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Asian Co-benefits Partnership
White Paper 2016

Putting Co-benefits into Practice:

Case Studies from Asia

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Asian Co-benefits Partnership (ACP)

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Sustainable Development Goals (SDGs)

Sustainable Development Mechanism (SDM)

Third Assessment Report (AR3)

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United Nations Conference on Environment and Development (UNCED)

United Nations Development Programme (UNDP)

United Nations Environment Programme (UNEP)

United Nations Environmental Assembly (UNEA)

United Nations Framework Convention on Climate Change (UNFCCC)

United Nations University (UNU)

Value added tax (VAT)

Waste Electrical and Electronic Equipment (WEEE)

Executive Summary

The second Asian Co-benefits Partnership (ACP) White Paper comes at a watershed moment for the environmental and development community. Last year much of the world approved of a Paris Agreement and Sustainable Development Goals (SDGs) that could help transform development for the foreseeable future. One of the keys to this transformation will be capitalising on policies and measures with climate and development co-benefits. The second ACP White Paper helps present this global opportunity and demonstrates how cases that put co-benefits into practice in Asia can help realise it.

The first chapter outlines design features of the climate regime and SDGs that can promote co-benefits in Asia. These range from a new sustainable development mechanism under the Paris Agreement to a more integrated framing of the development agenda in line with the SDGs. It further shows how many countries are beginning to integrate multi-benefit considerations into policies such as those articulated in Intended National Determined Contributions (INDCs). The chapter then sets up three chapters that analyse opportunities and propose solutions for achieving co-benefits in Asia's waste (Chapter 2), transport (Chapter 3), and energy/industry sectors (Chapter 4).

Chapter 2 focuses on the waste sector. It begins by suggesting that long-term budgeting for recycling processes and the innovative monitoring of dumping may help Kawasaki City, Japan realise additional co-benefits. The next case, waste management in Dhaka, Bangladesh, highlights the importance of strengthening the enabling environment to acquire carbon finance to meet the city's expanding waste management needs. The final case underlines the need to carefully consider the location on palm oil mills and gradually strengthen regulatory compliance with environmental regulations to make Indonesia's palm industry sustainable.

Chapter 3 concentrates on the transport sector. The first case maintains that applying environmental, social, and economic indicators for urban planning solutions could increase the co-benefits from Toyama's compact city in Japan. Meanwhile, in Metro Manila, Philippines robust and harmonised data collection routines; well-designed public and private partnerships for non-motorised transport; and multi-stakeholder engagement will help maximise the co-benefits from a planned bicycle sharing programme. The final case, Thailand's transport Nationally Appropriate Mitigation Actions (NAMAs), underscores the need to consider finance early and throughout the NAMA planning as well as aligning existing transport and new climate policies.

Chapter 4 presents cases from Asia's energy and industrial sectors. The first case underscores harvesting better quality coal, strengthening financial incentives for investing in efficient technologies, and sustaining capacity building programmes to introduce and scale up efficient practices for heat only boilers in Ulan Bator, Mongolia. The next case, on waste heat to energy technologies in Chongqing, China, suggests multi-stakeholder engagement mechanisms; multi-year capacity programmes (that help retain institutional memory); and technical support to secure climate finance can help achieve multiple benefits. The final case, on Delhi, India's energy system, calls for mechanisms facilitating communication between property holders and the local government as well as continual awareness raising on energy saving and conservation benefits.

Overall the case studies shed light on the growing number of activities that could achieve climate and other development objectives in Asia. Even with this diverse collection of case studies, several unifying messages can be distilled from the chapters. The last chapter presents the messages summarised below:

1. **Policymakers need to steadily improve co-benefits data collection and monitoring processes.** Robust data and standardised reporting protocols are crucial to quantifying co-benefits. Improving the quality and quantity of data as well as capacities to work with modelling results will be critical to achieving co-benefits.

2. **Governments should seek local expertise and international collaboration when gathering, analysing, and sharing co-benefits data.** Collaborative partnerships with local universities and international organisations can help routinise data gathering processes. This could be done as logical extension of data gathering for NAMAs, INDCs and other climate actions.

3. **Capacity building of co-benefits needs to be sustained and fit-for-purpose.** Providers of international technical assistance need to consider near and long-term needs for co-benefits capacity building. Tailoring data and modelling to frequently varying local contexts is also essential.

4. **Institutional reforms across multiple levels and sectors are critical for maximising the co-benefits of innovative solutions.** Often institutional arrangements make possible the innovations needed to maximise co-benefits. Institutional architectures that facilitate coordination across and within government agencies, businesses, and civil society organisations will be particularly useful for multi-benefit innovative solutions.

5. **Scaling up innovations requires aligning diverse stakeholder interests.** Often achieving co-benefits at scale requires not just coordination but active efforts to align diverse interests beyond the sector or outside the country. Innovative approaches to aligning interests will be increasingly important for sharing lessons in multiple directions across cities and communities.

6. **Policymakers need consider not only the magnitude, but also the distribution of co-benefits.** Decisions related to co-benefits are made by politicians whose interests are often to retain their jobs rather than maximise climate and other benefits. Identifying not just the magnitude but the recipients of benefits is thus integral to translating good policies into good politics.

7. **Public finance can help start a co-benefits project; the private sector is critical for making a project financially viable in the medium to long-term.** Following an injection of public finance, investments from the private sector can improve the funding outlook for co-benefits project or policy. In many cases, acquiring and maintaining finance will be facilitated by engaging the private sector early and often in the planning process.

8. **Continued public awareness raising can also improve the performance of a project or policy**. In much the same way that private finance can give a project momentum, continual awareness raising can make a project or programme politically attractive. Low levels of awareness also make it more difficult and costly to monitor the progress of a project or policy. Innovative ways of raising awareness could also help limit non-compliance.

Though the key messages are presented separately, when linked together they highlight the steps that policymakers and other actors can take to initiate, formulate, implement, and spread co-benefits solutions. The challenge for researchers will be to integrate research that focuses on actors and institutions that play a role in realising co-benefits into modelling frameworks that frequently leave them out. Just as it is critical to bring co-benefits estimates to policymakers, it will be essential to bring the policymaking processes into modelling frameworks. This second ACP White Paper takes important steps in that direction.

Co-benefits under the Paris Agreement and the 2030 Development Agenda

Kaoru Akahoshi, Akiko Miyatsuka, Eric Zusman, and So-Young Lee/Institute for Global Environmental Strategies (IGES)

1.1 Introduction

The Asian Co-benefits Partnership (ACP) provides an informal and interactive platform for information sharing and awareness raising on co-benefits in Asia. Since its inception in 2010, the ACP has grown to include more than 300 individual and institutional partners, all with an avowed interest in promoting the spread of co-benefits in Asia. One of the main tools the ACP uses to achieve its goals is a biennial White Paper.

The first ACP White Paper, published in 2014, arrived against a backdrop of mounting interest in the climate co-benefits from mitigating air pollution in Asia (ACP, 2014). This interest was generated in large part by the emergence of smog episodes in Northeast Asia; continued struggles with serious haze in Southeast Asia; and escalating concerns over urban air pollution in South Asia. With each of these issues drawing increased attention from policymakers, new findings continued to reveal the hazards of poor air quality across Asia: the most sobering of these findings being the World Health Organisation's (WHO) estimate that outdoor air pollution resulted in approximately 7 million deaths across the globe in 2012. Data like this suggests that air pollution poses an even graver threat to human health and well-being than typically more high-profile issues such as acquired immune deficiency syndrome (AIDS) and tuberculosis (WHO, 2014). Recent findings like those above also led the newly created United Nations Environmental Assembly (UNEA) to pass a resolution that called for, *inter alia,* strengthening the role of the United Nations Environment Programme (UNEP) in promoting improved air quality (UNEA, 2014).

Box 1.1 What are co-benefits?

A co-benefits approach is an approach to planning that is intended to capture both development and climate benefits in a single policy or measure. The term "co-benefits" appeared in the academic literature in the 1990s and generated wider interest in the lead up to the Third Assessment Report (AR3) of the Intergovernmental Panel on Climate Change (IPCC). There are three ways that co-benefits or similar terms are used currently:

- Development co-benefits—refer to the local benefits of climate change policies. These benefits can range from improved air quality to cleaner technologies to better jobs.
- Climate co-benefits—refer to the climate change benefits of development plans or sectoral policies and measures. This view on co-benefits emerged in response to the belief that developing countries would focus on development issues first before climate change.
- Air quality co-benefits—refer to the multiple impacts of air pollution policies on climate systems. This view is often employed by the air pollution community when discussing short-lived climate pollutants (SLCPs) such as black carbon.

Source: Miyatsuka & Zusman, 2010

A number of other important developments have happened since the publication of the first ACP White Paper in 2014. Members of the ACP are collaborating on a new programme known as Integrated Better Air Quality (IBAQ). The IBAQ will train policymakers on the newly published Guidance Framework, which is designed to help cities manage air pollution more effectively across Asia (Clean Air Asia, 2016). Another example is the work of the Climate Change and Clean Air Coalition (CCAC)[1] —a voluntary, multi-stakeholder partnership designed to catalyse action on short-lived climate pollutants (SLCPs) that cause near-term warming. The CCAC is currently funding an Assessment Report on Atmospheric Pollution in Asia to help synthesise relevant research in the region (CCAC, 2015). The Assessment Report is being jointly authored by researchers from the CCAC as well as the recently created Asia Pacific Clean Air Partnership (APCAP) Science Panel. The APCAP was formed to provide an authoritative voice on atmospheric pollution in Asia. In addition to the Science Panel, APCAP is supporting a Joint Forum that will serve as an overarching framework to bring together different air pollution agreements in Asia (UNEP, 2015). Put together, these developments elevate the key messages from the first ACP White Paper to an even more salient position today (See Box 1.2).

