 1.1: Radiative Forcing of Different Pollutants and GHGs



Source: IPCC, 2014

what is rightly viewed as a "climate emergency." As the recent Intergovernmental Panel on Climate Change's (IPCC) 1.5 degree report makes clear, responding effectively to this emergency will require mitigating sources of both near- and long-term warming (IPCC, 2018). Focusing on both types of warming is especially critical since the amount of the CO_2 in the climate system is already committed the world to warming of 1.5°C (IPCC, 2014; Schmale et al., 2014). Hence, policymakers will again need to consider not a climate or air-pollution centred co-benefits strategies but one integrating SLCPs as well as GHGs (and associated co-benefits) (UNEP WMO, 2011).

Beyond appreciating the varying effects of a climate or air pollution perspective on co-benefits, there have been some recent thinking that illuminates how these two views can be usefully brought together in Asia. That unified perspective sits that at the core the *Solutions Report*. An important shift in the report was that by using potential reductions in exposure to $PM_{2.5}$ to identify solutions, it arrived at options that would typically fall under an air pollution or climate co-benefit perspective as well as more conventional end-of-the pipe approach to air pollution regulation. In fact, the possible solutions fit into three categories:

1. **Conventional controls:** this involves time-tested and end-of-the pipe equipment installed on power plants and vehicles.

2. **Next stage measures:** this involves regulating sources that have not traditionally been the focus of the air pollution community including farms and new industries (in line with an air pollution perspective on co-benefits)

3. **Development priority measures:** this involves introducing and scaling new technologies that create changes in the energy structure (in line with a climate perspective on co-benefits).

Table 1.2: The Top 25 Clean Air Measures

Asia-wide application of conventional measures	
Post-combustion controls	Introduce state-of-the-art end-of-pipe measures to reduce SO_2, NOx and particulate emissions at power stations and in large-scale industry
Industrial process emissions standards	Introduce advanced emission standards in industries, e.g., iron and steel plants, cement factories, glass production, chemical industry, etc.
Emission standards for road vehicles	Strengthen all emission standards; special focus on regulation of light- and heavy-duty diesel vehicles
Vehicle inspection and maintenance	Enforce mandatory checks and repairs for vehicles
Dust control	Suppress construction and road dust; increase green areas
Next generation Asia-specific air quality measures that are not yet major components of clean air policies in many parts of the Asia Pacific	
Agricultural crop residues	Manage agricultural residues including strict enforcement of ban of open burning
Residential waste burning	Strictly enforce bans of open burning of household waste
Prevention of forest and peatland fires	Prevent forest and peatland fires through improved forest, land and water management and fire prevention strategies
Livestock manure management	Introduce covered storage and efficient application of manures; encourage anaerobic digestion
Nitrogen fertilizer application	Establish efficient application; for urea also use urease inhibitors and/or substitute with, for example, ammonium nitrate
Brick kilns	Improve efficiency and introduce emission standards

International shipping	Require low-sulphur fuels and control of particulate emissions
Solvent use and refineries	Introduce low solvent paints for industrial and do-it-yourself applications; leak detection; incineration and recovery
Measures contributing to development priority goals with benefits for air quality	
Clean cooking and heating	Use clean fuels – electricity, natural gas, liquefied petroleum gas (LPG) in cities: LPG and advanced biomass cooking and heating stoves in rural areas; substitution of coal by briquettes
Renewables for power generation	Use incentives to foster extended use of wind, solar and hydro power for electricity generation and phase-out the least efficient plants
Energy efficiency for households	Use incentives to improve energy efficiency of household appliances, buildings, lighting, heating and cooling; encourage roof-top solar
Energy efficiency standards for industry	Introduce ambitious energy efficiency standards for industry
Electric vehicles	Promote use of electric vehicles
Improved public transport	Encourage a shift from private passenger vehicles to public transport
Solid waste management	Encourage centralized waste collection with source separation and treatment, including gas utilisation
Rice paddies	Encourage intermittent aeration of continuously flooded paddies
Waste water treatment	Introduce well managed two-stage treatment with biogas recovery
Coal mining	Encourage pre-mining recovery of coal mine gas
Oil and gas production	Encourage recovery of associated petroleum gas; stop routine flaring; improve leakage control
HFC refrigerant replacement	Ensure full compliance with the Kigali amendment

Source: UNEP APCAP CCAC, 2019

1.4 From Identifying to Implementing Solutions

Another important step forward taken by the *Solutions Report* involves the implementation of identified solutions. From the intermittent aeration of rice paddies to the installation of solar panels, the report shows that it is possible for policymakers and other stakeholders to implement the solutions in Asia. Achieving the co-benefits from implementing the 25 solutions is therefore feasible. This message is one of the reasons that the report generated considerable interest from the policy community.

At the same time, the report also implies a gap that is visible in the work on co-benefits more generally. While there has been an increased understanding of co-benefits, several demonstration projects, a few key policies and modest reforms to funding mechanisms, decision-making process are not regularly aiming to capture co-benefits. By unifying different views on co-benefits and identifying 25 solutions based upon this unified view, the *Solutions Report* can help overcome a key barrier to incorporating co-benefits into decisions. However, working on one solution at a time, while helpful for demonstration effects, is unlikely to drive wider scale changes. Rather to achieve a fundamental shift will require thinking more carefully about the changes to the surrounding enabling environment. As such, this Fourth ACP White Paper concentrates on three sets of key enabling factors: mobilising financial and other resources, strengthening policies (and institutions) and building essential capacities. The three main chapters each cover one of these areas.

The next chapter focuses chiefly on financing mechanisms that could bring resources needed to support the implementation of particularly the "development priority" solutions. In so doing, it

argues that it will be increasingly important to standardise and harmonise approaches to assessing co-benefits in different funding mechanisms and other vehicles offering support. This includes but is not limited to forms of climate finance flowing coming from the Green Climate Fund (GCF) or Joint Crediting Mechanism (JCM) (Amellina, 2017). It also includes other technology transfer platforms that do not offer financial support but match technology "seeds" with "needs" (Rabhi and Pal, 2019). A final point made in this chapter is that many of the resources needed to implement the solutions will require domestic not international funds. Further, while some countries have limited resources for air pollution control, much of the funding could come from the private sector from regulations or sectoral policies that enable the flow of private resources to meet public goals. Including solutions (especially the "next generation" solutions into high-level policies such as NDCs) can help attract that finance.

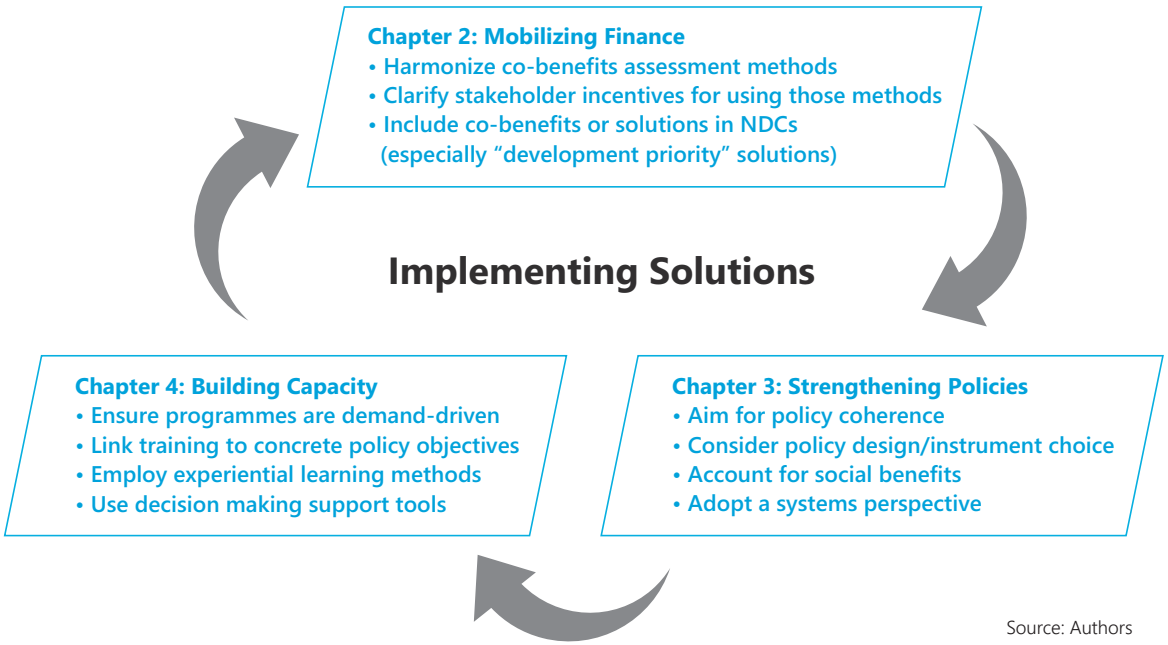
The third chapter turns to policies (and institutions) that could bring both financial and other resources to the implementation of different solutions. In so doing, it focuses on solutions that fit within the "next generation" and "development priority" categories in Northeast, Southeast and South Asia. The policy example for Northeast Asia are from Mongolia. That example highlights the reforms to relevant energy and heating policies that are needed to bring to scale up more efficient boilers or heating systems. The example from South Asia involves reducing emissions from India's diesel vehicles. The case highlights that achieving significant reductions in diesel emissions will require combining stricter emissions standards with a more rigorous inspection and maintenance programmes. A final case focuses on open biomass burning in Southeast Asia. This case suggests that resolving the problem will require a suite of policy reforms to multiple sectors that incentivise changes to behaviours and alter business models (Rogge and Reichardt, 2016). A systems perspective on the problem can help in aligning the interests of different stakeholders behind these reforms.

The final chapter of the main body of this White Paper focuses on capacity building needed to implement the 25 solutions. This chapter contends that implementation at scale will require the combination of multiple mutually reinforcing policies and solutions (Rogge and Reichardt, 2016). Crafting a strategy with these supportive elements will place new demands on decision makers at different levels (ranging from national policymakers to local project implementers). Fortunately, several organisations in Asia and the Pacific (and beyond) have accumulated experiences building capacities at different levels. The chapter therefore identifies some of the key success factors for those programmes. These include ensuring programmes are demand-driven, aligned with agreed policy objectives and employ experiential learning. It also finds that those providing capacity building play more of a knowledge brokering than teaching role, especially when the main goal is project implementation.

1.5 Concluding Thoughts

One of the main themes in this White Paper is that the implementation of the 25 solutions in Asia will not occur without a strong and deliberate effort from those promoting co-benefits. Nor will it happen with a single change to financing mechanisms, supportive policies or relevant capacities. Rather, within each of these areas there will need combinations of shifts that reinforce each other. As demonstrated in Figure 1.2, financing will be needed to initiate demonstration projects and to encourage greater flows of resources from international and domestic investors. Further, policies and institutions will need to build support from those implementing solutions incentivise public and private investments. Finally, policymakers and other stakeholders will require the knowledge and tools to develop enabling policies and structure supporting institutions to attract finance and alter behaviours. Hence, it is also imperative that broader changes to financing mechanisms, supportive policies or relevant capacities move, much like co-benefits themselves, in mutually reinforcing directions.

Figure 1.2: Mobilising Finance, Strengthening Policies and Building Capacity



Source: Authors

Last but not least, it is important to stress the critical need to align changes in these three main focal points of the White Paper also opens an opportunity for the ACP. As this White Paper (and the contributions of the different partners) makes clear, there is already significant ongoing work on particular solutions and specific mechanisms or policies. However, there is limited coordination across these efforts. The ACP then is well-situated to help coordinate individuals and institutions that can help implement the 25 solutions. When the track-record of the ACP is reviewed ten years from now, it is hoped that the wide scale implementation of solutions to air pollution and climate change will be part of its legacy.

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Chapter 2

Mobilising Finance for Air Pollution and Climate Change Solutions: A Survey of Financial Mechanisms, Technology Platforms and Investment Channels

Key Messages

- While domestic finance will fund many of the 25 solutions, international financing mechanisms, technology matching platforms and other investment channels can also help fill critical funding gaps.
- The chapter surveys how six mechanisms, platforms and channels could help narrow these gaps for chiefly the "development priority" solutions. This set of solutions are featured because they have the greatest potential to mitigate greenhouse gases (GHGs) and earn carbon finance.
- The survey looks at which co-benefits are considered for which reasons based on which assessment methods for each of the six funding sources. The survey shows that the mechanisms consider a range of different co-benefits for varying reasons employing diverse methods.
- The chapter finds that assessing co-benefits can shed light on contributions to domestic policy goals for developing country governments; present costs and energy savings for host country businesses; and communicate an activity's implementation prospects to foreign investors and donor governments.
- The adoption of more rigorous and standardised assessment methods for pollution reductions, health impacts, energy savings, job creation and gender equality would strengthen incentives to finance the solutions for all of the above stakeholders. This could, in turn, enhance implementation of co-benefits solutions and attract more co-finance for these purposes.
- The ACP could contribute to efforts to harmonise assessment methods and clarify the incentives for different stakeholders to promote their adoption and spread.
- The ACP could also call for including some of the solutions that focus more on short-lived climate pollutants (SLCPs) in high-level policy documents such as the nationally determined contributions (NDCs) to attract streams of finance outside of those surveyed in this chapter.