Box 1.2 Key messages from the 2014 ACP White Paper

- Some view co-benefits broadly as the multiple environmental and development benefits from a single action. Others focus more narrowly on reductions in air pollutants that also warm the climate, known as SLCPs.
- The air pollution view on co-benefits has gained attention in large part because implementing a suite of 16 SLCP priority measures in Asia could help reduce global mean warming by ~0.3°C by 2050. The same measures could help avoid approximately 0.3 to 3 million premature deaths annually and increase annual crop yields by approximately 20 to 100 million tonnes by 2030 (and beyond) in Asia.
- Improving cookstoves is the SLCP reduction measure with the greatest mitigation potential in Asia. Increasing the use of clean diesel is the technical measure with the second most benefits and with the least uncertainty over its warming effects.
- Countries in Asia could also find solutions to other pressing environmental problems by recognising that action on SLCPs is but one step towards a more integrated approach to air pollution and climate change policy in the region.
- In Asia, such an integrated approach could evolve into a strategy that recognises the varying impacts of black carbon, tropospheric ozone (O_3), and methane (CH_4) as well as non-methane precursors of O_3 (such as nitrogen oxides (NOx)) and cooling pollutants (such as sulphur dioxide (SO_2)). It would also look at the varying temporal and spatial impacts that come from mitigating greenhouse gases (GHGs) in line with other pollutants.
- Adopting an integrated approach will require moving toward greater collaboration among relevant agencies and non-governmental stakeholders. Many countries in Asia could draw upon their experiences with national policies supporting multiple objectives in developing this integrated approach.

Source: ACP, 2014

At the same time that the climate co-benefits of air pollution reductions have risen across policy agendas in Asia, the sustainable development co-benefits from mitigating greenhouse gases (GHGs) have also become an expanding area of interest. This area received a major boost from the 21st Conference of the Parties (COP 21) to the United Nations Framework Convention on Climate Change (UNFCCC) at the end of 2015. The Paris Agreement, the main outcome of COP 21, is already motivating countries to look closely at the links between sustainable development and climate actions. This is particularly clear in the Intended Nationally Determined Contributions (INDCs). Many of the INDCs are making linkages between GHG reductions and other development goals (including abating air pollution).

Furthermore, 2015 also ushered in the 2030 Development Agenda, which features a set of 17 Sustainable Development Goals (SDGs). The SDGs are designed to give policymakers, businesses, and civil society

1 The CCAC has grown in membership from eight to 104 partners. In Asia, state partners now include Australia, Japan, Korea, Mongolia, Bangladesh, Maldives, Philippines, and Cambodia.

organisations not just a new set of goals but an *integrated* framework that aims to leverage synergies across goals to guide development planning through 2030.

This chapter intends to update readers on these important developments in the UNFCCC and the 2030 Development Agenda. It also aims to highlight the fact that recent reforms within the global climate change and development communities suggest that international technological, institutional, and capacity building support will increasingly flow to projects and policies that can achieve climate and other development goals simultaneously—i.e. a co-benefits approach. These changes further underline the emerging international acceptance of a more holistic approach to development planning—one similar to the multi-benefit rationale underpinning co-benefits. Finally, the changes suggest that securing access to new funds and aligning local and national policy decisions with global trends will require not just greater awareness of co-benefits, but also practical demonstrations of how to achieve co-benefits in key sectors.

Asia offers a diverse selection of cases demonstrating the potential, challenges, and possible countermeasures to achieving co-benefits in key sectors. The first chapter of the second ACP White Paper frames the global opportunity. The three following chapters—on co-benefits in the waste management (Chapter 2), transport (Chapter 3), and industry/energy sector (Chapter 4)—illustrate how this opportunity could be realised at national and subnational levels in several Asian countries. The final chapter pulls back from the case studies in an effort to both reiterate key findings and propose research projects that could help strengthen the linkages between climate change and sustainable development in Asia.

1.2 Co-benefits in the Climate Policy Landscape

The linkages between climate change and sustainable development trace back more than two decades to the United Nations Conference on Environment and Development (UNCED) in 1992 (also known as the Rio Earth Summit). The Rio Earth Summit officially endorsed 'sustainable development' as a holistic vision for development that meets "the needs of future generations without sacrificing those of the present" (Brundtland & World Commission on Environment and Development, 1987: 152). The official text of the UNFCCC was also developed at the Earth Summit. So this milestone meeting established an initial connection between mitigating GHGs and promoting sustainable development. In the following years, climate negotiators would attempt to further introduce sustainable development policy into the language and mechanisms covered under the international climate regime. This section reviews some of the key features of climate actions and finance mechanisms that were—and will continue to be—critical to strengthening international support for co-benefits. It starts with the Kyoto Protocol's Clean Development Mechanism (CDM) and ends with the new additions to the Paris Agreement.

1.2.1 The Clean Development Mechanism (CDM)

The Kyoto Protocol's CDM was created with the twin goals of assisting developing countries with sustainable development and helping developed countries affordably reduce their GHG emissions (UNFCCC, 1997). Since the Kyoto Protocol came into force in 2005, a great deal of interest has focused on whether the CDM has indeed achieved the goal of promoting sustainable development. Some assessments allege that the CDM mechanism lacks the financial incentives necessary for catalysing investment in development-friendly projects. They further assert that the absence of these incentives has limited the CDM's ability to promote both climate and other sustainable development objectives. Others have pointed to concerns over the added transaction costs necessary for systematically evaluating the development benefits from projects: costs that could ultimately disadvantage development-friendly projects. A third and related critique focuses on the fact that projects with the strongest alignment with development needs also tend to fail to present additional benefits when compared to what would have happened under business-as-usual development. Non-additional projects may have the greatest benefits for existing development needs, but would not qualify for finance because the emission reductions could have been achieved even without climate finance. The above concerns were particularly relevant when a significant portion of Certified Emission Reductions (CERs) were coming from hydrofluorocarbon-23 (HFC-23) or nitrous oxide (N_2O) destruction projects that offered fewer development benefits than many other project types (For a review of the above critiques see Olsen, 2006, 2007; Schneider, 2007; Zusman, 2008).

As these criticisms became more pronounced, some countries and organisations took additional measures to achieve reductions in GHGs through other development objectives. At the national level, the Philippines, Thailand, India, and Indonesia established methods for measuring the developmental contributions of projects prior to their approval. At the global level, the Gold Standard, established by several non-governmental organisations (NGOs) in 2003, created a certification scheme for projects that explicitly sought to reward projects that positively impact communities hosting the project (WWF, 2015).[2] In 2012, the CDM Executive Board compiled inputs from stakeholders on how to include co-benefits and negative impacts in the documentation of CDM. The results have yielded a sustainable development tool meant to help policymakers evaluate the impacts of a project in a more systematic fashion (UNFCCC, 2012).

1.2.2 Nationally Appropriate Mitigation Actions (NAMAs)

Efforts to better demonstrate the development impacts of CDM projects have further increased as attention has shifted to other options beyond the CDM that countries can use to achieve GHG mitigation, with much of the pre-2020 effort focusing on Nationally Appropriate Mitigation Actions (NAMAs). Initially mentioned in the Bali Action Plan at the close of COP 13, NAMAs were conceived as a deliberately broad set of voluntary national actions—ranging from economy-wide emissions targets to sector specific policies to standalone projects—that developing countries would pledge to a registry overseen by the UNFCCC. Over time, NAMAs have evolved into three categories:

1. Unilateral NAMAs—those that are financed with national funds.
2. Supported NAMAs—those that seek support from the international community.
3. Credited NAMAs—those that generate credits that can be traded in the global carbon market.

Beyond presenting opportunities for more country-driven mitigation actions, NAMAs also take a 'development first approach,' meaning that they squarely position development priorities as the driving force behind GHG reductions. This was evident in the language of the Bali Action Plan: NAMAs are meant to be taken in the "context of sustainable development" (UNFCCC, 2008). This was further demonstrated in the number of NAMAs focusing on actions in the transport sector, where they enable cleaner, quicker, and safer commutes between residences as well as reductions in GHGs (ECN & Ecofys, 2015). Using this development first approach, five steps have been recommended for integrating development concerns into NAMA planning:

1. Identify national sustainable development objectives in the context of national development planning priorities and low-carbon development strategies;
2. Design NAMAs to include sustainable development indicators, stakeholder involvement procedures, and safeguards against negative impacts;
3. Relate NAMAs financing to sustainable development impacts;
4. Integrate monitoring, reporting, and verification into NAMA design; and
5. Certify and potentially trade under a new market mechanism or a framework for various approaches (Olsen, 2014).

2 Many of the credits for Gold Standard projects have been purchased by companies on the voluntary markets as part of corporate social responsibility programmes.

The aforementioned sustainable development tool mentioned for the CDM has also been applied for analysing the sustainable development benefits of NAMAs (CDM Executive Board, 2014).

While NAMAs helped forge a link between climate mitigation and wider development concerns, they also encountered a familiar set of challenges, including the absence of a universally agreed upon definition of sustainable development benefits. Because of this ambiguity, countries can set a relatively low bar for what constitutes 'sustainable.' There is also the familiar challenge of striking a balance between the standardsation of international norms for sustainable development and permitting the flexibility to accommodate a wide array of national and subnational contexts. To further catalyse the integration of co-benefits into NAMAs, some argue for the quantification of development co-benefits. There is also a push for better pilot projects that demonstrate the transformational change possible with a fuller appreciation of co-benefits. Finally, there are calls for certification of sustainable development impact units that could then be traded, much like carbon, under a new market mechanism (Olsen, 2013).

1.2.3 The Green Climate Fund (GCF)

One of the primary reasons for the initial enthusiasm over NAMAs was that some of the 'supported NAMAs' would receive financing, technology, and capacity building support based on considerations outside the amount of GHGs they mitigated. The newly formed Green Climate Fund (GCF) is part of the climate architecture meant to deliver this financing. Initially mentioned in the Copenhagen Accord (COP 15) and then further detailed in the Cancun Agreements (COP 16), the GCF has been created to help promote a paradigm shift towards low-emissions and climate-resilient development pathways. This is particularly important because the GCF is supposed to a portion of the USD 100 billion in annual climate finance to be allocated by 2020 (UNFCCC, 2009).