2.1 Introduction

The implementation of many of the 25 solutions highlighted in Chapter 1 will depend on adequate and sustainable flows of finance. A significant share of those resources will come from national government budgets (including investment, debt financing, bonds etc.) as well as domestic investors (Carrozza, 2015). To some extent, the co-benefits concept—by demonstrating the synergies between global climate and national/local development objectives—can help persuade policymakers to

adopt domestic policy reforms to leverage private investment (International Finance Corporation, 2013). For instance, such reforms may offer direct financial incentives (such as public procurement or subsidy reforms) to channel private sector funds to some of the 25 solutions. They may also take advantage of climate policy reforms such as those pledged in the Nationally Determined Contributions (NDCs) that generate signals to investors to allocate resources to particular technologies (UN, 2010).

While domestic finance will fund many of the 25 solutions, international financing mechanisms can also help fill funding gaps. The chapter surveys how six international mechanisms could help narrow these gaps for chiefly the "development priority" solutions. This set of solutions are featured because they have the greatest potential to mitigate greenhouse gases (GHGs) and earn carbon finance. The survey shows that the mechanisms consider a range of different co-benefits for varying reasons with diverse methods. Assessing co-benefits can clarify contributions to domestic policy goals for host country governments; present costs and energy savings for developing country businesses; and reflect implementation prospects for international investors and foreign governments. The adoption of more rigorous and standardised set of assessment methods would strengthen incentives to support the development priority solutions for all of the above stakeholders. The ACP could contribute to efforts to harmonise assessment methods and clarify the incentives for different stakeholders to promote their widespread adoption. The ACP could also call for including some of the solutions that do not mitigate GHGs in high-level policy documents such as the NDCs to attract resources from sources of finances not surveyed in this chapter.

The remainder of the chapter is divided into two sections. The next section provides an overview of the aforementioned mechanisms, platforms and channels. This is followed by a conclusion that underlines potential ways to bring more support for solutions that mitigate chiefly short-lived climate pollutants (SLCPs).

2.2 Surveying the Financial Landscape

Following the Paris Agreement, there has been significant growth in the number and types of mechanisms that could bring finance to solutions to climate change with development benefits.[1] This growth has led to more opportunities to attract finance that delivers both on climate change as well as broader sustainability agendas (Hart, 2013). Though this diversity has also made it virtually impossible to cover every potential opportunity for support, many of the pilot approaches demonstrate a post-Paris Agreement interest in ensuring funds for climate mitigation contribute to sustainable development (Greiner et al., 2019). To understand whether and how key mechanisms could deliver needed support, this chapter surveys six international and bilateral financing mechanisms, technology platforms and investment channels that could help provide financial and other forms of support.

The selection of the surveyed sources is deliberately diverse. This is partially to reflect the range of vehicles that have emerged in the wake of the Paris Agreement (Hart, 2013) to help fill still sizable funding gaps in Asia (Kameyama et al., 2016; Lee et al., 2017). The mechanisms and funding sources surveyed in this chapter include two multilateral sources of finance in the form of the Green Climate Fund (GCF) and the Asian Development Bank's (ADB) Future Carbon Fund; two sources of bilateral support in the form of Japan's Joint Crediting Mechanism (JCM) and Japan India Technology Stakeholder Matchmaking Platform (JITMAP); as well as other select mechanisms and channels such as crowdfunding and impact investing (see Table 2.1 for a listing of the mechanisms). For each of these mechanisms, the chapter provides an overview of the financial mechanism or platform and discusses how it encourages the adoption of technologies that deliver co-benefits. In many cases, that encouragement involves the quantification of sustainable development co-benefits in the project approval processes; this is, therefore, a point of emphasis.

1 Many of these mechanisms are called Article 6 pilots, referring to the Article in the Paris Agreement which has provided a basis for international cooperation.

Table 2.1: List of Surveyed Mechanisms

Mechanism	Sources of Finance	Locations of Funded Activities
The Green Climate Fund	Multilateral	Global
ADB (Future Carbon Fund)	Multilateral	Asia and the Pacific Developing Countries
JCM	Bilateral (Japan)	17 Countries (mostly Asia and the Pacific)
JITMAP	Bilateral (Japan)	India
Crowdfunding	Private Sector	Global
Impact Investing	Private Sector	Global

Source: Authors

2.2.1 The Green Climate Fund

The Green Climate Fund (GCF) was established at the close of the 16th Conference of Parties (COP 16) to the United Nations Framework Convention on Climate Change (UNFCCC) in 2010. The GCF functions as the main financial mechanism of the UNFCCC (in addition to the Global Environment Facility (GEF)) and has a clear mandate to promote low-emission and climate-resilient development in developing countries. Since its establishment a decade ago, the GCF has begun to allocate a growing pool of resources to help address pressing mitigation and adaptation needs of developing countries. As part of the UNFCCC architecture, it also aims to ensure that its investments are aligned with sustainability goals. The GCF's ability to contribute to these broader goals has arguably gained added impetus with the agreement over the Sustainable Development Goals (SDGs) as one of the three pillars of the post-2015 developmental agenda (joining the Paris Agreement and the Sendai Framework for Disaster Risk Reduction) (see also growing interest in climate and SDGs synergies UN, 2019).

The GCF would appear particularly well-placed to support the set of "development priority" solutions as many of these options mitigate GHGs as well as achieve other sustainable development benefits. This might also have the advantages of attracting additional co-finance—an area that is generating considerable interest in climate finance circles (Frankfurt School FS UNEP Collaborating Centre, 2020).

Bringing in this finance on a consistent basis to the highlighted solutions requires looking more carefully at the project development and approval process. When proposing a project/programme to the GCF, a concept note is presented to the GCF Secretariat for feedback. The GCF Secretariat reviews the concept note to ensure it is consistent with the GCF's objectives, policies and investment criteria. The investment criteria are particularly important since one of the main criteria is "sustainable development potential." The other criteria—impact potential, paradigm shift potential,[2] responsiveness to recipient needs, promoting country ownership and effectiveness and efficiency—arguably could also be related to co-benefits (GCF, 2015a). The concept note then needs to offer a clear narrative that outlines potential co-benefits beyond mitigating GHGs. In more concrete terms, project proponents consider the following types of co-benefits:

- **Economic co-benefits.** These benefits include jobs created, poverty alleviation, enhancement of income and financial inclusion, especially for women.

- **Social co-benefits.** These benefits include improvements in health and safety, access to education, cultural preservation and improved access to energy, social inclusion, improved sanitation facilities, and improved quality of and access to public utilities (i.e. water supply).

- **Environmental co-benefits.** These benefits include improvement in air, water and soil quality. Other elements include conservation and biodiversity.

2 For example, the criteria of 'paradigm shift' contains elements of innovation, replicability, creation of enabling environment that could contribute directly or indirectly to the delivery of co-benefits.

In addition to these three categories of co-benefits, the GCF secretariat places a premium on gender co-benefits, promoting projects/programmes that reduce inequalities between women and men from climate change related vulnerabilities or low carbon reforms. This is in line with the GCF gender strategy (GCF, 2014; 2015a).

When presenting co-benefits, the GCF Secretariat encourages the use of qualitative and quantitative indicators. The GCF concept note should also include an economic analysis of the proposed activities and/or a study to demonstrate they can achieve the abovementioned co-benefits. The methodology should further be provided for different benefits, ranging from jobs created to improved access to education to improved air quality. The presentation of those benefits is often expressed relative to a business-as-usual baseline (see the example provided below of the Karachi Bus Rapid Transit System) (GCF, 2015b). While the GCF then helps to highlight and quantify co-benefits, it does not provide additional finance for their inclusion in the proposal or achievement during implementation. Rather their inclusion and achievement are meant to motivate additional domestic financial and non-material support for the project.

Box 2.1: The Co-benefits from Karachi's Bus Rapid Transit

Like many rapidly motorising cities, Karachi, Pakistan, suffers from heavy traffic as well as serious air and noise pollution. The sharp rise in motorised transport that is responsible for these local socioeconomic and environmental stresses also contributes to global climate change. To address these problems, in 2018 the GCF approved funding for a 30 kilometre, fully segregated bus rapid transit (BRT) system operated by the "world's first" biomethane hybrid bus fleet. The project also includes complementary projects such as a dedicated biogas plant covering 100% of fuel demand and the last mile connectivity via bikes and e-pedicabs. Much of the 583.5 million USD of finance from the project is from domestic sources, but the GCF also offered 49 million USD in co-financing. The project is scheduled to be operational in 2022 and run for 30 years.

As mentioned in the chapter, the project proponents analysed some of the co-benefits associated with the project as part of the concept note development and approval process. That analysis indicated that the project is expected to generate 2,130 jobs directly through future BRT operations. The jobs include 1,424 jobs for station services (such as ticketing, security and cleaning), 615 jobs in bus operations (such as driving, conducting and mechanics), and 81 TransKarachi staff. In addition, the project would deliver 59 million USD annually in time savings; and an average reduction 5.5 tonnes $PM_{2.5}$, 723 tonnes of NOx, and 9.5 tonnes of SO_2; and a cumulative savings of 7 million USD in health impacts. Equally important (though not quantified) co-benefits are improved access and safety features for women, children and the disabled in the 28 BRT stations and less noise pollution.

Source: GCF, 2015b

The GCF is not the only UNFCCC mechanism that could potentially bring finance to solutions with co-benefits. The Climate Technology Centre and Network (CTCN), also operated by the UNFCCC as an operational wing of the technology mechanism is part of the landscape of entities designed to help developing countries acquire equipment, practical knowledge and skills that decrease GHGs and/or increase resilience for smaller-scale projects.

Box 2.2: The Climate Technology Centre and Network (CTCN)

The CTCN helps remove barriers to transferring technologies such as lacking capacities, government policies and regulations; limited access to proper information; and/or insufficient infrastructure. The CTCN provides technical assistance for 250,000 USD for projects aimed at addressing these barriers to technology transfer. Though the CTCN does not explicitly aim to support projects with co-benefits, some of its interventions have had that effect. For example, in Ecuador, the CTCN supported a waste-to-energy technology that generated biogas from animal waste while simultaneously providing energy access and reducing non-point source water pollution. Plans are in the works to scale this project in Ecuador.

Source: CTCN, n.d.

2.2.2 The Asian Development Bank (Future Carbon Fund)

As a multilateral development bank, the Asian Development Bank (ADB) supports climate change mitigation and adaptation projects through sovereign and non-sovereign loans. In many cases, climate-related loan projects already deliver multiple co-benefits; however, interest in supporting projects that can deliver on multiple dimensions of development is growing within the ADB. Apart from climate projects (discussed more below), the ADB has also created the Cities Development Initiative for Asia (CDIA) that funds city projects resulting in large co-benefits (CDIA, 2018). Finally, health benefits from climate-related projects in the transport (road safety), urban (healthy cities), water (water safety), sanitation (communicable diseases) and energy (low carbon and reduced pollution) portfolio areas are another priority for the ADB, as articulated in it its 2030 strategy (ADB, 2018).

An ADB investment vehicle that could help achieve co-benefits is the Future Carbon Fund. The Future Carbon Fund was established in 2009 to offer technical and financial support for Clean Development Mechanisms (CDM) projects (the project-based offset mechanism that operates under the Kyoto protocol with the twin goals of achieving sustainable development in host countries and delivering affordable emission reductions in developing countries) (Sun et al., 2010). The Future Carbon Fund currently focuses on renewable energy, transport, waste management and energy efficiency technologies in 12 developing countries in Asia (ADB, n.d.). Since many of the targeted projects under Future Carbon Fund were already delivering co-benefits, the ADB developed and applied a standardised methodology to review their social, environmental and economic impacts. In addition to systematically measuring these impacts, key benefits were also mapped onto the SDGs (ADB, 2017).

The review of the Future Carbon Fund revealed several pragmatic suggestions that could lead to the delivery of co-benefits more generally. These begin with careful consideration of potential benefits during the early planning stages of the project. If co-benefits are carefully integrated into a project's design, the likelihood of their delivery increases significantly. In a similar fashion, opening a dialogue with local communities to solicit inputs into the decision-making process can create greater ownership and ensure that benefits beyond climate mitigation accrue to a project. Additional recommendations that may offer a "push" for co-benefits involve the actions of the purchaser and/or the purchase agreement (these are particularly relevant as countries such as Switzerland have concentrated on purchasing credits that deliver sustainable development benefits) (Greiner et al., 2019). For example, purchasers may want to assess co-benefits as part of their due diligence and consider them in their transactions (as they are likely to offer a good indication of the project's implementation). In a similar vein, co-benefits may be included in the emission reduction purchase agreement wherein buyers structure their transactions to provide results-based carbon finance linked to development activities and the delivery of pre-defined co-benefits. In both of the above cases, the initial and continuous assessment of co-benefits can offer some insights into the project's implementation prospects and actual performance as they focus on benefits that are most relevant to domestic policymakers and affected communities. A final related suggestion is to long-term fixed-price contracts and upfront payments that help project entities during project implementation and operations, contributing to the sustained delivery of co-benefits.

As the ADB also works on several other carbon and climate change funds (Bhandari, 2020), it is watching carefully the development of carbon markets under the Paris Agreement. Here too some of the same lessons learned from the ADB's Future Carbon Fund may carry over to other climate finance mechanisms. These include making co-benefits an integral part of project design and promoting reporting on co-benefits. A similar reform could involve requiring buyers to indicate that they want to see the monitoring, reporting and verification of co-benefits. Finally, there may also be scope for international organisations and civil society to provide support in systematically assessing benefits. The ADB is currently working with the Sustainable Dialogue Initiative (SDI) and other partners that concentrate on promoting sustainable development

through the Paris Agreement to allow for higher ambition in the implementation of NDCs. The SDI may have a role to play in offering host countries and prospective buyers the tools to *ex ante* assess and track co-benefits (Braden et al., 2018).

2.2.3 Joint Crediting Mechanism

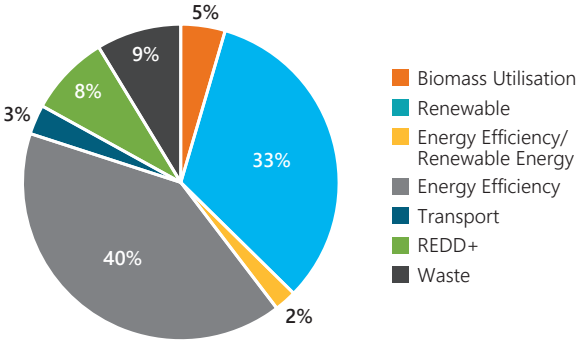
Before the close of the Kyoto Protocol's first commitment period, Japan began to develop a bilateral offset crediting mechanism called the Joint Crediting Mechanism (JCM). The JCM was created to facilitate the dissemination of low carbon technologies (as well as related services, products and infrastructure) that contribute to reductions in GHGs and sustainable development in developing countries. A related goal of the JCM was to bring benefits to both partner countries and Japan. For developing countries, these benefits entailed receiving a subsidy to cover a part of a low carbon technology's initial investment costs as well as a portion of the carbon credits from the GHG emission reductions (to be applied to the recipient country's NDCs). Some of the credits from the GHG emission reductions would also be counted as appropriate to Japan's reduction. The JCM is currently operating in 17 countries from Asia, Africa and Latin America (JCM official website, 2020).

While the JCM is seemingly well-positioned to support the transfer of technologies from the "development priority" category in the *Solutions Report*, a brief overview of how it functions can help shed a light on possible entry points for this to take place. In each country, a Joint Committee (JC) oversees the JCM with the representatives from partner countries and the Japanese governments (the Ministry of the Environment; Ministry of Economy, Trade and Industry; Ministry of Foreign Affairs and Forestry Agency). Each JC then develops rules and guidelines necessary for JCM implementation, while also approving or rejecting JCM methodologies and determining whether to register JCM projects. Third-party entities (TPEs) are responsible for validating and verifying JCM projects. A JCM secretariat in the host country helps to manage the project from proposal through to implementation (Government of Japan, 2019).

Since the JCM aims to facilitate "the diffusion of leading low carbon technologies, products, systems, services and infrastructure…[while] contributing to the sustainable development of developing countries" (JCM rules and guideline) a few channels exist through which co-benefits are recognised and promoted. The most straightforward way is that project participants in some countries have to develop a Sustainable Development Implementation Plan (SDIP) and an SDIP Report at the time of developing a Project Design Document (PDD) and monitoring report. This scheme applies to Indonesia and Mongolia JCM projects because the countries have voluntarily developed a rule to request project proponents to submit an SDIP and the SDIP Report under the JCM guidelines (Amellina, 2017).

Outside of the above efforts many of the projects offer a clear illustration of contributing to multiple SDGs. For example, in Mongolia, a photovoltaic project in the agriculture sector not only increased the share of renewable energy but also reduced air pollution (SDG 3, good health and well-being) and helped produce fresh vegetables for residents (SDG 2, zero hunger). In Vietnam, a JCM project designed to install a high-efficiency water pump in a water treatment facility created a stable and sustainable water supply that also contributed to resilient infrastructure (SDG 6, clean water and sanitation; SDG 9, resilient infrastructure). In addition, both the aforementioned projects are linked to the achievement of 9 additional SDGs, including SDG 4 (quality education and promoting lifelong learning opportunities for all) by providing technical and vocational training under the JCM programme (IGES, 2019). As demonstrated in Figure 2.1, the fact

Figure 2.1: JCM Projects by Sector



Source: Authors

that more than 70% of the JCM projects focus on renewables or energy efficiency suggests the JCM is already help finance two of the "development priority" solutions—though the amount of co-benefits from these activities could be made more explicit.

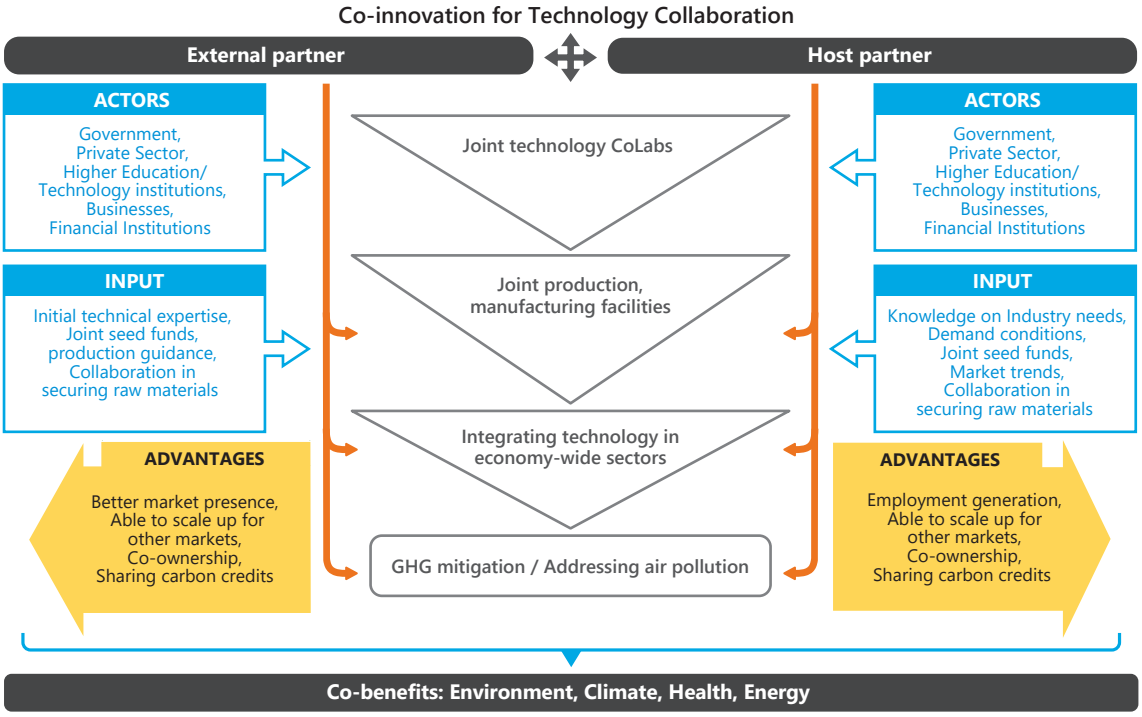
While the consideration of co-benefits is currently dependent on the project proponent and host country, there are plans to strengthen the integration between the JCM and the SDGs that could result in co-benefits being mainstreamed into the JCM project development and implementation processes.[3] Some thinking is also underway on how mechanisms such as the JCM could be enhanced to promote not merely the transfer of technologies but initiating a co-innovation process that avoids some of the challenges associated with conventional technology transfer (See Box 2.3).

Box 2.3: Co-innovation: Facilitating Technology Transfer

While many existing technology transfer initiatives are limited to the sale of finished products, these efforts can struggle to achieve significant impacts in importing countries. Part of the challenge is that since technological knowledge remains with the donor country, there may be limits on how much they can break into an importing country's market. There may also problems in securing complementary technologies needed to make the imported technology work in diverse contexts.

A possible solution to both of these problems is co-innovation. The concept of co-innovation has at its core a mutual learning process wherein both the exporting and importing country participate in technology development and a needs-based localisation. It further aims to use this learning to facilitate the introduction and spread of different kinds of technologies. While some of the technologies may require collaboration at innovation or conceptual stage, established and mature technologies may need collaboration at the customisation or piloting stage.

The model also had the potential to be combined with vehicles such as the JCM. At this point, the JCM is designed to facilitate transfers of finished products; however, it also functions through a series of exchanges between stakeholders inside and outside the host country. A stronger emphasis on supporting the innovation process through the JCM may lead to more significant and sustainable exchanges on knowledge that helps contextualise technologies. Efforts to more systematically represent in co-benefits through these exchanges may further enhance the quality and quantity of exchanges.



Source: Janardhanan, 2019

3 Such a change would mean that the JCM is becoming different than a "market" mechanism driven by incentives for carbon credits.

2.2.4 Japan India Technology Matching Platform

Unlike the previously reviewed mechanisms, the Japan India Technology Matching Platform (JITMAP) is a more narrowly defined technology matching platform designed to support business-to-business cooperation on energy-efficient technologies between India and Japan (though JITMAP is focused on cooperation with India a similar model is being used in Thailand). The JITMAP was created by the Institute of Global Environmental Strategies (IGES) jointly with The Energy Resources Institute (TERI) to address a well-recognised problem: where countries are not mandated to abate GHGs, there are limited incentives to install energy-efficient technologies. JITMAP introduces Indian companies to energy-efficient cross-cutting technologies (such as compressed air systems, refrigeration systems and steam systems) using a feasibility study to facilitate that introduction. It also employs a slightly different strategy for large- and small and medium enterprises (SMEs). Large Indian companies are provided with practical information on a technology's payback period, installation cost, energy and non-energy benefits during the feasibility study. These companies are also asked to conduct detailed energy audits that can help demonstrate the cost savings of energy-efficient technologies. For SMEs, because there is often significant energy saving potential by adopting energy-efficient technologies and by improving operating practices, technical experts are deployed to provide advice on best-operating practices by conducting a "walk-through" energy audit during the feasibility study. Of the 47 Indian companies engaging with JITMAP since its launch in 2016, most adopted best operating practices within six months and installed energy-efficient technologies within one to three years (Abdessalem and Pal, 2019; Khodke et al., forthcoming).

Since there is a realisation that business cultures are quite specific in India, the JITMAP model has been most successful in Gujarat, Maharashtra and Andhra Pradesh as well as India's National Capital Region. Part of the reason for the selection of these states is that they are some of the most highly industrialised regions in India with significant industrial clusters. A related justification is that these states are home to a network of cluster-level business associations that lowers the transaction costs of reaching out to Indian companies.

Due to the focused and relatively small scale of JITMAP, it is not feasible that it would offer financing to offset the costs of energy-efficient technologies like some of the other mechanisms reviewed in this chapter. Further, the provision of financial incentives needs to be assessed carefully and often on a case-by-case basis. This careful consideration is necessary because it is not clear that financial incentives would be meaningful as the capital cost of the technology itself is often not a key barrier. Rather, the most significant obstacles tend to be the additional cost the company has to bear while installing energy-efficient technologies. Hence, financial incentives should address the gap between energy-efficient technologies and business-as-usual technologies. Further, the Indian government offers many subsidies for installing energy-efficient technologies like the Technology Up-gradation Scheme (TEQUP) for Micro Small and Medium Enterprises (MSMEs) to reduce production costs while also lowering GHG emissions (Ministry of Micro Small and Medium Enterprises, n.d.). Yet many Indian SMEs (especially in smaller cities) are not aware of TEQUP and related schemes. This suggests that one of the key levers on change is awareness-raising that encouraging companies to take advantage of existing schemes, particularly in industrial clusters in smaller cities. There may also be scope to qualify for additional financial support by recognising other developmental co-benefits (as illustrated in Box 2.4).