In early 2015, the GCF developed a proposal template based on its six main investment criteria, which includes sustainable development potential. As Box 1.3 illustrates below, the GCF emphasises that environmental, social, and economic co-benefits should all be delivered by the proposed project/programme under these criteria. GCF proposals should also be consistent with environmental and social safeguards (ESS), as the GCF is to be "accessed against the GCF's fiduciary principles and standards, ESS and gender policy" (GCF, 2015a: 4).

Box 1.3 Green Climate Fund funding proposal outline

A. Summary
B. Detailed Description
C. Rationale for GCF Involvement
D. Expected Performance against Investment Criteria
  D.1. Impact Potential
  D.2. Paradigm Shift Potential
  D.3. Sustainable Development Potential.
    Describe environmental, social and economic co-benefits including the gender-sensitive development impact.
  D.4. Needs of the Recipient
  D.5. Country Ownership
  D.6. Efficiency and Effectiveness
E. Appraisal Summary
F. Implementation Details
G. Risk Assessment and Management
H. Results Monitoring and Reporting
I. Timeline

Source: Author's simplification of GCF, 2015b

While the GCF is still in the early stages of operation and has only recently started to finance projects, there are reasons to believe that it will help align climate and sustainable development goals. One such indication can be found in the USD 183 million allocated for the first eight GCF projects, which cover a range of activities with economic, social, and environmental co-benefits (including job creation, energy security, health improvements, local participation, gender equality, educational opportunity, poverty reduction, water availability, biodiversity, and air quality improvement). There is nonetheless the chance that the GCF will encounter familiar challenges such as the absence of a standardised approach to evaluating and monetising co-benefits.

1.2.4 Intended Nationally Determined Contributions (INDCs)

The previously mentioned INDCs are another recent addition to the climate policy landscape, having originated from a 2013 COP 19 decision stating that "all Parties communicate [INDCs] well in advance of the twenty-first session of the Conference of the Parties (by the first quarter of 2015 by those Parties ready to do so) in a manner that facilitates the clarity, transparency and understanding of the intended contributions…" (UNFCCC, 2014: 4).

In some ways, INDCs carried forward the trend begun by NAMAs, in which countries determine their own mitigation actions before pledging them to the international community. But while NAMAs were mitigation actions taken by developing countries and in line with their capacities and national circumstances, INDCs are meant to be more comprehensive measures that embrace mitigation elements (often encompassing smaller scale NAMAs) for both developed and developing countries during the post-2020 period (Boos et al., 2014; also see Table 1.1 below). Unsurprisingly, varying domestic circumstances—including different emissions profiles, emissions-reduction opportunities, climate risks, and resource needs—has led to a diverse range of INDCs.

Table 1.1 A comparison of NAMAs and INDCs

Timeline	1992-1997	1997-2010	2010-2020	Post-2020
Annex 1	Limit GHG Emissions	Economy-Wide Reduction Targets		INDCs
Non-Annex 1	Take Measures to Mitigate GHGs		NAMAs	INDCs

Source: Boos, et al., 2014

Though the performance of the INDCs will depend on taking concrete steps toward implementation, a review of the 129 INDCs (submitted as of November 2015) reveals two pertinent trends. As illustrated in Table 1.2, the first is that some countries in Asia, such as Laos PDR and Bangladesh, indicated in their INDCs a desire to achieve air quality co-benefits through their mitigation actions (in fact, many INDCs reflect this message from the first ACP White Paper). The second is that many of the INDCs also make a link between GHG mitigation and broader sustainable development concerns. In establishing this connection, some also refer to the other high-level international process that culminated in 2015, the 2030 Development Agenda (covered in the next section).

Table 1.2 Countries that refer to air quality or sustainable development benefits in their INDCs

Links with air quality	
Country	**Related remarks**
Chile	Chile recognises that SLCPs abatement reduces air pollution and contributes to national sustainable development.
Togo	SLCPs are mentioned in Togo's sustainable development plans.
Côte d'Ivoire	Côte d'Ivoire will develop a national action plan by 2018 to reduce SLCPs. The co-benefits of mitigation actions are described in the economic, social and environmental context.
The Central African Republic	The Central African Republic aspires to reduce SLCPs.
Morocco	Morocco intends to develop a national plan to combat SLCPs, prepare an SLCPs emission inventory, and assess the benefits of reducing SLCPs with support from the CCAC.
Mexico	Mexico's National Strategy on Climate Change and the Special Programme on Climate Change 2014-2018 underlines that reducing SLCPs offer low-cost mitigation due to public health co-benefits.
Peoples Democratic Republic of Laos (Laos PDR)	Laos PDR's mitigation activities will lead to a reduction in NOx and SOx that will have significant air quality and public health co-benefits.
Bangladesh	Bangladesh's mitigation measures are expected to have co-benefits, including improved air quality (e.g. from increased renewables or reduced traffic congestion).
The United Arab Emirates (UAE)	The UAE continues to improve emission standards for new motor vehicles by boosting fuel economy and cutting local air pollution. It is also aiming to improve air quality measurement and reporting.
Links with the sustainable development	
Country	**Related remarks**
Jordan	Jordan proposes aligning its INDC with the SDGs. Additional attention will be devoted to linking the mitigation and adaptation measures in the INDC to SDGs 1-5.
Malawi	The INDC opens an opportunity to achieve the development objectives described in Malawi's national developmental agenda.
India	India's INDC takes into account its commitment to the SDGs for its 1.2 billion people.
Algeria	Algeria supports a transition to its energy systems and the diversification of its economy to achieve development goals.
Thailand	Developing countries' adaptation actions do not only provide local and national benefits but contribute to the global MDGs and SDGs.
Papua New Guinea	Papua New Guinea highlights the challenges of sustainably managing the country's rich natural resources and meeting development goals.
Ghana	The INDC's inclusion of both mitigation and adaptation are aligned with Ghana's medium-term development agenda, the 40-year socio-economic transformational plan, and the universal SDGs.

Source: UNFCCC, 2015

1.2.5 The Paris Agreement

The recently completed COP 21 negotiations succeeded in crafting a relatively ambitious framework for the post-2020 climate regime. One potentially relevant change to the post-2020 climate landscape is the reawakening of interest in carbon markets and the creation of the Sustainable Development Mechanism (SDM), which will become a UNFCCC-governed market mechanism when the Paris Agreement enters into force.

While the CDM played an important role for the development of a global carbon market, demand for credits fell due to the global economic downturn in 2008 and uncertainty in carbon markets. It is expected that binding rules and international oversight for the SDM might become comparable to that of the CDM. However, the SDM is intended to cover a bigger scope of activities than the CDM. At this point, it is known that the SDM needs to be an additional mitigation effort supplementing the host country's INDCs so as to increase the ambition of the host country (UNFCCC, 2015a). More defined rules, modalities and procedures—including those related to co-benefits—are likely to follow from subsequent COP meetings (AHK, 2015).

The Paris agreement also makes reference to non-market cooperative approaches. These cooperative approaches may allow parties to work together on bilateral and multilateral arrangements (UNFCCC, 2015a). In this respect, they could be similar to supported NAMAs or other bilateral mechanisms. In principle, more complex climate activities could fall under this arrangement, including a sector or sub-sector dimension and potential for greater valuing of the co-benefits. As with the SDM, there are still many details to be negotiated on the rules and modalities governing non-market approaches.

1.3 Co-benefits and the Sustainable Development Goals (SDGs)

The SDGs were adopted in September, 2015 at the United Nations Sustainable Development Summit in New York as the successors to the Millennium Development Goals (MDGs). The MDGs, consisting of eight goals and 21 targets, were lauded for giving countries and development partners a clear set of priorities focused on alleviating poverty. The SDGs have 17 goals and 169 targets, and are not only intended to eradicate extreme poverty but also to fundamentally transform the development paradigms of developed and developing countries (universal coverage) from 2015 to 2030.

The universal coverage and transformative aspirations are not the only distinction between the MDGs and SDGs. The SDGs, in the words of the UN Secretary-General Ban-Ki moon, offer an "integrated…vision for a better world" (Moon, 2015). The operative term from these remarks is 'integrated.' There has been a growing emphasis on treating the SDGs as a holistic framework explicitly recognising the positive and negative interactions between the economic, social, and environmental dimensions of sustainable development (ESCAP, 2015a, 2015b; Griggs et al., 2014; IGES, 2015). There has also been discussion of seeking positive synergies where a single action can bring co-benefits or multiple benefits to others sectors. For example, architects of the 2030 Development Agenda have organised the SDGs into five P's—people, planet, prosperity, peace and partnership—to illustrate the potential interactions across categories (UN, 2015). Other observers have classified the 17 SDGs into three main groups: 1) the inner 'well-being' level (goals associated with individual and collective welfare); 2) the middle 'infrastructure' level (e.g. production, distribution and delivery of goods and services such as energy); and 3) the outer 'environment' levels (e.g. management of global climate and biodiversity). Actions in the middle-level must also take a pivotal integrated role in both inner- and outer-level goals (Waage & Yap, 2015).

The kind of SDG interactions that could prove particularly relevant to co-benefits involve links between energy security, climate change mitigation, and air pollution reductions. Several studies have demonstrated potentially advantageous interactions between these three policy areas (McCollum et al., 2011). More concretely, some studies show that pursuing strategic climate change mitigation objectives can help to achieve energy sustainability while protecting the climate and air pollution, whereas sector-specific policies offer smaller returns (Aunan et al., 2004; Markandya & Rübbelke, 2004; Nemet et al., 2010).

Questions nevertheless remain as to whether models demonstrating these linkages can be incorporated into single-issue policymaking institutions and decision-making processes (Kok et al., 2008; Weitz et al., 2014). The same observers who pointed to the potential for integration across the inner, middle and outer levels also lament that many countries have taken urgent action to combat climate change and its impacts (SDG 13) while simultaneously ignoring links with middle-level infrastructure goals (Waage & Yap, 2015). The debate over whether the energy-air-climate nexus can fit into existing policymaking institutions will depend on overcoming many of the challenges discussed in the case study chapters.