Overall, the case of JITMAP underlines that the key to unlocking additional funds for co-benefits at the industrial level is often domestic regulations. Motivating companies in India to undertake at least a "walk through" energy audit would help to target the low-cost improvements in operating practices that could save energy. A similarly focused set of reforms would be encouraging disclosure of energy efficiency performance of technologies. If tied to the previously mentioned awareness-raising efforts, this may lead to even greater efforts in India's industrial clusters to capture the benefits of installing energy-efficient technologies.

Box 2.4: Reducing HFCs from Seafood Processing in India

Many seafood-processing companies in India use R404A refrigerant. R404A is a Hydrofluorocarbon (HFC) that has high global warming potential. Under JITMAP, Indian seafood processing companies that are willing to change their refrigeration system were identified and introduced to an NH_3-CO_2 Refrigeration system that has high energy saving potential and can deliver more environmental benefits than the system relying on the R404A refrigerant. However, due to the high upfront cost, without financial support for technology adoption, the companies cannot install this technology.

Such technologies that are closely associated with human and environmental safety should qualify for additional financial support and preferential treatment. Agencies like the Marine Products Export Development Authority (MPEDA), India could play a crucial role in mainstreaming such environmentally sustainable technologies across the seafood sector.

Source: Abdessalem and Pradhan, forthcoming

Domestic regulations that encourage the sharing of some of the cost savings information may also be useful for financiers. Financiers are typically interested in how much cost savings can be achieved, how it will be certified, what kind of risks are assumed (i.e. energy efficiency performance is achieved and maintained in a sustainable manner). They also have a keen interest in how these risks are mitigated in introducing and operating energy efficiency technology and then how such information is disclosed. If mechanisms like JITMAP reinforce provisions in domestic regulation, they can also help attract investments into technologies with co-benefits.

Another option is government-backed support programmes from developed countries. These programmes usually target the development and demonstration of technologies or products. For instance, programmes such as the "Renovation/ Co-innovation of Low Carbon Technologies to be applied in Developing Countries" that is overseen by the Ministry of Environment of Japan (MOEJ) offers support to SMEs in developed countries that are motivated to export renovated or newly developed demonstration technologies to developing countries. This fund requires a description of environmental benefits in the project application procedures—though it is not always clear how that reporting is used by investors (Global Environment Centre, n.d.).

2.2.5 Other financial mechanisms and channels

The previous section reviewed multilateral and bilateral financing mechanisms or technology platforms. There are also other vehicles designed to leverage private finance to support the introduction of projects that can help implement some of the 25 solutions (Hongo et al., 2015).

Investment-related crowdfunding falls into this category. This type of crowdfunding often supports projects with substantial social benefits. This can include activities from SMEs that may otherwise struggle to attract investment. To cite a specific example, the investment platform "Securité" encourages project developers to relay a compelling story about how the proposed project delivers on particularly the social dimensions of development above and beyond the investment's monetary returns (Securite, n.d.). This may involve developing a narrative about the livelihood enhancing benefits of off-grid solar home systems (SHSs) business.

Though not formally a mechanism, another channel, "environmental, social and governance investment" (ESG) has witnessed a marked rise in recent years. Some of that growth has come from "impact investing" that often presents measurable social or environmental impacts along with financial returns. Increasingly, there have been calls for assessing ESG as well as ties to more conventional value drivers (Schramade, 2016). Despite the growth in investment, the lack of a common standard that constitutes an ESG impact has presented confusion for investors. Systematising the assessments of co-benefits could also help contribute to the much needed spread of impact investing specifically and ESG generally (Serafeim and Grewal, n.d.). In this regard, a standardised methodology to track social, environmental and economic impacts could be

useful for impact investors.

In the above as well as many of the other profiled mechanisms, there is scope for international lenders and governments to offer additional guidance on how to assess contributions to co-benefits. A possible way forward in this connection would be for supporting mechanisms that help address weaknesses in not simply the assessment in key categories of benefits but highlight business environments in targeted countries, technology matching and fundraising at stages that help strengthen co-innovation (see Box 2.3).

2.3 Conclusion

This chapter has surveyed a range of mechanisms and platforms that could provide financial support for chiefly the "development priority" technologies in the *Solutions Report*. That survey demonstrated that there is a diverse range of mechanisms, vehicles and channels that could offer financial and/or other forms of support for key technologies. It underscored that many of these mechanisms are aiming to attract not only climate finance but other forms of domestic private and public "co-finance." In most of the cases, the mechanisms are not explicitly linking the number of resources offered to the inclusion achievement of key co-benefits; this perhaps reflects concerns about placing an international or regionally agreed value on ostensibly local or national benefits and/or additional transaction costs from systematically assessing these benefits.

At the same time, a gradual convergence in the need to fully measure these benefits appears to be underway. There are also some pragmatic suggestions of how both measurement and greater engagement with affected stakeholders could enter into buyer and seller calculations and purchase agreements. The chapter further suggests that the kinds of benefits that are highlighted will vary with the kind of technology and the potential technology user; this is most evident in the case of SMEs in India where the key benefits are the reductions in energy use and costs (one of the key roles of JITMAP then is to raise awareness of these benefits as well as domestic subsidy schemes that could lower the costs of using technologies that would deliver them). Even with this variation, the adoption of more rigorous and standardised set of assessment methods would strengthen incentives for developing country policymakers and businesses as well as international investors and governments to finance key solutions. The ACP could support harmonising assessment methods and clarify different stakeholder incentives for using these methods.

A final point that merits attention in this chapter is that, while the focus has been chiefly on "development priority" solutions, some of the lessons learned may also apply to "next stage" solutions. This is particularly the case for solutions that reduce methane and/or hydrofluorocarbons (HFCs) as these gases covered under the UNFCCC. At the same time, there is an ongoing movement to include SLCPs under the UNFCCC purview which may eventually unlock resources for these solutions. Perhaps even more importantly, there may be a growing amount of resources from national governments or domestic investors to support the introduction and spread of key technologies. This is suggested, for instance, by the inclusion of SLCPs in the NDCs (see Box 2.5). This final point—about the importance of national policies to enhance implementation of the 25 solutions—is the focus of the next chapter on strengthening policies.

Box 2.5: SLCPs in NDCs

Country	Black Carbon	Methane	HFCs
Bangladesh	X	X	X
Cambodia		X	
China		X	X
India	X	X	X
Indonesia		X	
Japan		X	X
Lao	X		
Malaysia		X	
Mongolia	X	X	
Nepal	X	X	
Pakistan		X	
South Korea		X	X
Sri Lanka	X	X	
Thailand		X	X
Vietnam	X	X	X
Philippines	NDC is likely to have SLCPs integrated within it.		

Several countries in Asia are integrating SLCPs into its NDCs as shown the above chart. India, Sri Lanka and Laos focus on achieving black carbon reductions in the transport sector through measures targeting diesel emission reductions while Vietnam intends to reduce open burning of agricultural residue. As for methane, most of the countries in the chart are planning to reduce methane in the NDCs in the waste, agriculture and energy sectors. In the waste sector, Bangladesh has set clear targets for landfill gas to be captured and used for electricity generation. Regarding HFCs, several countries such as Bangladesh, China, India, Japan, South Korea, Thailand and Vietnam expressed their intention to reduce HFCs. While Japan is introducing refrigerant control technology and some other measures to control emissions of fluorinated gases and promoting life cycle management of HFCs, other countries do not discuss specific measures to reduce HFCs in their NDCs.

Source: Authors

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Chapter 3

Strengthening Policies and Institutions to Control Air Pollution and Mitigate Climate Change in Asia

Key Messages

- **Implementing many of the 25 solutions at scale requires supportive enabling policies and institutions. This chapter identifies key enabling policies and institutions for three cases from different sectors and regions: heat only boilers (HOB) in Mongolia; diesel inspection and maintenance programmes in India; and open biomass burning in Southeast Asia.**

- **While several of the chapter's recommendations are case-specific (i.e. enhanced oversight of vehicle inspectors), four findings could prove more generally useful.**

  1. Policy coherence is critical. The synergies or conflicts between air pollution, climate and sectoral policies can strengthen or weaken the enabling environment. Greater coherence between policies can ensure that efforts to control air pollution do not undercut attempts to achieve climate or other sectoral goals and vice versa.
  2. Policy design and instrument choice matters. Often policies will require a mix of administrative, financial and reputational incentives to achieve their potential. Policymakers need to consider adding or refining the mix of instruments to get the most from these incentives.
  3. Accounting for social impacts enhances implementation. Poorer segments of the population may lack the financing to invest in a new boiler, low-emission vehicles or field clearing equipment. A failure to consider financial capability and corresponding social impacts could undermine implementation and scaling.
  4. Achieving co-benefits requires a systems perspective. This perspective will help identify upstream causes of a problem; multiple entry points for altering unsustainable practices; and institutional arrangements to align stakeholder interests behind a solution.

- **The ACP could work with policymakers and other stakeholders to develop a diagnostic tool to help decision makers identify opportunities and options for strengthening policies and institutions needed to deliver co-benefits at scale in Asia.**

3.1 Introduction

Chapters 1 and 2 contended that many of the 25 solutions require supporting policies and institutions to achieve their intended impacts. These policy and institutional considerations merit attention for several reasons. One is that many of the solutions are narrow in scope and thus will need to be scaled to realise their potential. Additionally, several solutions require not one but multiple policies—or an overarching strategy—to achieve the greatest potential. A final reason is that some of the solutions not only necessitate supporting policies but institutional changes that bring together government agencies and other stakeholders behind a solution.

This chapter, then, is about how policies and institutions can support the implementation of the 25 solutions. The chapter deliberately focuses on case studies of solutions from different sectors and regions: 1) more efficient and low emission coal boilers in Mongolia; 2) improved inspection and

maintenance for diesel technologies in India; and 3) managing open burning in Southeast Asia. To some extent, the diverse selection of cases implies that some of the conclusions are case-specific. For instance, the case of the boilers clearly shows the quantification of benefits for specific changes to technologies and policies in Mongolia, whereas the other cases point more to potential social impacts and inclusive policies and institutions.

At the same time that this diversity warrants attention, there are a few generally applicable conclusions. These begin with the need to consider coherence between relevant development, air pollution and/or climate strategies. A lack of coherence between these policies could undermine implementation and scaling of the solutions (Kivimaa and Kern, 2016; Rogge and Reichardt, 2016). In a similar manner, policymakers will need to be cognisant of policy designs and instrument choices. For many of the solutions, policies will require a mix of administrative, financial and reputational incentives for implementation. In considering synergies/conflicts and instrument mixes, social impacts should be accounted for in policies. Poorer segments of the population may lack the financing to invest in a new boiler, low-emission vehicle or field clearing equipment. A failure to consider equity could undermine implementation at scale (Hajer et al., 2015). Finally, in working toward the implementation of the solutions policymakers need to think a larger system of changes. This will help to identify some of the upstream causes of a problem; multiple entry points for altering practices; and reforms and institutional arrangements that needed to align interests of key stakeholders behind a solution (Corfee-Morlot et al., 2009).

The chapter has three sections. The next section focuses on the case studies. A concluding section presents general recommendations and connections with other chapters.

3.2 Case Studies

This section describes the policies and the institutions that could influence the implementation and scaling of three solutions. The chapter moves from more efficient coal boilers to clean diesel in India to managing open burning in Southeast Asia (with specific attention to Thailand).

3.2.1 Improving Coal Boilers in Mongolia

Mongolia suffers from dangerously high levels of air pollution (Hasenkopf et al, 2016). During the winter, ambient concentrations of $PM_{2.5}$ can be as much as ten or more times above World Health Organisation (WHO) guidelines. Poor air quality is frequently due to the burning of low quality coal in inefficient boilers and stoves in homes and buildings. By emitting carbon dioxide (CO_2) and short-lived climate pollutants (SLCPs), many sources of air pollution also contribute to climate change. A major source of air pollution and climate change in Mongolia are heat only boilers (HOBs). The boilers help warm schools, hospitals and public building in Ulaanbaatar and other parts of the country.

Both the national and Ulaanbaatar government recognise the contribution of inefficient boilers to air and climate change. This realisation was partially responsible for the Mongolian and Japanese government's decision to cooperate on a Joint Crediting Mechanism (JCM) (see Chapter 2 for information on the JCM) that demonstrated the feasibility of retrofitting a HOB (less than 1 MW capacity) at two schools in Ulaanbaatar. That project went through several phases that led to reductions in air pollution and GHG emissions[4]: a roof was built over the fuel storage to decrease humidity; a manual fuel supply system was replaced with a mechanical stoker; and a high efficiency de-duster (cyclone) was installed to decrease the emissions of PM. Each of these changes had different effects on air pollutants and CO_2. They further demonstrated the potential for combining multiple interventions to achieve greater impacts (ACP, 2016).

At the same time that understanding these effects is important, it is critical to appreciate the broader impacts of scaling changes to the HOBs or incorporating similarly motivated reforms to heating systems. The chapter examines these broader impacts because climate, air pollution

4 The one exception to this installation of the post-production cyclones actually leads to greater energy use and thus increases in GHGs.

and development policies include provisions that could enable or undermine the upscaling of demonstration projects.

One of the core policies with this potential is Mongolia's recently submitted Nationally Determined Contribution (NDC). Mongolia's NDC is not merely about mitigating climate change but also other development needs, including controlling air pollution (Baljmaa, 2019). It therefore draws upon policy documents from other sectors with broader aims, including the State Policy on Energy 2015 and Green Development Policy 2014. The NDC also notes that a large part of the key sources of emissions is in the energy sector with power generation and heating leading the way. Therefore, the NDC underlines measures in several policy areas; the replacement of outdated boilers and/or transition to district heating is one such complementary area (See Table 3.1).

Table 3.1: Energy Related Targets in Mongolia's NDC

Energy (power and heat)	Increase renewable electricity capacity from 7.62% in 2014 to 20% by 2020 and to 30% by 2030 as a share of total electricity generation capacity.
	Reduce electricity transmission losses from 13.7% in 2014 to 10.8% by 2020 and to 7.8% by 2030.
	Reduce building heat loss by 20% by 2020 and by 40% by 2030, compared to 2014 levels.
	Reduce internal energy use of Combined Heat and Power plants (improved plant efficiency) from 14.4% in 2014 to 11.2% by 2020 and 9.14% by 2030.
	Implement advanced technology in energy production such as super critical pressure coal combustion technology by 2030.

Note: While Mongolia adopted an *Intended* Nationally Determined Contribution (INDC) in 2015, the NDC (without the "intended" preface) was recently released. Implementation of the NDC is still in the early stages.

Source: Authors

Outside of the NDCs and climate policies, the Mongolian Government has made notable efforts to curb air pollution with the potential to deliver co-benefits. Some of these efforts involved a range of activities that have other goals besides abating air pollution such as promoting renewable energy and public transportation; however, many of the provision and targets are have been promulgated over the past five years to control air pollution. For example, in 2016 the Mongolian Government introduced an evening electricity discount for households in Ger districts to encourage those using raw coal for heating to transition to electric heaters. A year later, the Mongolian Government adopted a National Program on Reduction of Air and Environmental Pollution, 2017-2025 with an ambitious target of aiming to decrease air pollutants by 80% while prohibiting the use of unprocessed coal in Ulaanbaatar (in all applications except thermal power plants). Donor-supported projects with similar aims have complemented these policies.

Box 3.1: The Asian Development Bank's Support for Mongolia

In 2018, The Asian Development Bank (ADB) agreed to a request from the Mongolian government for financial assistance to address Ulaanbaatar's air pollution. The ADB then followed with policy-based loan that is helping to prioritise and expand public resources for pollution reduction efforts and update urban energy and transport systems. The loan has three streams of activities that are broadly consistent with the recommendations in the chapter. For example, a policy-based loan is aiming to strengthen the alignment between existing policies and institutions working on air pollution, energy, transportation and urban planning to improve the prospects of adopting and spreading efficient technologies.

Source: ADB, 2018

Outside of these air pollution policies, other efforts have targeted changes to existing housing patterns. In terms of housing policies, the Mongolian government has sought the relocation of people from Ger district residents (the Ger districts are the peri-urban areas that circle Ulaanbaatar where many migrants have settled) to apartments connected to the communal heating grid and/or offering incentives to move to better-insulated apartments. A fund was also created to encourage movements away from designated air quality improvement zones with subsidies of up to 30% of the mortgage new apartment. Last but not least, the Mongolian government committed to provide households in Ger districts with cleaner solid fuels and plans on supplying 600,000 tonnes in 2019.

A logical question that follows from these reforms is what would be their broader impacts? Five scenarios were prepared for Ulaanbaatar and regions beyond to quantify co-benefits using the International Institute for Applied Systems Analysis (IIASA) GAINS model (Amann et al., 2011). The scenarios demonstrate the effects of replacing conventional low efficiency boilers and/or connecting to more efficient heating systems. The policies outlined previously could offer the enabling environment in which one or many of these scenarios could play out.

Table 3.2: IIASA GAINS Co-benefits Scenarios for Ulaanbaatar and region beyond

Scenario Description	Assumptions
Scenario 1: Replacement of conventional HOB with more efficient HOBs.	Replacement of conventional with improved models in Ulaanbaatar. This leads to a 25% reduction of coal (lignite) consumption in 2030.
Scenario 2: Connection of buildings using small boilers to the local 30 MW heating plant.	Up to 70% of the small boilers in Ulaanbaatar can be connected to the local heating network supplied by 30 MW boilers; the remaining boilers are replaced with models that are more efficient.
Scenario 3: Connection to the district heating network serviced with large boilers of about 300 MW.	Replacement of remaining boilers with more efficient models. Similar to scenario 2, 70% of the small boilers are connected to the district heating network. The remaining small boilers can be replaced with models that are more efficient.
Scenario 4: Replacement of conventional HOB with the improved ones in other Mongolian cities/towns.	The amount of heat supplied by the reference boilers in the rest of Mongolia was based on urban population statistics. In particular, assumptions were made about heat demand in other towns relative to Ulaanbaatar—per capita demand for heat produced in small manual boilers in towns above 25,000 inhabitants set as equal to 70% of the demand in Ulaanbaatar. The assumption that there were fewer public buildings (in schools) per capita compared with Mongolia's capital. For towns below 25,000 inhabitants, per capita demand was 50% of that in Ulaanbaatar. Based on these assumptions, heat production in small boilers outside Ulaanbaatar were set at about 37% of the Ulaanbaatar level or 0.54 PJ (Petajoule). Existing boilers can be replaced with improved boilers from 2020-2030.
Scenario 5: Connection of buildings heated with small boilers in other Mongolian towns to the local 30 MW heating plants.	This scenario assumes that 30% of small HOBs in towns above 25,000 inhabitants were connected to the local district heating networks supplied with 30 MW boilers. The remaining small boilers were upgraded to improved ones. Such assumptions imply that local heating networks could supply about 15% of heat demand outside Ulaanbaatar. Note that the building of larger district heating networks as in the case of Ulaanbaatar was not been taken into account because of limited heat demand.

Source: Authors

For each of these scenarios, a standard approach to estimating co-benefits was employed. CO_2 and air pollution emissions were quantified by multiplying coal consumption (activity data) by emission factors. The amount of coal consumed or the activity data is a function of heat demand and boiler efficiency. Emission factors depend on fuel quality and emission control equipment for a given boiler type.

The results of the analysis showed significant reductions in air pollutants (including SLCPs) as well as CO_2 for the cases in Ulaanbaatar. In the first scenario, the replacement of the reference boilers in Ulaanbaatar, CO_2 decrease by 81.5 thousand tonnes

in 2030. Emissions of total suspended particulates (TSP) fall by about 1,400 tonnes and $PM_{2.5}$ emissions fall by about 605 tonnes. In the second scenario, where Ulaanbaatar is connected to the local 30 MW heating plant, fuel savings of up to 34% are joined by reductions in GHGs of 108,700 thousand tonnes of CO_2 and $PM_{2.5}$ emissions by 714 tonnes. The third scenario, which involves the connection of small boilers in Ulaanbaatar to the district heating network serviced with large boilers of about 300 MW, fuel saving reach 39% and the reduction of CO_2 emissions are about 123,000 tonnes; reductions of $PM_{2.5}$ (729 tonnes) are marginally higher compared with Scenario 2.

Estimates of the ripple effects of promoting these policies outside of Ulaanbaatar are also notable. The replacement of the old (reference) boilers with the improved ones to locations outside Ulaanbaatar allows saving 0.27 PJ (Petajoule) fuel in 2030 and reducing emissions of GHG by more than 29,000 tonnes of CO_2, while emissions of TSP and fine particles $PM_{2.5}$ fall by 1,400 tonnes and 221 tonnes respectively. Finally, fuel savings further increase by about 20 TJ (Terajoule) when small HOBs outside Ulaanbaatar are addressed, bringing additional reduction of CO_2 by 2,000 tonnes and the emissions of $PM_{2.5}$ by 9 tonnes.

Though the co-benefits from making the link between policy and project are sizable, the estimates presented here are only from examining more efficient small boilers with dust removal equipment as well as connecting buildings to local/district heating networks of different sizes. Calculations clearly show that replacing boilers brings non-negligible reductions; but connecting buildings to district heating networks is even more beneficial because larger boilers have higher thermal efficiencies, more effective air pollution control technologies and thereby generate even lower emissions. The list of technology changes discussed in this section are not exhaustive, however. Fuel savings can also be achieved through better insulation of building envelopes or combined heat and power generation (CHP) in the district heating plants. Several of the reviewed policies could motivate not only the scaling of the analysed technology changes but additional interventions with the potential to deliver sizable co-benefits.

3.2.2 Cleaning up Diesel in India: The Case of Inspection and Maintenance

Many of India's cities are experiencing strikingly high levels of air pollution, posing a serious threat to the health and well-being of large portions of the population as well as the environment. Recent data tells a sobering story: out of the 30 most polluted cities globally with the highest concentration of $PM_{2.5}$ in 2018, 22 cities were in India (Air Visual, 2018). Air pollution poses a major threat to the economy and human health as evidenced by some studies that suggest that poor air quality is the countries' third biggest cause of mortality (Institute for Health Metrics and Evaluation, 2019). The transport sector—and particularly the diesel segment—is an important contributor to these problems. The deposition of fine particulates in the lungs, as well as high polycyclic aromatic hydrocarbon and benzopyrene levels, has made these emissions not only a cause of respiratory disease but carcinogenic. The $PM_{2.5}$ emissions from diesel engines are also rich in black carbon, which contributes to near-term climate change(UNEP WMO, 2011b). The bottom line is that reducing emissions of $PM_{2.5}$ from diesel-powered vehicles would deliver significant co-benefits.

To some extent, the solution to these problems is straightforward. Those solutions begin with making emissions standards stronger and enhancing their enforcement (Minjares and Rutherford, 2010). The current BHARAT STAGE IV (BS IV) emission standards (equivalent to EURO IV) is a step in the right direction. The standards apply to new cars and require that the sulphur content in gasoline and diesel fuels fall below 50 ppm. Low levels of sulphur in diesel fuels is important because it allows for the installation of diesel control technologies, namely diesel particulate filter (DPF) and selective catalytic reduction (SCR). More encouragingly, following a recent Supreme Court ruling in India that found a need for cleaner emission standards and fuel quality, BS VI standards (equivalent to EURO VI) will be introduced in India in April 2020; these standards will require reductions of fuel sulphur content to 10 ppm. With strong enforcement, these reforms could pay significant dividends for not only air quality but climate change in India.

While strengthening standards is therefore one part of the solution, a second critical component involves the inspection and maintenance of operating vehicles. Inspection and maintenance are pivotal because they can help reduce emissions from older and poorly serviced vehicles (Hausker, 2004). This part of the vehicle population are often labelled "super emitters." While "super emitters" are typically small in numbers, they contribute disproportionately to emissions (Reynolds et al., 2012). Some studies estimated that super-emitters constitute about 20% of the total vehicular population (Pandey and Venkataraman, 2014). Both transport and environmental policymakers in India are not blind to these contributions. They have introduced programmes designed to stop vehicles with faulty emission controls from operating. In India, this programme is implemented as part of the periodic emission standards inspections for in-use vehicles. In-use vehicles then require a pollution under control (PUC) certifications with violators subjected to punitive measures (Malik et al., 2017). The PUC is a mandatory document for any vehicle to operate on the road and police or the representatives of transportation department in the respective state often check for a PUC. Further, to strengthen inspection and maintenance, the government is aiming to expand the network of vehicular emission monitoring stations and certification centres.

Though recent efforts to expand and deepen the reach as well as rolling out of penalties are useful, there is scope for further improvement. The growing evidence shows that among many vehicles owners the PUC test frequency is low (Malik et al., 2017). To a significant degree, the problems extend beyond just failing to meet technical requirements and have their roots in deep-seated policy and institutional issues. Those issues involve high levels of manual interference and tampering in the PUC test, which, in turn, are frequently facilitated by service personnel in pollution control stations. There is hence a need to not only step-up efforts to inspect vehicles, but to enhance oversight of the inspectors.

The recognition of these issues could also lead to broader changes to supporting policies and institutions. To start, the Ministry of Road Transport and Highways or the Indian Police Service could increase oversight of the PUC inspection system; random check-ins and stiff penalties for deliberately skirting rules could help boost compliance rates. Another set of possible supporting reforms could involve strengthening links to some of the transport policies outlined at the beginning of this section. After April 2013 in India, diesel vehicles are mandated to install on-board diagnostic systems (OBD) for BS IV compliance. Although OBD is still not a part of the formal PUC system, it could potentially be a game-changer in terms of its contribution to inspection and maintenance of in-use vehicles. Further, because many of the owners of super emitting vehicles are likely to have limited resources to invest in maintenance, there could also be a set of incentives for self-reporting and subsidies to offset some of the costs of maintenance. Finally, it is critical to underline that there are important lessons from other countries in responding to diesel emissions (see Box 3.2 for the example of Japan).