1.4 Conclusion

The previous sections highlighted some of the main advances and challenges in promoting co-benefits through several key climate finance mechanisms. They suggest that there has been some noteworthy headway: countries have moved from focusing on CDM projects to larger-scale NAMAs and INDCs that may receive support from the GCF. To a certain extent, these shifts enable countries to better align their mitigation actions with development priorities. The expanding scale of mitigation actions (from projects to policies to sectors to economy-wide targets) could reduce the relative transaction costs of systematically accounting for co-benefits during the planning and implementation stages. The advent and piloting of tools such as the UNFCCC Sustainable Development Tool also could help countries standardise their approaches to assessing contributions beyond GHG mitigation.

At the same time, the chapter also reviewed the growing emphasis on integration in the 2030 Development Agenda. The SDGs offer countries a relatively concise and coherent set of goals that could help transform conventional development patterns. One of the more promising areas for transformational and integrated approach is seizing upon the linkages between air quality, climate mitigation, and energy security. There has been a considerable amount of research underlining these synergies. Experience with international climate finance mechanisms could inform countries as they seek to align their development planning with the SDGs. This raises the possibility of even more synergy across SDGs and climate finance mechanisms. Indeed, there is ample scope for the sharing of experiences across the SDGs, the GCF, and other financing windows.

It is also worth noting that the chapter's review is not exhaustive. The UNFCCC is currently setting up a Technology Mechanism and complementary Climate Technology Network Centre (CTCN) that will help deliver chiefly small-scale climate mitigation and low-carbon technologies to developing countries. The CTCN will aim to build an assessment of development co-benefits into project proposals. Further, multilateral development banks appear likely to continue to work with a set of Climate Investment Funds (CIFs) that were initially established to underwrite financing from 2007 until a post-2012 climate regime and related funding could be established. There are also a host of bilateral funding mechanisms, such as Japan's Joint Crediting Mechanism (JCM), that have the potential to promote co-benefits. At the same time, the existence and proliferation of different funding channels could fragment the climate policy landscape, encouraging countries seeking finance to pursue those with least transaction costs and fewest development benefits. This could potentially create new pressure to lower standards on what constitutes a development benefit.

Arguably the greatest opportunity—and challenge—involves forging the links between these changes to global mechanisms and national and subnational actions. Beneath the reforms to the UNFCCC and 2030

Development Agenda, many countries have already designed and implemented actions that could bring benefits for climate change and sustainable development. The next three chapters provide case studies within the transport, waste, and energy sectors throughout Asia, with a focus on their essential background, challenges, and ways forward. The final chapter (Chapter 5) synthesises the lessons learned from the case studies into a series of key messages and points to areas for future research.

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Co-benefits in the Waste Management Sector

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2.1 Introduction

Waste, the byproduct of a number of socioeconomic activities, comes in a variety of forms, including human and animal waste, industrial and manufacturing waste, and waste associated with the production and consumption of goods and services. Global population pressures and changing consumption patterns promise to make limiting waste's undesirable impacts increasingly important. A number of efforts are already underway to curtail those impacts. UNEP (2011) divided these solutions into two categories: 1) using less resources per unit of economic output, known as resource decoupling; and 2) reducing the environmental impact of resources used for economic activities, known as impact decoupling (see Figure 2.1). Many resource and impact decoupling activities not only have sizable local social, economic and environmental benefits, but also curb energy use and mitigate climate change. In short, the waste sector has significant potential for achieving climate and developmental co-benefits (Bahor et al., 2009; Santucci et al., 2014; Yedla & Park, 2009).

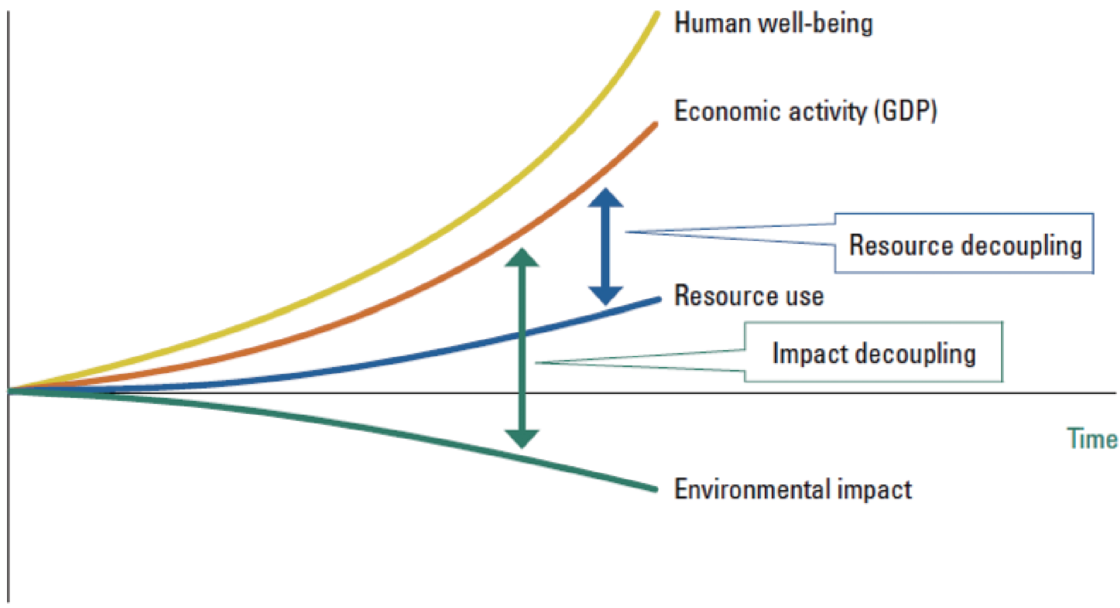

Figure 2.1 **Illustrating resource impact and decoupling** Source: UNEP, 2011

This potential is particularly great in Asia. As illustrated in Figure 2.2, urban waste levels are forecast to more than double in East Asia and the Pacific and South Asia by 2025, surpassing Organisation for Economic Cooperation and Development (OECD) countries. Without forward-looking waste management strategies, Asia's waste sector could become a major source of global greenhouse gas (GHG) emissions as well as other environmental and socioeconomic problems. Fortunately, researchers are increasingly cognizant of these risks, and well-designed solutions are attracting attention. Recent studies show, for instance, that integrated solid waste management in Muang Klang Municipality, Thailand could recover nutrients, materials, and energy from the waste stream, and reduce landfill disposal of organic and recyclable waste (Menikpura et al., 2013; see also Chapter 3 for the co-benefits from Muang Klang's transport sector). The possibilities for Muang Klang Municipality can be found in many other municipalities across Asia.

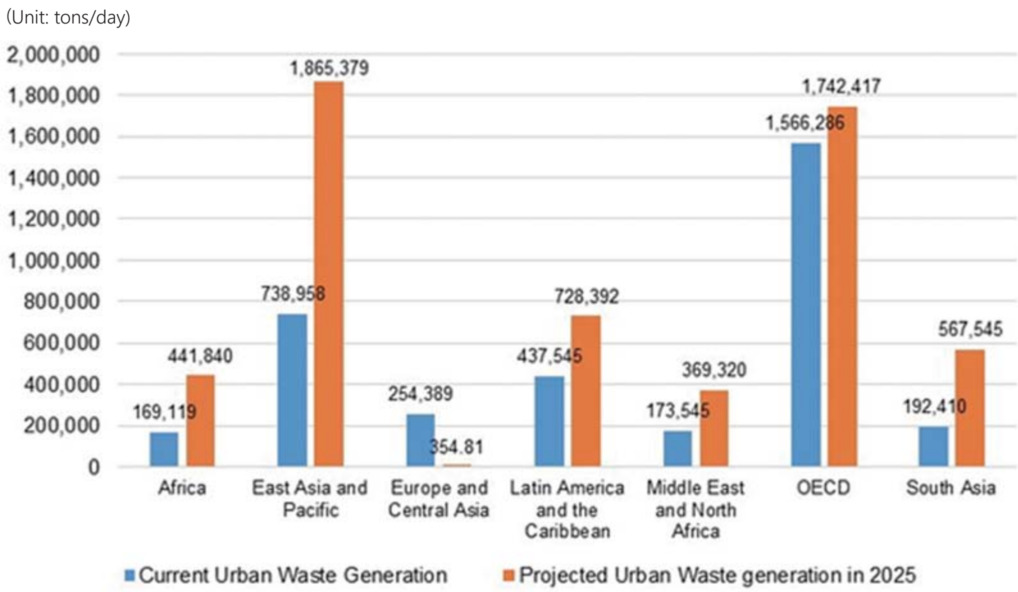

Figure 2.2 Comparison of current* and projected urban waste per region in 2025

*Note: The baseline year for these calculations varies from approximately 2000 to 2007 depending upon the availability of data from cities in the different regions.

Source: Hoornweg & Bhada-Tata, 2012

This chapter considers waste management case studies in three Asian countries: Japan, Bangladesh and Indonesia. For each case, essential background is reviewed, implementation challenges are discussed, and ways forward are outlined. The cases illustrate the diverse approaches to waste management at different levels of development in Asia. Whereas Kawasaki aims to avoid waste, Dhaka needs to construct landfills. Meanwhile, Indonesia is working to harness palm oil waste streams. Even with this heterogeneity in approach, several common recommendations emerge across the cases. These include the need for more holistic waste management strategies; the importance of securing long-term financing to maintain solutions beyond initial investments; aligning waste management with national policies; solidifying links between relevant technical and governmental institutions; and employing co-benefits to elucidate the interrelationships between the local, national, regional and global scales of waste management.

2.2 Waste Management in Kawasaki City, Japan

2.2.1 Background

Kawasaki, a large, populous city (1.47 million people) located between Tokyo and Yokohama in Kanagawa prefecture, served as an industrial hub in the Keihin Industrial Zone during Japan's high-growth era from the 1960s to the 1990s. As the city's economy prospered, Kawasaki developed a keen interest in preserving the city's clean image and the resident's high quality of life. The earliest evidence of this strong desire can be seen in a series of initial waste disposal measures, including the rollout of mechanical garbage trucks in 1955 and the collection of garbage six days a week in 1961. But as the city's population and economy expanded over the next few decades, waste volumes approached the limits of the municipal incineration capacity. Facing a possible waste crisis in 1990, the city announced 'a state of waste management emergency' that encouraged citizens and businesses to reduce waste and recycle. In 1992, Kawasaki revised its ordinance on waste management to promote sustainable resource management in line with the growing need to curb municipal waste.

After the waste emergency was declared, Kawasaki took countermeasures to reduce the volume of incinerated waste as well as redress other waste-related problems. The city started separating the collection of garbage in a stepwise fashion. In 1995, the rail transport of regular waste, incineration ash, and recyclables was introduced for the first time in Japan. In 1997, the national government approved Kawasaki's Eco-Town plan to promote the recycling of waste materials and industrial discharge for a group of companies sited along coastal areas. Using national government funding, recycling facilities were built around a 1.5-kilometer radius for a collection of industries clustered there, including electric appliances, cement production, waste paper, and waste plastic to ammonia.

2.2.2 Waste Management Co-benefits

Starting in 2000, Kawasaki began to refine its waste management approach with new initiatives focused on the 3Rs: Reduce, Reuse, and Recycle. To promote the 3Rs, the city made efforts to facilitate the efficient use of resources—for example, segregating paper and plastic containers for reuse. In 2005, the Rubbish Management Fundamental Plan, otherwise known as the Kawasaki Challenge for 3Rs, called for Kawasaki to become a 'recycling-based' city promoting collaboration among citizens and businesses based on the 3Rs.

Table 2.1 History of waste collection and treatment in Kawasaki

Year	Milestone
1991	Started empty bottle collection
1995	Started railway transport of garbage
1997	Started small metal collection
1999	Started plastic bottle collection
2006	Started mixed paper collection
2007	Reduced the frequency of general garbage collection from 6 to 3 days a week
2011	Started plastic containers and packaging collection
2013	Reduced the frequency of regular garbage collection from 3 to 2 days a week

Source: Kawasaki, 2014b

As a result of these efforts, Kawasaki City has decreased the total volume of incinerated waste. Using alternative transportation means has also allowed the city to move waste from collection sites to incineration facilities in a way that reduces GHG emissions. According to the city, GHG emissions are expected to fall by 35% in the waste sector—from 167.255t in 2007 to 109.538t in 2015. The volume of daily per capita waste fell from 1308g in 2003 to 1021g in 2012. The city's recycling rate grew from 19.5% in 2003 to 29% in 2013 (Kawasaki, 2014b).

These efforts ushered in additional benefits above and beyond the reduction of waste. For example, the life of Kawasaki's Sea Surface Landfill Facility was extended by 25 years (Kawasaki, 2014a). Though more difficult to quantify, Eco-town and the Kawasaki-challenge for the 3Rs have helped the city accrue invaluable experience in environmental policy and technology. In recent years, Kawasaki has been working to build on and gain from that experience and expertise through an initiative called the 'Low CO_2 Kawasaki Brand'. This brand helps evaluate products, technologies and services from a holistic life-cycle perspective that can, ideally, contribute additional CO_2 reductions throughout the value chain.

2.2.3 Challenges and the Way Forward

While Kawasaki has made important strides in managing waste, the chapter authors identified two sets of challenges confronting city policymakers.[1] From the 1990s to early 2000s, the Japanese national government—namely the Ministry of Economy, Trade and Industry (METI) and the Ministry of Environment (MOE)—were cooperating on an Eco-Town project that utilised local industries and promoted waste recycling to help construct a broader resource-recycling economic society. Kawasaki's Eco-Town policy was implemented as a part of this larger national government initiative. Due to its leadership on recycling facility maintenance and contributions to the cause of a recycling society, Kawasaki also enjoyed financial support from the national government. But, when the national government subsidy was removed in 2005, the Eco-Town project needed to streamline operations in order to put the recycling industry on a sounder economic footing (Fujita, 2006).

The challenges have not been exclusively financial in nature, either. Though the city has introduced separate waste collections and made the collection service for certain types of waste chargeable, illegal dumping is an issue. The number of illegal dumping incidences increased from 458 in 2006 to 3853 in 2012 (Kawasaki, 2014b). To a certain extent, dumping has been an unanticipated consequence of emphasising waste separation at the source. It has nonetheless further added to the financial burden of waste collection and posed a challenge for the city government's waste administration.

There have been considerable efforts to overcome the above financial challenges. Japan's MOE and METI have, for instance, conducted studies on the profitability and sustainability of Eco-Town projects in several cities, including Kawasaki. The results of their studies showed that expanding the market and having stable resource procurement are essential to the financial sustainability of 3R projects. The establishment of a circulation system that will capture multiple environmental values associated with different types of products for recycling has also been proposed. Planning amongst multi-stakeholders towards the promotion of separation, collection and green purchasing also needs to be a top priority in the waste management strategy (Fujita, 2011).

The emergence of illegal dumping may prove more difficult to remedy than financing. One solution would be to step up efforts to monitor areas known for dumping. The Australian city of Marion, for instance, installed motion sensitive monitors near dumping hotpots. This led to a 40% reduction in dumping in waste over a half-year period relative to the same period the previous year (City of Marion, n.d.) Another possible way forward could involve raising awareness and reporting of dumping (Oregon Department of Environmental Quality, n.d.) A third proposed solution for some forms of waste would entail the strengthening of laws on extended producer responsibility (EPR). This would limit incentives for dumping by placing the onus on

1 The assessment offered in this section reflects the views of chapter authors not Kawasaki city.

industries to produce products and packaging that are more easily managed at the consumer level (Akenji et al., 2011). The next section turns to a city where waste management problems are becoming particularly acute: Dhaka, Bangladesh.

2.3 Waste Management in Dhaka, Bangladesh

2.3.1 Background

Dhaka is the densely populated capital of Bangladesh. In recent years, urban migration and changing consumption patterns have caused steep increases in Dhaka's waste levels. As a result, the city's policymakers are faced with higher incidences of disease as well as increasing air pollution and groundwater contamination. The waste sector in Dhaka also contributes to climate change through the generation of methane (CH_4), which is 28 times as potent as CO_2 on a 100-year time scale (IPCC, 2014). Since solid waste accounts for only 1% of Bangladesh's current national CH_4 (Government of Bangladesh/UNDP, 2008), waste management is first and foremost a development not climate change issue.[2] Carbon finance can nonetheless provide revenues to meet development needs in Dhaka.

2.3.2 The Co-benefits from Municipal Solid Waste

Dhaka's authorities have contemplated several steps to improve waste management, primarily for development reasons. Among the most visible of these steps are targets to collect and treat at least 68% of the waste produced from the city's inner metropolitan area. This would translate to a 180% increase in collection and final disposal efficiency above the 44% collection rate in 2005. The plan to reach this target focuses on re-engineering and improvement of waste disposal sites. The re-engineering of the existing site of Matuail and a controlled landfill in Amin Bazar are projected to reduce emissions by an average of 99,000 tons of CO_2e per year (C40, n.d.).

Several technical measures could also help achieve Dhaka's target. Anaerobic digestion could be employed to generate biogas and electricity, and the extraction of landfill gas could generate electricity and briquettes from refuse-derived fuel (RDF). Every year the Matuail landfill (recently converted to a semi-aerobic landfill) vents an estimated 16.5 Gg of CH_4. Capturing this CH_4 would have an electricity generation potential of 3–4 MW. This type of project could both offset energy costs and attract carbon finance (ADB, 2011).

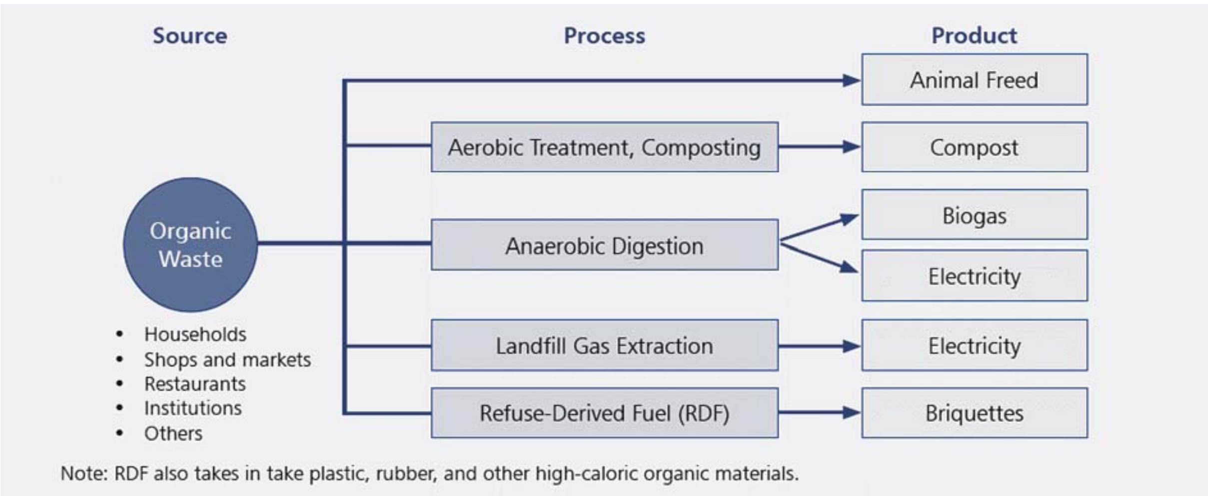

Figure 2.3 Waste recycling options for organic waste in developing countries Source: ADB, 2011

2 This situation may be different for other waste streams that produce a larger share of CH_4 emission in Bangladesh, such as domestic wastewater, livestock, paddy and poultry but these are not the focus in this chapter.