Box 3.2: Clean Diesel Regulations in Japan

Based on the 2020 version of the Automotive NOx and PM Law (most recently amended in 2008), Japan has implemented regulations designed to remove old in-use vehicles from the vehicle fleet in select metropolitan areas for more than a decade. That law requires the replacement of older vehicles after a specified grace period. If vehicles do not comply with the regulation within that grace period, they will not pass inspection and will not be able to operate. Japan has also introduced similarly motivated administrative directives to private companies possessing more than 30 vehicles. As part of those directives, targeted companies are required to submit and implement a plan to replace old vehicles with low emission vehicles (CNG or electric). These directives have encouraged the private sector and corporate entities to play an active role in pollution control. However, ameliorative steps may need to be taken to ensure that the regulations do not unfairly burden poorer segments of the population that are likely to depend heavily on older vehicles for their livelihoods. These steps are particularly important in developing countries such as India.

Source: Authors

3.2.3 Open Biomass Burning in Southeast Asia

Open biomass burning sits high on the agendas of Southeast Asia's policymakers (Huang et al., 2013; Pimonsree and Vongruang, 2018). The heightened attention reflects the problem's high costs as well as potential benefits from a resolution. These benefits begin with reductions in air pollution and dangerous haze episodes (Oanh, 2013; Oanh et al., 2018): burning accounts for 5–30% of total anthropogenic $PM_{2.5}$ emissions in the region (Streets et al., 2003). Related benefits are improvements in health: haze resulted in an estimated 100,300 excess deaths in Indonesia, Malaysia and Singapore in 2015 (Koplitz et al., 2016). While the climate benefits depend heavily on the type of biomass and other ecological and meteorological variables (affecting the ratio of cooling and warming of emissions), evidence exists that regional climate is disturbed from particulates—even with high concentrations of cooling pollutants—hence there are also climate benefits (UNEP WMO, 2011a). Other benefits include the generation of organic fertilisers (from composting); increased trust between farmers, agribusiness and parties affected by the burning; and positive geopolitical spillover effects from regional cooperation in Southeast Asia.

There is no sliver-bullet solution to achieving the benefits from addressing open burning. Rather, similar to other cases in this chapter, a broader strategy and institutional changes are required. Policymakers need such a strategy because farmers are often reluctant to change longstanding cropping practices. It also reflects a desire to move quickly to replant fields rather than waiting two weeks for rice straw stubble and rice husks to decompose. More broadly, a strategy is required since the resistance to change can feed a vicious cycle wherein development is fuelling burning at the same time rising emissions are undermining sustainable development. The interest in breaking this cycle has led to a welcomed shift to move away from strictly banning the practice—bans that have in some cases led to farmer protests (Mohan, 2017)—to "managing" burning. This shift will also require a system of changes wherein policies and institutions support the combination of technical and non-technical solutions.

The shift to managing burning underlines the importance of not simply a single but mix of solutions and instruments (Kivimaa and Kern, 2016; Rogge and Reichardt, 2016). In developing this mix, some of the options will discourage practices that enable burning, while others offer viable alternatives to established practices. Farmers have adopted some the narrower technical options on a limited scale. These include technology and technology-enabled practices such as stubble ploughing in rice cultivation; soil mulching using happy seeders; the non-burning of sugar cane harvesting using cutting machines; and the baling of rice straw for sale. There are also technical measures that aim to produce organic fertiliser by composting residual or using those residuals as animal fodder (Abington, 1992; Helgason et al., 2007).

To implement and then scale these solutions, a set of enabling policies will need to reinforce these measures. Flexibly enforced government prohibitions on burning are likely to anchor these efforts. Other policies that offer economic incentives for alternative approaches are also required. Public subsidies—including fiscal transfers from national to subnational governments—could help farmers purchase mulching or alternative use technologies. Carefully designed subsidy programmes that help reduce those costs and provide support for maintenance and upkeep can complement the technological solutions. Other policies will focus on using the power of information and peer learning to alter behaviours. The establishment of non-burning agricultural practice village network and campaigns for non-burning agricultural practices also have merits. Increasing the number and quality of air quality monitoring near affected areas can help to understand the timing and scope for needed interventions. Satellite data can enhance on-the-ground monitoring to identify hotspots. Finally, easily accessible public hotlines can support government-led efforts to track burning (CIFOR, 2018; Lualon et al., 2013).

The above package of policies is likely to gain the most traction if agencies responsible for its enforcement and incentives are on the same page. This will necessitate that both national and local environmental as well as agricultural and related

sectoral agencies have sufficient human and financial resources to enforce provisions and raise awareness of both successful efforts to alter the practice; as well of areas where there are deliberate efforts to skirt regulations. It will also require working with different government agencies, businesses and community groups at different levels (Lualon et al., 2013).

In creating institutions that support this collaboration across multiple stakeholders at multiple levels, there is no need to reinvent the wheel. There is already significant experience working at building a framework for collaboration at the regional level with ASEAN haze agreement. The recent pledge to make ASEAN Haze Free has an ambitious goal to reduce the number of burning hotspots to 50,000 by 2020. Similarly, the Chiang Mai Plan of Action 2017 with four target areas and four core measures has some desirable straightforward features that could serve as a common reference point for agencies and stakeholders working on these issues (See Figure 3.1).

Figure 3.1: Roadmap for a Haze Free ASEAN

Year	2017	2018	2019	2020
Hotspot Targets	75,000	60,000	55,000	50,000

Source: Pollution Control Department, Thailand, 2018

At the same, there is also some experience with institutional coordination and cross-agency planning in key countries. For example, Thailand has invested considerable effort in designing and implementing an eight-point plan that outlined responsibilities for key agencies. Importantly, the plan also placed considerable emphasis on engaging with local communities during it design. Past efforts had faltered due in part to engagement that focused chiefly on engaging stakeholders only after implementation (Lualon et al., 2013).

A final set of considerations involves some of the factors that can make any solution successful. To this point, the proposed system of changes have a rather a technical focus (including the non-technical measures) mentioned previously. However, resolving open burning will also require greater attention to less frequently discussed socioeconomic and political economic issues. More concretely, there are powerful economic interests that are likely to lose from a significant shift in agricultural practices; hence, a package of reforms also needs to consider both engaging businesses and looking for ways that "losers" of reform can be compensated for those loses, moving into policy spaces where there are potential wins. Thinking more in terms of winners and losers will help ease the way for many of the reforms outlined herein.

Table 3.3: Implementing Responsibilities for Thailand's Eight Point Plan

Measure	Responsible Agencies
Prohibit burning of agriculture residue, waste, and unwanted flora during an "80 day period" (21 January – 10 April) except in areas receiving a waiver. Each province received a quota and defined area for burning during this period. Special permission from local administrators is required for burning during the period.	• Ministry of Interior with other key agencies, i.e. Department of Provincial Administration, Department of Local Administration, Governors of Chiang Mai, Chiang Rai, Phrae, Nan, Lampoon, Lampang, Phayao, Mae Hong Son and Tak Provinces • Ministry of Transport with key agencies, i.e. Department of Highways and Department of Rural Road for control of open-burning along the highways
Intensify forest fires prevention	• Department of National Park Wildlife and Plant Conservation and Royal Forest Department in close collaboration with the aforementioned agencies for countermeasure 1
Promote "villages free from burning"	• Pollution Control Department (PCD) and the Department of Environmental Quality and Promotion within the Ministry of Natural Resources and Environment (MNRE)
Engage private companies to participate in haze and forest fire countermeasures through corporate social responsibility programs	• Electricity Generation Authority of Thailand • Ministry of Energy • Ministry of Agriculture and Cooperatives with key agencies, i.e. Land Development Department, and Department Agricultural Extension
Raise awareness by stepping up public relations	• Public Relations Department • Ministry of Tourism and Sports • Ministry of Social Development and Human Security • Ministry of Education • Ministry of Public Health
Establish an early warning haze incident notification system	• Thai Meteorological Department • Department of Disaster, Prevention and Mitigation in cooperation with the Royal Thai Army, Royal Thai Navy, Royal Air Force, and Border Patrol Police in case of need to putting out the large-scale open fires
Expand cooperation with neighbouring countries to mitigate trans-boundary haze	• Ministry of Foreign Affairs • Ministry of Defence in collaboration with MNRE
Establish "haze pollution prevention and solution centres" for nine provinces in Northern Thailand	• Ministry of Interior with key agencies assigned for countermeasure 1 and Department of Disaster Prevention and Mitigation in collaboration with PCD of MNRE

Source: Lualon et al., 2013

3.3 Conclusion

The chapter has argued that achieving co-benefits is not only about identifying cost-effective technologies. It also requires consideration of supportive policy and institutional reforms. In formulating those reforms, policymakers are encouraged to think carefully about policy coherence; include multiple supportive instruments in policy designs; factor in impacts on poor or disadvantaged people; and employ a system perspective that can bring together interests addressing the problem from varying perspectives.

The chapter also connects to some of the key themes in other chapters. For example, the chapter on capacity building notes the need to build competencies at different levels across diverse stakeholders. Meanwhile, the chapter on finance underlines that many of the resources needed for implementation and scaling will come from domestic sources and enabling policies. The chapter therefore reflects the need to bring both capacity building and mobilising finance into the larger systems perspective – that is presented most clearly in the case of open burning.

Last but not least, the main recommendations

in the chapter – on policy coherence, instrument choice, social impacts and a systems perspective – could be used to develop a tool for policymakers to evaluate how conducive their policies and institutions to delivering co-benefits. Such a tool would not only serve a diagnostic purpose, helping to assess the quality of the current policy and institutional environment. It would also provide concrete options that could help improve upon that policy and institutional environment. This tool could be integrated with other decision-making support tools, especially those used to quantify co-benefits and identify cost-effective solutions.

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Chapter 4
Building Capacities to Implement Solutions to Air Pollution and Climate Change in Asia

Key Messages

- Implementing solutions to air pollution and climate change require policymakers and other stakeholders possess sufficient capacities to generate action on the ground.
- This chapter reviews factors contributing to the success of capacity programmes of key organisations working on co-benefits or related themes in Asia.
- That review demonstrates ensuring programmes are demand-driven and tied to concrete policy objectives are key success factors. Experiential learning methods—often complemented by decision-making support tools (such as co-benefits quantification tools (Chapter 2) or the policy coherence and institutional diagnostic tool (Chapter 3))—can aid the acquisition and application of essential knowledge.
- While the above factors are generally important, tailoring the content of capacity building programmes is critical for implementing actual projects. Often those providing capacity building play more of a knowledge brokering than teaching role when the main goal is project implementation.
- The active exchange of knowledge between policymakers and project implementers will be important for demonstrating and spreading the 25 solutions. Enhancing coordination across capacity building programmes targeting co-benefits from GHGs and SLCPs is equally vital to designing policies that can demonstrate and spread projects.
- The ACP can become a platform that convenes trainings and offers decision-making support tools to facilitate cooperation across programmes focusing on inventions at the policy and project levels as well as approaches to co-benefits centred on GHGs or SLCPs.

4.1 Introduction

A critical factor in implementing *Air Pollution in Asia and the Pacific: Science-based Solutions* (hereafter the *Solutions Report*) (UNEP APCAP and CCAC, 2019) is ensuring that policymakers and other stakeholders possess sufficient capacities to set and achieve desired goals (Willems and Baumert, 2003). Building that capacity may nonetheless prove easier said than done. Part of the challenge is institutional in nature: implementing recommendations in the *Solutions Report* requires close cooperation between agencies responsible for climate change and air pollution. A related obstacle is the need to combine technical and experiential knowledge: many of the proposed solutions require a deep understanding of how users adopt different technologies and/or alter social practices in diverse settings. Finally, in many instances, equipping policymakers and other key stakeholders with actionable knowledge will involve

not only boosting the capacity of a single agency but aligning interests at different levels of action within and beyond government (Sharma, 2018)[5].

Though acquiring the needed technical and non-technical knowledge present challenges, these hurdles can be overcome. Equipping policymakers and other actors with knowledge to move this work forward can build from ongoing efforts. Initiatives such as the Clean Air Asia, the Asia Pacific Clean Air Partnership (APCAP) and the Climate and Clean Air Coalition (CCAC) have extensive track records with programs that offer insights into what does—and does not—work for capacity building. Moreover, it also becoming clear that organisations active in this area recognise that promoting and supporting implementation will often require not a single set of activities but a collective effort that works across sectors, actors and institutions. Finally, many of the key organisations realise the most successful approaches are demand-driven, targeted at well-defined policy objectives, and incorporate experiential learning (Fazey et al., 2006). In fact, in many cases instructors play more of a brokering role that enables different stakeholders to exchange knowledge, efficiently coordinate, and learn from each other as opposed to a more conventional teacher-learner model (Fazey et al., 2013).