A further option, composting, is preferable to landfilling organic waste from an environmental perspective. Composting takes two to four months to move from source separation to end product. The amount of compost then depends up the waste type and composition as well as management technologies (*ibid*). Though practiced at relatively low levels (around 2%) in Bangladesh, several successful community-based composting schemes that have employed public-private partnerships (PPPs) suggest scope for expanding composting. In 2010, for instance, the Ministry of Environment and Forests used its Climate Change Fund to carry out a composting initiative in 64 districts in Bangladesh under the Clean Development Mechanism (CDM). More recently, there have been discussions of opening of a composting facility in Dhaka to contribute towards the aforementioned 68% target (C40, n.d.).

Bangladesh has also promoted sustainable options centring on the 3Rs. In 2010, Bangladesh approved the National 3R Strategy, making source segregation mandatory and directing municipalities to pursue organic waste-recycling projects through composting, RDF, and biogas via PPPs. The strategy states that medium- to large-scale organic waste-recycling projects will be implemented and managed by the private sector; it also makes recommendations on critical operational issues such as tipping fees and access to municipal land for recycling projects. The strategy further underlines that accessing carbon finance to capture, recover and utilise CH_4 from landfills could help achieve waste management objectives. In accordance with the National 3R Strategy, seven city corporations developed solid waste management action plans.

The Solid Waste Management Rules, 2011 outline several relevant and complementary measures for the 3Rs. These include provisions encouraging the segregation and minimization of waste at the source; requirements that industries make contributions to city corporation/municipalities commensurate with waste volumes; and language offering biodegradable waste free of cost to governments and non-governmental organisations initiating projects involving the CDM. The same rules also state that CH_4 from landfills should be burned rather than vented.

A further set of solutions concentrates on biogas. Biogas generated from solid waste for cooking or generating electricity would provide a renewable energy source as outlined in the 'Renewable Energy Policy of Bangladesh (2008). According to the policy, all renewable energy equipment and raw materials will be exempted from a 15% value added tax (VAT), utilities will receive subsidies for the installation of renewable energy projects, and assistance will be provided by the government for land acquisition. Further, both public and private renewable energy investors will be exempted from corporate income tax for five years and an incentive tariff may be considered for electricity generated from renewable energy sources. These incentives could promote energy generation from biogas.

2.3.3 Challenges and the Way Forward

Several challenges have made it difficult to realise the significant potential for co-benefits from Dhaka's waste sector. The challenges start with ambitious policy objectives. The main goal of the 3R strategy, for instance, was to eliminate waste disposal at open dumps, rivers and flood plains by 2015 but it may be better to scale back targets. Increasing public awareness and building municipal capacity to operate and maintain waste management facilities would help to reach targets. Strengthening regulatory enforcement will also be needed.

Another challenge is the marketing of compost products. Chemical fertilisers enjoy subsidies because they increase crop yields. But fertilisers degrade soil quality, reducing the arability of land over time. Because of the degradation, either organic composts need subsidies or chemical fertilisers will need to have subsidies lowered. A transport subsidy for fertiliser companies may also be needed. Providing up-front capital, incentives, and tax breaks may help create a level playing field and attract the private investment needed to scale-up sustainable waste management practices.

Anaerobic digestion of organic solid waste generating biogas can be used for cooking or to generate electricity. Doing this will require strict source segregation, significant maintenance and technical skills, and high initial investments. RDF pellets can be used for combustion engines and boilers to generate electricity in combination with other traditional fuels (such as coal and biomass). The process of successfully converting solid waste to RDF is contingent upon the use of high caloric organic waste, adequate pre-treatment, and satisfactory management and technical capacity. Insufficient tax revenue, lax enforcement of existing waste regulatory frameworks, and weak inter-agency coordination are broader challenges affecting more than just waste management.

Bangladesh is currently embracing a range of international initiatives to attract finance and achieve national and subnational waste management targets, including CDM projects and potential linkages with Bangladesh's Intended Nationally Determined Contribution (INDC) under the UNFCCC. It is important that this finance is combined with capacity building efforts that help enforce existing regulations and strengthen the enabling environment for PPPs. Bangladesh's participation in the Climate and Clean Air Coalition (see Chapter 1) municipal solid waste initiative could help attract that assistance. The next case suggests that some of the same suggestions apply to Indonesia's management of palm oil waste.

2.4 Indonesia's Palm Oil Industry

2.4.1 Background

In Indonesia, waste management is regulated under the Law Number 32/2009 on Environmental Protection and Management. Several efforts have been made to protect the environment under this law. Some of these efforts have sought to minimise the adverse environmental impacts of Indonesia's fast-growing palm oil industry. Improving the industry's waste management system is central to achieving that objective.

Palm oil mills generate both solid and liquid waste. The solid waste consists of empty fruit bunches, mesocarp fiber, kernel shell, solid decanter, and boiler ash. Mesocarp fiber and kernel shells can be utilised as fuels to generate steam and electricity; this electricity can, in turn, be re-used by palm oil processing plants. Liquid waste, namely palm oil mill effluent (POME), is the effluent from the final stage of palm oil production. The effluent is a form of a colloidal suspension—a mixture that contains 95% to 96% water, 0.6% to 0.7% oil and 4% to 5% total solids, including 2% to 4% suspended solids (Wu et al, 2007). Every ton of crude palm oil production will generate about 2.5 to 3.0 m^3 of POME (Saidu et al., 2013). In plantation and mill operations, GHG emissions from POME far exceeds other GHG emissions, such as emissions from fertiliser and diesel (Brinkmann Consultancy, 2009).

The main source of pollution from palm oil mill is POME. The oxygen-depleting potential of POME is about 100 times that of domestic sewage, posing a serious environmental threat. Technologies do exist that can significantly reduce GHG emissions from POME, and consequently lower emissions from overall operations, the most common of these being a pond or lagoon treatment system (*ibid.*). The naturally available oxygen in such a system is generally insufficient for aerobic decomposition of the organic material in the wastewater. In consequence, the decomposition turns anaerobic, resulting in the production of biogas, which dissolves from the ponds into the atmosphere. A significant proportion of POME derived biogas consists of CH_4. Studies indicate a typical CH_4 content in biogas of 55% to 65% (Wahid et al., 2006; Yacob et al., 2006).

2.4.2 The Co-benefits from the Palm Oil Industry Waste

The Decree of the Minister of Environment Number 5/2014 (which includes national waste water quality standards) stipulates that industrial waste management is needed to promote sustainable development. Other statutes make a similar point, including the Decree of the Minister of Environment Number 28/2003 on Technical Guidelines for the Evaluation of Palm Oil Waste Water Utilisation on Palm Oil Plantation Land and No. 29/2003 on the Guidelines, Requirements, and Procedures for Licensing the Utilisation of Palm Oil Waste Water on Palm Oil Plantation Land. To meet the above standards, the wastewater treatment processes in palm oil industries usually use a conventional biological treatment. Generally, there are two types of biological treatment systems: 1) biological treatment with a land application; and 2) biological treatment without a land application.

As for treatment with a land application, the POME is treated in anaerobic ponds until the BOD reaches a maximum of 5,000 mg/l. The treated POME is then transferred to the plantation as a liquid fertiliser. The land application system of POME is regulated through the Ministry of Environment Decrees Number 28 and 29, 2003. The biological treatment without a land application system should be implemented by palm oil industries in compliance with the national effluent standard under the decree of the Minister of Environment Number 5/2014 on the Waste Water Quality Standard.

Importantly, POME reduction and recycling through capture and land application of treated POME will not only significantly reduce the environmental impacts of POME, but also produce valuable end-products, increase energy efficiency, maximise renewable energy, and curb GHG emissions. In recent years, palm oil mills have applied various technologies to improve the treatment of POME while also reducing CH_4 emissions. These include biogas-capture technologies that flare or convert biogas to electricity/heat. Flaring or heat conversions effectively transform CH_4 to CO_2 emissions, reducing the global warming potential (GWP) by a factor of more than 20 (Brinkmann Consultancy, 2009).

Biogas capture technologies have earned revenues through the CDM, although the efficiency of GHG emission reduction and biogas capture varies widely (Yacob et al., 2006). At higher efficiency ranges, biogas production from 600-700 kg of POME can be about 20 m^3 of biogas per m^3 of CH_4 (Goenadi, 2006) and can be converted into energy of 4,700-6,000 kcal or 20-24 MJ (Isroi & Mohajoeno, 2007). Therefore, a palm oil mill with a capacity of 30 tonnes of fresh fruit bunches per hour, can produce biogas for energy equivalent to 237 KwH (Naibaho, 1996). Based on Paepatung and Rahardjo (2006), the production of $1m^3$ of POME can result in $20\text{-}28m^3$ of biogas.

Generating electricity from POME through biogas or CH_4 capture has attracted a great deal of attention across the palm oil industry. This is largely because it is a source of additional revenue (from selling surplus energy). Other options exist for improved POME treatment, such as co-composting the material with empty fruit bunches, which would generate a high-quality compost with valuable carbon-to-nitrogen ratios, while also reducing POME discharge. Schuchardt et al. (2008) have demonstrated that this technology has the potential to significantly reduce POME quantities, while Lord et al. (2002) managed to achieve a zero discharge of POME. Other technologies that contribute to reducing CH_4 emissions from POME include decanters prior to pond treatment, removing suspended solids, and de-nitrification technologies.

2.4.3 Challenges and the Way Forward

With over 600 palm oil mills, Indonesia is currently the largest palm oil producer in the world. As has been demonstrated, the palm oil industry is in need of more sustainable agricultural and industrial practices to limit its environmental impacts. A key factor in making the industry more sustainable is location: if palm oil production is located on top of peat, continuous GHG emissions result from the oxidation of this peat, thus exceeding any GHG reductions from those operations (Brinkmann Consultancy, 2009). If new production facilities are developed in areas which are not high in carbon stocks, palm oil production can potentially lead to net carbon sequestration. Austin et al. (2015) have studied the extent to which land management policies can resolve the conflicting goals of oil palm expansion and GHG mitigation in Kalimantan, a major oil palm growing region of Indonesia. They concluded that a carefully designed and implemented oil palm expansion plan can contribute significantly to Indonesia's national GHG emission mitigation goal while reducing oil palm profits only moderately and allowing the oil palm area to double.

Palm oil mill has great potential as an alternative energy source via CH_4 capture and biogas conversion into energy. Biogas utilisation of energy sources and biomass from oil palm waste can also help overcome the problem of power shortages, particularly in villages—as palm oil mills are generally located in remote areas.

The Indonesian government has initiated a programme called the Indonesian Sustainable Palm Oil that calls for 60% of Indonesia's palm oil mills to have CH_4 capture facilities by 2020. In addition, the Indonesian government has also issued a regulation through the Ministry of Energy and Mineral Resources No. 27 of 2014 regarding the purchase of renewable energy by the State Electrical Company (PLN). Currently, there are not many palm oil mills investing to build up biogas power generation facilities due to 1) lack of regulation on capturing CH_4 gas from POME for energy; 2) high initial investment costs; 3) the absence of an electricity grid in the remote areas where palm oil mills are located; and 4) the lack of mechanisms to sell energy to PLN.

The government is starting to tackle several of these obstacles, and has promulgated policy plans that stipulate that all companies should use their waste for productive purposes by 2018. This policy's objective is to optimise waste-to-energy and contribute to the national GHG mitigation target of 29% by 2030. The policy will also increase renewable energy in the government's National Energy General Plan in 2025. In addition, the government will continue to facilitate coordination between palm oil industries, investors, and the PLN to accelerate the implementation of POME use in energy and also provide the incentives for investment in technologies that convert POME biogas into electricity—thereby creating a price signal that will make the market more attractive and profitable.

2.5 Discussion and Conclusions

This chapter demonstrates the wide range of waste management solutions with climate and development co-benefits in Asia. While these solutions are typically intended to enhance local communities and environments, increasing awareness of climate change and expanding flows of carbon finance are adding another motivation for policymakers to act on waste. In this context, Yedla and Park (2009) argued that co-benefits can help align climate change concerns with sector-specific developmental goals. All three country case studies show how this alignment is beginning to materialise.

A shift in thinking where waste has moved from residual material to a useful asset has helped strengthen this alignment. As noted in the Bangladesh National 3R Strategy, "streams of waste are being considered resources for a new economy" (MOEF GoB, 2010). Maximising returns on this new tier of resources will require a systems or holistic approach to waste consumption and production. Policies will need to consider how materials and resources flow through economies and create new value chains. Quantifying co-benefits can help to systematically assess the gains from more holistic waste management practices (Menikpura et al., 2014).

It is evident from the chapter's three cases that local governments will need to be pivotal players. From Kawasaki to Dhaka, local governments are offering ambitious targets and introducing out-of-the-box solutions. But it is further apparent that local governments will not be able to manage waste alone. National governments will need to provide financial and technical support, especially to make innovative approaches financially viable. National governments will also need to rein in poorly designed subsidies, strengthen enforcement capacities, and give industries clear incentives to minimise waste streams (for instance, through

EPR laws). Building awareness of the hidden value in waste streams (such as the organic waste example in Bangladesh (see Fig. 2.3) and the POME example in Indonesia) will be required from many levels of government as well as other non-governmental stakeholders. Recognising the social as opposed to the environmental benefits will prove pivotal in raising this awareness.

More suitable and long-term financing, including expanding the market and the stable procurement of resources is necessary to make the finances work on 3R projects. There are also additional opportunities in the waste sector that have not been discussed, for example, appropriate recycling and resource programmes of Waste Electrical and Electronic Equipment can offset significant GHG emissions that would have otherwise occurred through the virgin production of materials (Menikpura et al., 2014). The effect of the globalisation of the waste treatment and transport is yet another area that is ripe for additional research from those working on co-benefits.

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Co-benefits in the Transport Sector

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3.1 Introduction

Asia's transport sector faces a long list of negative externalities, from worsening congestion to increasing greenhouse gas (GHG) emissions. The region also has the potential to capture a number of co-benefits by internalising these negative side effects. For instance, some policymakers in Asia have already begun to plan and implement transport solutions that mitigate GHGs, reduce congestion, and cut air pollution (Zusman et al., 2012). The degree to which more projects and policies deliver these benefits will depend in part upon lessons learned from existing cases. This chapter presents three case studies at the city, inter-city, and country level to shed light on the different challenges and ways forward to achieving co-benefits in Asia's transport sector.

The city-level case study focuses on compact planning in Toyama, Japan. Toyama has been recognised for transport-oriented development (TOD) and a light-rail transit system that have demonstrated the wide range of benefits from compact city planning. The inter-city case study explores the potential of a bicycle sharing programme in Metro Manila. This programme could enhance multi-modal transport connectivity and expand access to low-income groups in Metro Manila. The country-level case study offers insights on the development of Nationally Appropriate Mitigation Actions (NAMAs) for sustainable transport in Thailand. The case highlights the potential for co-benefits on paper but difficulties to achieving them on the ground.

The three cases underline the importance of financing in initiating and maintaining transport planning at different scales. They also suggest the need for knowledge exchanges, technical cooperation and institutional strengthening. Finally, the three cases suggest that a co-benefits approach should feature early and throughout the transport planning process. Integrating the co-benefits into multiple stages of the planning process will require not only a clear understanding of potential benefits but also beneficiaries. Mechanisms that engage key stakeholders (as beneficiaries) throughout transport planning process can help maximise co-benefits in Asia's transport sector.

3.2 Compact City and Public Transport in Toyama City, Japan

3.2.1 Background

Toyama is located on the Sea of Japan in the Chūbu region. As of 2015, the city had a population of 418,957 and a total area of 1,241.85 square kilometers. In the early 2000s, the city's decreasing population and aging society led to a heavy dependence on automobiles and a corresponding decline in public transport. The combined impact of these changes resulted in a hollowing out of the city centre. This, in turn, raised the administrative and operational costs of managing the transport system and increased GHG emissions (Mori, 2013). For example, automobile dependency measured in terms of the number of trips grew to 72.2% in 1999 from 52.5% in 1983 (Awashima, 2009).

3.2.2 The Co-benefits of Transport Planning in Toyama

Toyama set up a Compact City Development Group in 2002 to address many of the above issues. To make the city more compact, the group employed a polycentric approach that linked multiple interconnected small cities and facilities (Fujimoto, 2008) (Figure 3.1). The compact city strategy consisted of three pillars: 1) revitalising public transport; 2) encouraging the relocation of residents and business to zones along public transport corridors, and 3) re-energising the city centre (Runzo-Inada, n.d.).

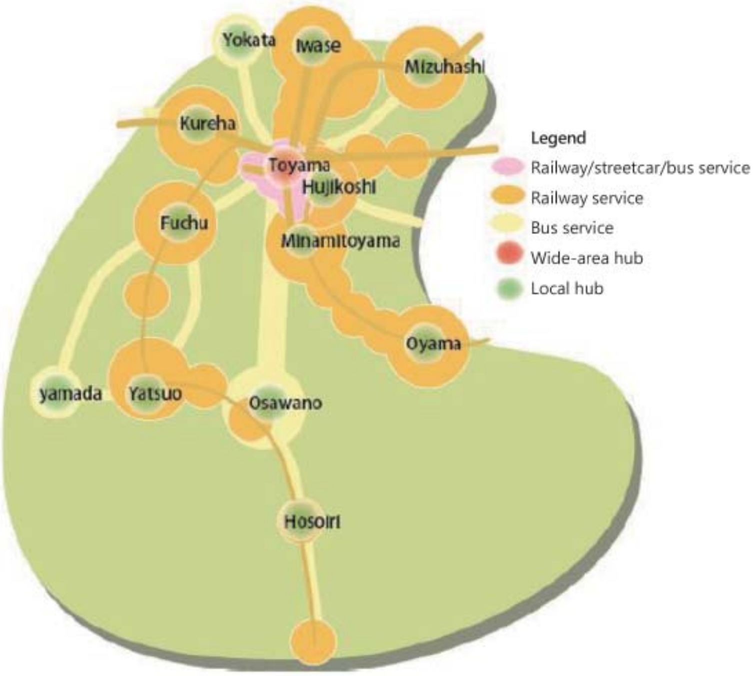

Figure 3.1 The organisation of a compact city and its public transport system Source: Mori, 2013

Toyama has also gradually strengthened its public transport network with the use of existing railway lines. This started with the launching of a Light Rail Transit (LRT) line in the northern part of the city in 2006. The LRT covers 7.6 kilometers with 13 stations, and has an average travel time of 25 minutes from origin to destination. To improve the LRT's infrastructure, five new stations were added, low carriage floors were introduced, and the stations were made wheelchair accessible. More frequent trains and longer hours also improved the LRT's operations. In addition, a preferential fare for elderly was introduced. In consequence, the ridership of the new LRT more than doubled on weekdays and grew by 3.5 times on weekends. The number of elderly passengers increased sharply after the opening of the LRT (Toyama City, 2014).

A key element in making the city more compact was the conversion of a local railway (JR Toyama Port Line) into the aforementioned LRT system based on a public-private partnership (PPP). In this case, the public sector constructed the infrastructure and the private sector managed the operations. Other changes to the city's infrastructure also helped make the city more compact. For instance, a connection linking the lines in the north and centre of Toyama was improved with the renovation of infrastructure for the recent launch of the Hokuriku Bullet Train (Figure 3.2).

The next step in the city's public transport reforms was the extension of the tram line into a loop line, an undertaking meant to revitalise the city centre by improving mobility. This extension involved the addition of a new loop-line section that connected the two existing tram stations. The loop line opened on December

Figure 3.2 **Formation of LRT network** Source: Mori, 2013

Figure 3.3 **Toyama LRT (April 2006)** Source: Mori, 2013

Figure 3.4 **City tram loop line (December 2009)** Source: Mori, 2013

23, 2009, marking the first time a city in Japan adopted a two-tiered system. This system meant the land for the extended railway section and newly added low-floor cars were owned by the city, while a private company used the city's property and paid rent to the city. The tram system is also well integrated with the surrounding road space in an effort to make the urban area more visually appealing (*ibid.*).