This chapter, then, is about the lessons learned from existing capacity building efforts and how they could be enhanced and spread more widely to help achieve the co-benefits outlined in the *Solutions Report*. Toward that end, it aims to answer several related questions that were posed to representatives of organisations that are supporting capacity building on solutions that deliver co-benefits. These questions were:

1. What are ongoing programmes and future plans for building capacity to strengthen the implementation of co-benefit solutions in Asia?

2. What techniques have been employed to ensure the provided knowledge meet the needs of training audience(s)?

3. What teaching methods and learning tools have been most effective in transferring that knowledge?

4. What other important (and perhaps underappreciated) success factors have helped translate that knowledge into implementable actions?

The remainder of the chapter is divided into two sections. The next section summarises how representations from several organisations responded to these questions. A final section concludes with an overall assessment of responses and implications for the ACP.

4.2 Surveying the Capacity Building Landscape on Co-benefits

There are many organisations working on relevant capacity building programmes. This section profiles several of the key organisations, beginning with the United Nations Environment Programme (UNEP), Asia and the Pacific Office and concludes with the regional intergovernmental knowledge sharing centre known as The International Centre for Integrated Mountain Development (ICIMOD). The section underlines that, though there exists considerable variation across the organisations, a number of potentially useful findings are mentioned repeatedly.

4.2.1 United Nations Environment Programme, Asia and the Pacific Office

The UN Environment Programme (UNEP) is the leading global environmental authority and the environmental voice of the United Nations whose work is focused on seven thematic areas, including chemicals, waste and air quality, resource efficiency and environment under review.

The UNEP, Asia and the Pacific Office has a long track-record of helping policymakers acquire

5 Some sources highlight the need to promote change in "individuals, institutions and systems that collectively enable effective and sustainable development." (Sharma, 2018: 3)

and apply knowledge to address air pollution. In recent years, its commitment to that objective has gained a stronger foundation due to the passage of Resolution 1/7 on Air Quality adopted at the First Session of the United Nations Environment Assembly (UNEA). In this milestone resolution, member states requested the UNEP Executive Director *"to undertake strengthened capacity-building activities on air quality, such as workshops and policy development assistance"* and identified three areas for action: identifying emission sources; clean air action planning; and awareness raising (UNEP, 2014). In response to this resolution, UNEP, Asia and the Pacific Office, developed a capacity-building programme for national air quality managers covering key topics that are typically featured at regional-level trainings. To ensure that the trainings developed are appealing to the target stakeholders, different learning techniques have been used. This often involves employing a mix of lecture, practical guidance, onsite demonstration and site visits, among others. Depending on the training objective, a combination of one-time or multiple trainings that build on each other may also be used.

This work is also expanding in scope with the publication of the *Solutions Report* as such activities are providing resources to facilitate dialogue on the 25 clean air measures, including case studies and training modules as well as a webinar series and an online solutions hub. These materials were developed initially for Asia and the Pacific are also being shared with other regions, including Africa and West Asia and thereby facilitating south-to-south learning.

One of the principles that underpins UNEP work is ensuring that capacity building meets stakeholder needs and broader development goals. As such, whether at regional or national level, capacity building support is designed based on identified demand, with stakeholders which need the support, and with a clear policy objectives or goals in mind (Box 4.1).

Box 4.1: Capacity Building on Air Quality and Health in Thailand

Overall development goal/objective: Policy change (with updated air quality standards, official recognition of air pollution as a non-communicable disease risk); organisational technical capacity on environment and health sustained through partnerships; strengthened technical skills to conduct air quality and health assessments.

Capacity to be developed: Capacity to assess health and economic cost of air pollution to inform policy action.

UNEP Asia Pacific recently worked with Thailand's Pollution Control Department (PCD), the Department of Health, and the Chulabhorn Research Institute to assess the health and economic cost of air pollution (PM_{10}, $PM_{2.5}$, and ozone) in three provinces: Chiang Mai, Saraburi and Song Khla. This work also aimed to address the gaps in knowledge base on ambient air quality and health impacts and connect the two areas in support of coherent policy making by recommending a policy action. Thailand's PCD used the output of this study to support the process of improving the $PM_{2.5}$ annual average standard from the WHO interim target 2 (25 µg/m^3) to target 3 (15 µg/m^3). Thailand's National Environment Board (NEB) committee has agreed to improve the $PM_{2.5}$ annual average standard (though the daily average standard will stay at 50 µg/m^3). The proposal from NEB will be forwarded to the cabinet for approval. This work also contributed to Thailand's official acknowledgement of air pollution as one of the causes of non-communicable diseases. These efforts led to a stronger engagement of the Ministry of Health on this issue. Another positive outcome was the support led to a more formal cooperation between the Chulabhorn Research Institute, PCD and the Ministry of Health on environment and health through a memorandum of understanding that could help ensure sustainability of initial efforts.

Source: Authors

To help meet stakeholder needs, UNEP, Office of Asia and the Pacific employs several techniques to identify and clarify demands, ranging from consultations to training needs assessment to pre-training questionnaires. This allows for refinements and adjustments to the existing materials so that they are tailored to user needs. To illustrate, UNEP, Office of Asia and the Pacific and its partners are

developing a proposal which will build on using environment and health data and tools to advance the Sustainable Development Goals (SDGs) in the Association for Southeast Asian Nations (ASEAN) Region. The proposal draws upon a series of consultations with ASEAN member states and engaged ASEAN's Working Group on Environment and Working Group on Health to receive official endorsement for the concept note.

In addition to capacity building techniques and methods described here, UNEP Office of Asia and the Pacific has found that there are some additional success factors. These include working with the right partners and maximising local technical expertise. Further, capacity building needs to be a two-way street that features a back-and-forth knowledge exchange—where there is commitment to sharing and expanding the base of both the trainer and the learners. Last but not least, it is important to allocate sufficient time to let knowledge accumulate and build trust in the process.

4.2.2 Climate and Clean Air Coalition: The National Planning Initiative (SNAP)

The Climate and Clean Air Coalition (CCAC) is a voluntary partnership of 68 State and 76 non-state partners (as of January 2020) that aims to increase action on short-lived climate pollutants (SLCPs). The CCAC has developed an initiative called "Supporting National Action & Planning" on SLCP mitigation, or "SNAP", which supports the integration of SLCPs into national planning and policy processes. Currently 35 countries are involved in SNAP activities. Their engagement ranges from training to develop integrated GHG, SLCP and air pollutant emission inventories to the development of national action plans to reduce SLCPs and achieve air pollution health and near-term climate change benefits (16 countries).

The SNAP process is led and implemented at the country level by national institutions (in most cases Ministries of the Environment). Each step of that process involves a strong capacity building component whereby international partners provide technical support, training and guidance to country partners. The support involves setting up an efficient planning exercise, including appropriate stakeholder consultation, linking quantitative analysis to policy development, and getting buy-in from key stakeholders (CCAC SNAP, 2018). The following discussion focuses on experiences of building capacity of country planners through SNAP.

There are a number of critical components in developing an SLCP national plan. This includes a clear idea of the policy process in which the planning will be embedded; an assessment of current policies plans and strategies that affect the relevant emission sources; a quantitative analysis of the likely progression of emissions from different sources of all emissions relevant to the air quality and climate planning; the identification of key measures that can reduce impacts of concern and an understanding of the barriers to implementing them. The above then can feed into a strategy to reduce emissions. At all stages, capacity building can help officials and their technical support to evaluate their options.

Efficient capacity building requires tools that national planners can use and that they can tailor to their needs. The SNAP Initiative has enhanced the Long-range Energy Alternative Planning (LEAP) system for these purposes. LEAP is a tool developed by the Stockholm Environment Institute (SEI) that was widely-used for energy policy analysis and climate change mitigation assessments. LEAP can now develop a historical emission inventory covering GHGs, SLCPs and air pollutants and create scenario projections by comparing different policies and measures against business-as-usual trends. It can also assess the impacts of these future emission projections on health impacts and global average temperature increases attributable to air pollution.

LEAP is useful because it can facilitate capacity building in a flexible way in which emissions from different source sectors can be modelled. A variety of modelling methodologies are supported, including simple "top-down" methods that require readily available data (e.g. a national energy balance) to more data-intensive "bottom-up" methods. An advantage of this flexibility is that planners can increase their expertise based on the data that is available, rather than waiting until a threshold for data availability has been reached.

A formal programme of training and workshops are essential to build capacity to undertake analyses of emissions and related co-benefits. In SNAP, the capacity building component is implemented within a framework of a national planning process on SLCPs (CCAC SNAP, 2018). This means that there is a clear focus on the development of an emissions and co-benefits analysis—i.e. to provide necessary quantitative information on the most effective strategies to improve air quality and mitigate climate change.

The first step in the formal capacity building programme is a discussion with national stakeholders about their preferred scope of the analysis. Such a discussion helps build a common understanding of what the analysis will do and what outputs the capacity building activities will produce. It ensures that the capacity building is tailored to country needs and provides a clear endpoint for planners around which learning can be structured. This discussion also allows the sustainability of the analysis and capacity being built to be embedded within an existing process. Embedding the training in existing process helps to maximise the chances that the analysis can continue to be used and updated after the formal capacity building activities have finished.

Box 4.2: Embedding Training in an Existing Process: The Case of the Maldives

One of the keys to ensuring ownership of the SNAP activities is integrating results into an ongoing policy process. In the Maldives, this was achieved when discussions revealed an interest in including air pollution co-benefits in the country's Nationally Determined Contribution (NDC). These co-benefits had not been considered in previous work on the NDC. To bring them into the NDC, key national data have needed to assess emissions of all pollutants and evaluate the co-benefits of the Maldives' NDC. During the first training workshop, a LEAP dataset was developed that covered all major source sectors in the Maldives for 2010-2012, and a work plan was agreed for the development of baseline projections and different mitigation options. Following the workshop, regular online discussions allowed the analysis to be completed. A desirable side effect of the decision to work on the NDC was that the air quality division in the Ministry of Environment was able to show that the full implementation of the Maldives' NDC would result in substantial air pollution emission reductions, including a 35% reduction in primary particle $PM_{2.5}$ emissions (Ministry of Environment of the Maldives, 2019). Another positive outcome was that the results of this analysis were also incorporated in the First National Action Plan to Reduce Air Pollutants.

Source: Authors

Following initial discussions on the scope of the analysis, an in-person training workshop is organised. This workshop includes training exercises that provide users with hands-on experience of key features of the tools that gradually focus more on the development of the country-specific analysis. Prior to the training, online discussions are typically held to try to identify data useful to the analysis, e.g. input data to the GHG emissions inventory or national energy balance. Bringing this data to the workshop helps to enhance ownership and accelerate progress because participants can clearly see how the results for their country can be obtained.

In addition to the formal programme, a potentially overlooked aspect is the utility of informal guidance and support through the capacity building process. Planners are often extremely busy and the integration of air pollution and climate change is often additional to core tasks. Two implications follow from this observation. First, any time spent by planners on improving their expertise on co-benefits assessment (or emissions analysis) needs to be used effectively. When learning how to use this tool, a new approach or methodology, it can be easy to encounter barriers. In many cases, these barriers can be overcome if an experienced user assists. In these cases, informal guidance, through whatever communication channel is most useful, can ensure that such obstacles do not slow progress. Second, if the guidance and capacity building activities can also be useful for the core work of planners (i.e. extend beyond the specific work of integrated air pollution and climate change

planning) this helps to increase the effectiveness of planners in their core tasks and therefore is more likely to be welcomed.

Building capacity of national institutions to assess co-benefits of climate change and air quality strategies does not happen in isolation, but is a central component of a national planning process supported by the SNAP Initiative. In many cases, this is done by incorporating co-benefit into existing expertise. Illustrative examples of these complementarities include adding air pollutants to GHG emission inventories (see for example, Ghana's Biennial Update Report (Ghana Environmental Protection Agency, 2019a; 2019b)) or incorporating SLCPs and air pollutants into GHG mitigation assessments such as NDCs (CCAC SNAP, 2019) or national communications to the UNFCCC (INECC, 2019).

4.2.3 Clean Air Asia

Clean Air Asia is an international non-governmental organisation based in Manila, Philippines with offices in Beijing, China and Delhi, India. In line with its mission of bringing "better air quality and healthier, more liveable cities to Asia," much of Clean Air Asia's work focuses on building capacity of decision-makers to address air pollution in urban areas. For Clean Air Asia, this increasingly requires advocating for converting science-based policies into implementable solutions (a vision that is also outlined in the *Solutions Report)*.

Making the connection between science and implementation often involves integrated action planning process with an emphasis on multi-stakeholder engagement. This is frequently achieved by employing a programmatic capacity needs assessment. That assessment then feeds into roadmap development and draws upon Clean Air Asia's decision-making support tools (including the *Guidance Framework for Better Air Quality in Asian Cities*, Clean Air Scorecard) to fill critical knowledge gaps (Clean Air Asia, 2016; Clean Air Asia N.D.). Developing resources for e-learning and disseminating these through an online learning portal is also becoming increasingly important to extend outreach and monitor progress in learning and application of solutions.

To make sure that efforts to fill these gaps are in line with expectations, Clean Air Asia has employed training needs assessment that, depending on the target stakeholders, include surveys, key informant interviews and focus group discussions. These approaches have helped identify technical, financial or institutional needs. The results of the needs assessment are then employed in the design and development of training programs and materials. At the same time, they are used to support the development of key performance indicators that help assess knowledge, understanding and skills over time.

Given that much of the work is demand-driven, teaching methods are dependent on the identified needs of the target stakeholders. In many cases, policymakers find experiential learning methods (e.g., air sensing, walkability tour) backed with data analysis, visualisation and scenario projection (e.g., on issues that help visualise co-benefits) most useful. On the other hand, implementers and technical officers find it more practical to include hands-on training with tools and databases as part of a larger training package that could facilitate their everyday work.

Above and beyond training methods that meet expressed demands, Clean Air Asia aims to "thread" capacity building into existing institutions and processes. This is chiefly to avoid putting additional burden on cities wherein they feel compelled to introduce knowledge, methods or processes that does not fit well with their existing priorities and strategies. Further, a common problem in many countries Asia is the quick turnover of technical staff who are in charge of analysing data to inform policymaking. To compensate for losses in institutional memory, Clean Air Asia aims to ensure that there is continuity of knowledge transfer through the institutionalisation of working groups. This helps to ensure that learning results will be retained and applied to policy or organisational decisions.

4.2.4 Regional Resource Centre for Asia and the Pacific: Experience with Heavy Duty Diesel

The Regional Resource Centre for Asia and the

Pacific (RRCAP), based at the Asian Institute of Technology (AIT) in Bangkok, Thailand, also has extensive experience with building capacity on air pollution and climate change. In recent years, it has not only aimed to broaden awareness of the need to take integrated actions on these issues but has also targeted sectoral interventions that can help deliver co-benefits. One of the areas where it has accrued useful experience are diesel emissions from the transportation sector under the CCAC Heavy-Duty Vehicles Initiative in ASEAN countries (CCAC, 2018a; 2018b).

Echoing some of the lessons above, RRCAP has also aimed to ensure that its work is well aligned with clear policy goals. As such, its capacity building work in this area has been carried out through a set of high-level consultations on EURO 4/IV Implementation and EURO 6/VI Roadmap with two policy objectives: 1) to identify common obstacles and challenges to implement low-sulphur fuel and Euro 4/IV vehicle emission standards and advance to Euro 6/VI among ASEAN countries; and 2) develop a technical work plan to deliver support needed among ASEAN countries to overcome fuel quality and vehicle emission standard implementation challenges. In both cases, there is an emphasis on harmonisation to ensure that countries in the region are moving in the same progressively more soot-free direction (CCAC, 2018a; 2018b).

To help ensure that the capacity building efforts meet country needs, RRCAP worked with countries to host two roundtable discussions. The discussions were then framed around common challenges to transitioning to stronger emissions standards and the technical support needed to overcome barriers to change. RRCAP both facilitated learning across countries as well as developed a report entitled "Guidance to Fuel Importing Countries for Reducing On-Road Fuel Sulphur Levels, Improving Vehicle Emissions Standards" to help familiarise policymakers with the technical content of this work (Wangwongwatana and Dumitrescu, 2018). Further to expand the spread of knowledge, RRCAP has also organised webinars on topics including costs to consumers, regulatory issues, matching vehicle emission standards to cleaner fuels, inspection and maintenance and lubricity. Last but not least, in developing the technical work plan for this project RRCAP also included several follow-up activities that would promote its sustainability such as establishing an interagency task force on soot-free transport in each ASEAN or identifying capacity building needs among ASEAN's smallest countries and recommend activities to support these countries with compliance and enforcement measures.

4.2.5 The International Centre for Integrated Mountain Development: Brick Kilns

The International Centre for Integrated Mountain Development (ICIMOD), as a regional intergovernmental learning and knowledge-sharing centre for the Hindu Kush Himalaya region, devotes considerable energy to building capacity on a broad range of topics, including air pollution and climate change. These efforts are intended to reach wide audience, ranging from policymakers in national capitals to cookstove operators in rural villages. Further, as implied by these different audiences, this effort is often targeted at using cutting-edge atmospheric science to inform practical actions. One area where this translation of science into practical science has gained traction involves the conversion of brick kilns, particularly the conversion of fixed chimney bull's trench kilns, ubiquitous in northern South Asia into more efficient zigzag kilns. The reflections that follow are based chiefly on an on-the-ground brick kilns project and therefore underline a different dynamic in how work on the links between climate change and air pollution can grow and spread—even if that work rarely mentions climate change and air pollution in the motivation for improvements (ICIMOD, 2018a).

In ICIMOD's efforts to improve the efficiency of brick kilns there were two levels of training. The first was to convince kiln owners of the benefits of converting their kilns into more efficient models. Once ICIMOD and its partners had a few converted kilns and the benefits became clear, this persuasion became much easier. In fact, the owners of the converted kilns in Nepal were happy to demonstrate what they had achieved. This sense of ownership was particularly important as ICIMOD sought to transfer the lessons from Nepal to Pakistan, India

and Bangladesh. In the case of Pakistan, ICIMOD's efforts started *not* after numerous talks and lectures provided by experts, but after kiln owners flew to Nepal and spent days at converted kilns observing their operation. These visits allowed the owners of converted kilns in Nepal to not just convince their Pakistani counterparts of the economic benefit of the conversion but for the Pakistani kiln owners to be convinced of the feasibility of operating converted kilns within their sociocultural contexts.

The second equally important stream of training involves the critical "how to do the conversion and how to operate converted kilns." This second stream then required making sure that kilns were being engineered according to new manuals; and then making sure that critical kiln employees such as the fire masters knew how to operate the kilns. While traditional kilns could take large amounts of fuel in large intervals, zigzag kilns require adding small amounts more frequently through a larger number of holes (ICIMOD, 2018b).

As implied above, ICIMOD observed that brick kiln owners and workers are not used to sitting in a conference room listening to lectures. As a consequence, this project needed to be on-site, hands-on, preferably taught by other kiln owners and workers. Given these understandable preferences, some of the best instructors and trainers were owners and workers. Further, it merits underlining that capacity building was part of the bigger picture that also involved technological demonstrations and relationship building with the policymakers and the private sector. It was particularly useful to work with the leadership of the brick kiln owners' federations in Nepal and Pakistan, and the work has led to the formation of the Federation of South Asia Brick Kiln Associations (FABKA) that also includes the associations from India and Bangladesh.

A final realisation is that the success factors for the work on brick kilns had very little to do with co-benefits – or even improved air quality. It was rather about increased profits for the brick kiln owners. However, over time project participants came to appreciate that their engagement in this work helped change their reputation from that of "bad guys" who were responsible for pollution to a heightened status with new respect in discussions with the government. This improved standing also had real impacts on policy. In Pakistan, for example, with some push from those working on the air quality agenda, policy changed after the first seven kilns were converted and this caught the attention of policymakers working on the NDC.

4.3 Conclusion

The different organisation's interventions provide some useful insights into both advisable content and methods of capacity building programmes that could support the implementation of the *25* measures in the *Solutions Report*. In terms of substance, many of the programmes aim to equip both national and local decision makers with the tools and knowledge to strengthen air quality and climate plans. Several programmes are also underway that aim to enrich knowledge about particular solutions to specific emission sources such as diesel or brick kilns. In terms of knowledge transfer techniques, all of the surveyed programmes place an emphasis on being demand-driven and tied to a particular policy output. Experiential knowledge that help learners own the information they acquire is also viewed as critical in many programmes. Moreover, often there will be several target audiences needed to implement solutions. Further, the preferred instructors, locations, training techniques and learning materials will tend to vary with that targeted audience (see Box 4.3).

There are also a few areas that the previous excerpts do not cover that could help implement the *Solutions Report.* The first is that there is limited vertical integration between the work at the national and the city level as well as between the project and the policy level. There is also an opportunity to further strengthen horizontal integration of air and climate policies among agencies, which will support coordination among capacity building programmes. These linkages are important because—as also highlighted in Chapter 3—it is frequently national and local policies that provide the incentives and financial resources for implementing specific projects. Further, often innovations occur at the city or local level. Finally, coherence between national and local policies is critical to ensuring that agencies

at different levels are not working at cross-purposes. Greater alignment between the capacity building at different levels is therefore much needed (see also Chapter 3).

A similar need that is implied in the previous section of the chapter involves linking capacity building on what are chiefly air pollution and SLCPs concerns with activities on GHGs. The *Solutions Report* takes an important step forward in unifying different views on co-benefits, but with the exception of work concentrating on NDCs, there is a chance that some of the opportunities for mitigating long-term climate change are not given sufficient attention in some of the described programmes. In a related manner, prospects for securing climate finance—from both international and domestic sources—may also be missed.

In general, a significant gap appears in terms acquiring finance to support the purchase and scaling of technologies. It is therefore useful to strengthen the linkages between some of the ongoing capacity building work profiled here and work related to long-term climate change (Table 4.1 provides a shortlist of some of the programmes where relationships could be strengthened). The ACP is in a good position to convene trainings and learning activities that support this cross-fertilisation of knowledge. This could occur by hosting workshops and webinars where the listed partners demonstrate synergies between their activities.

Box 4.3: The Who, What, Where and How of Capacity Building for the *Solutions Report*

Capacity building needs to be tailored to different target audiences. The following table summarises the key differences for different recipients of capacity building, underlining the crucial role of coordination across agencies, functions and competencies when facilitating learning.

Target audience	Who facilitates learning of what content	Where	How	Learning materials
Policymakers	Policymakers with practical experience of implementation of the policies to be transferred	Training rooms	Training workshops with site visits	Presentations, printed and web-based learning materials focused on case studies and examples, policy briefs, AQM frameworks
Implementation managers	Managers with practical experience of implementation of these policies	Training rooms and on-site	Training workshops with site visits	Presentations, printed and web-based learning materials that emphasise what to do and what not to do, resources needed
Technicians	Managers and technicians with practical experience of the implementation of these policies	Mostly on-site	Mostly hands-on, on-site	Manuals, including standard operating procedures

Source: Authors

Table 4.1: Capacity Building Programmes Related to the *Solutions Report*

Lead Organization	Name of Programme	Summary	Relevant Website
Institute for Advanced Sustainability Studies (IASS)	Mobilising the Co-benefits of Climate Change Mitigation	Aims to align climate change mitigation with policies that deliver social and economic benefits.	https://www.cobenefits.info/
International Council for Local Environmental Initiatives (ICLEI)	East Asia Clean Air Cities Network (EACACN)	Offers a long-term cooperation platform between East Asian local governments committed to improving air quality and the quality of life for citizens.	https://www.eacac.net/
Japan International Cooperation Agency (JICA)	Control of Air Pollution from Motor Vehicles	Aims to build the capacity of policymakers to control transport-related pollution	https://www.jica.go.jp/english/our_work/types_of_assistance/tech/acceptance/training/about/2018/sector/sector17.html
World Bank	Developing Market-based Energy Efficiency Program in China	Supports decision makers in China on results measurement and verification systems as well as market-based mechanisms for energy efficiency and environment programs.	http://documents.worldbank.org/curated/en/685701489888842407/China-Developing-Market-Based-Energy-Efficiency-Program-Project
United Nations Development Programme	De-risking Renewable Energy Investment	Promotes private-sector investment in large and small-scale renewable energy to help Kazakhstan's 2030 renewable energy target.	https://www.undp.org/content/undp/en/home/librarypage/environment-energy/low_emission_climateresilientdevelopment/derisking-renewable-energy-investment.html
United Nations Industrial Development Organisation	Cities-IAP: Sustainable Cities, Integrated Approach Pilot in India	Supports the integration of sustainability strategies in urban planning and management to create a favourable environment for investment in infrastructure and service delivery in India	https://www.thegef.org/project/cities-iap-sustainable-cities-integrated-approach-pilot-india

Source: Authors

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White Paper 2020

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> Asian Co-benefits Partnership (ACP) is a voluntary information sharing platform. The ACP seeks to collaborate with organisations working to mainstream co-benefits into decision making processes in Asia.