The two reformed railway systems became integrated as a part of the renovation of the Japan Railways Toyama station in March 2015. While the station was the final destination for both the Toyama LRT and the loop line, transit was physically divided on the ground-level by the JR railway and station. This physical barrier was removed when the Hokuriku Bullet Train was opened: the new JR line is elevated and the tram stops for both Toyama LRT and the loop line were built underneath the JR line. This facilitated smooth transit between the north and south trams and enabled the further extension of the LRT system (Toyama City, 2015). In addition to these key infrastructure reforms, the city is also attempting to raise public awareness through mobility management programmes and other outreach channels, including radio broadcasting, elementary school education, citizen forums, and city community papers (Toyama City, 2014; Toyama Rail Life Project)

To encourage people to move to the city centre, the city designated a 'city-centre area' (approximately 436 hectares) and 'residence encouragement zone' (along public transport lines covering an area of approximately 3,000 hectares) (Mori, 2013). Public subsidies support the development of housing complexes in these areas (Kuroda, 2015).

The city has also made serious efforts to make the city centre more attractive and accessible, including the major undertaking of building a public square called 'The Grand Plaza.' This glass-roofed central plaza is equipped with a huge screen and an elevating stage, which together facilitate multi-purpose uses regardless of the weather. To ease access to the city centre, Toyama also launched a bicycle sharing system similar to

Vélib' of Paris (also see Section 3.3 on Metro Manila), and introduced a special public transport discount fare for senior citizens (Mori, 2013).

The reported benefits of the Toyama LRT and the City Loop line include increased ridership (especially for elder citizens during the day time), a shift away from motorised vehicle use, an increasingly active elderly population, higher levels of economic activity in the city centre, and reduced GHG emissions. The growth rate of city centre population turned positive in 2008 and has remained so for the subsequent six years. Toyama estimates that during fiscal year 2014 its compact city-related policies mitigated 317.5 tonnes of carbon dioxide (CO_2)—equivalent to the amount of CO_2 absorbed by 40.7 hectares of forested area (Toyama City, 2014).

3.2.3 Challenges and the Way Forward

During the planning of the Toyama LRT, the most crucial issue was securing sufficient financing for infrastructure construction and operations. This was addressed with PPP financial schemes as well as private companies that were willing to contribute to the project. In addition, the Toyama LRT was eligible for subsidies from the national government (Fukayama et al., 2007). Securing funding for the continued operation and a reliable ridership was also critical in sustaining the momentum created with the initial launch of the project. Subsidies that encouraged relocation to the city centre and revitalised activities in the area played a role in retaining this momentum.

Other challenges related the city's compact city policies include further upgrading public transport, raising public awareness, conveniently locating/relocating urban amenities, and facilitating lifestyle changes (Kanayama, 2011).

While Toyama City has made considerable progress towards becoming a truly compact city, the process is ongoing. Ambitious goals have been set to increase the ratio of residential population to 40% from the current 30% and reduce total CO_2 emissions by 30% by 2030 compared to 2010.

Table 3.1 The three pillars in Toyoma's compact city management strategy

Value creation		
Environment	**Social**	**Economic**
• Reductions of CO_2 emissions • Revitalisation of the city centre	• Fostering social capital • Community health care • Nursing care • Health • Safety and security	• Reduction of administrative costs • Formation of new industries • Revitalisation of agriculture and forestry • Increases in tax revenue • Promotion of local industries • Job creation

Toyama City 2014, reformatted by the authors

It is worth underlining that Toyama City has been promoting its compact city policies using a holistic rather than a sector-based approach to planning. By integrating the three dimensions of sustainable development, Toyama's Compact City Management Strategy aims to create value not only in the environmental realm, but also the social and economic realms as shown in Table 3.1 (Toyama City, 2014). This approach suggests the potential of local transport policies to go beyond emission reductions to other economic and social co-benefits. In the new era of the Paris Agreement and Sustainable Development Goals (SDGs) (see Chapter 1), how Toyama's approach unfolds could provide valuable lessons to other cities in Asia, including Manila.

3.3 Potential for Bicycle Sharing in Metro Manila, Philippines

3.3.1 Background

Metro Manila is the densely populated political economic centre of the Philippines. Transport in Metro Manila is therefore essential to sustaining the country's development. However, the rapid pace of urbanisation and motorisation has left Manila with heavy traffic and extended commutes. Regidor (2012) revealed that productivity losses from congestion amounted to about USD 35 billion between 2001 and 2012. The transport sector also contributes significantly to GHG emissions, accounting for more than a third of national energy-related emissions. This figure increased on average by 8.5% annually from 1994 and 2000 (Climate Change Commission, 2014).

The Philippines has adopted several strategic policies to address these problems. For instance, the country's National Framework Strategy on Climate Change for 2010-2022 calls for 'model to improve the transport sector's efficiency and (support) modal shift.' The National Climate Change Action Plan for 2011-2028 supports 'an integrated transport master plan that includes non-motorised transport (NMT).' The National Environmentally Sustainable Transport Strategy as well as the National Implementation Plan on Environmental Improvement in the Transport Sector for 2011-2016 emphasises NMT as a way to reduce vehicle numbers and congestion. In recent years, options such bicycle sharing have become viable NMT approach to delivering co-benefits.

3.3.2 The Co-benefits of Bicycle Sharing in Metro Manila

A bicycle sharing system is a programme in which users rent and return a bicycle over a publicly available network. Bicycle sharing schemes originated in Amsterdam, Netherlands in the 1960s. These first-generation systems functioned with a fleet of public use bicycles. The concept has since evolved with programmes employing increasingly automated approaches to picking up, tracking, and returning a bicycle.

Figure 3.5 A bicycle sharing station in Pasig city
Clean Air Asia, 2013

The Asian Development Bank showcased an automated bicycle sharing system for the first time in Pasig City in 2012 (Figure 3.5). In its first few months, the station generated 15 trips/day—this figure then rose to about 35 trips/day. The feasibility of expanding the system across multiple local government units in Metro Manila is now being considered.

Most of the benefits of bicycle sharing systems come from shifting motorised short-distance trips to NMT. A scenario in which 2,000 bicycles were set up for the first year of the trial and then grew to 20,000 over five years in Metro Manila could potentially result in 10,828.6 tCO_2 of abated CO_2—translating to roughly 196.9 $kgCO_2$/bicycle/year (based on the Transport Emissions Evaluation Model for Projects (TEEMP))[1].

Co-benefits from the bicycle sharing systems extend beyond simple emission reductions however. Some of the more important benefits are social in nature. For example, bicycle sharing systems provide an affordable means of mobility for low-income groups and eliminate the need for bicycle ownership. In Metro Manila, low-income groups are heavily dependent on NMT and public transport. By placing the stations close to buses and public utility vehicles,[2] bicycle sharing can also serve as a feeder system for public transport. As such, they can help improve first- and last-mile connectivity as well as strengthen links between public transport modes. This increased convenience can help shift motorised short-distance trips towards cycling, thus

1 The latest version of TEEMP can be downloaded from the Global Environment Facility https://www.thegef.org/gef/pubs/STAP/CO2-Calculator

2 Public utility vehicles include public utility jeepneys and Asian utility vehicles (AUV) are used to transport passengers in the Philippines along a fixed route with a seating capacity of ten.

accommodating populations that have moved from central business districts or other heavy traffic destinations.

An added advantage of bicycle sharing systems is their cost effectiveness. The systems tend to service large areas and many commuters for a modest cost. Bicycle sharing systems can also create employment opportunities through the handling, development, and maintenance of the facilities, the manufacture of hardware (i.e. docks, bicycles and kiosks), and the back-end operational systems such as the control and call centre.

Apart from improving mobility and creating employment, bicycle sharing systems offer a convenient transport mode that increases physical activity and provides health benefits. These benefits could potentially reduce health care costs and improve worker productivity. Enhanced mobility and accessibility to markets, jobs, business districts, and public services and health services can also expand economic opportunities and narrow income gaps.

Last but not least, the cost effectiveness and numerous co-benefits of a bicycle sharing system could lead the Philippines and the 17 local government units of Metro Manila to upgrade bicycle infrastructure for the NMT. This could indirectly impact emissions by bringing more cycling onto urban roads. As motorists adapt to increased cyclists and safety improves, the bicycle sharing system could attract even more cyclists.

3.3.3 Challenges and the Way Forward

To finance a bicycle sharing programme, governments in the Philippines will need to leverage both existing and new funding opportunities. One promising existing option is the Special Vehicle Pollution Control Fund (SVPCF). The SVPCF is a special trust account that the Department of Transportation and Communications (DOTC) oversees to reduce mobile source air pollution. It covers vehicle standards and regulations; training and public information; as well as sustainable transport projects, activities and programmes.

A feasible new financing channel is a PPP. A PPP for bicycle sharing programmes typically involves contracting logistics and day-to-day operations (such as the redistribution of the bicycles) to a private partner. It is important that contracts under a PPP are structured long enough for the operator to procure quality stations, terminals, docks, and bicycles but short enough to replace underperforming operators (Institute for Transportation and Development Policy, 2013). Implementing a PPP also requires avoiding delays in project tender preparation; well-designed legal and regulatory frameworks (regarding competition and implementation issues); and carefully designed sector-specific guidelines (such as risk-sharing arrangements) (Asian Development Bank, 2012; Navarro & Llanto, 2014).

Bicycle sharing systems tend to perform best in cities where they are integrated with public transport systems. New forms of public transport such as bus rapid transit (BRT) systems can be integrated with bicycle infrastructure (Midgley, 2011). A recently approved 27.7-km BRT system for Metro Manila (to be open by 2018) offers a promising opportunity in this regard (InterAksyon, 2015). Plans for cycling and pedestrian infrastructure to complete the commuters' last-mile trip and reduce the need for motorised transport for the BRT are further encouraging (Rappler, 2016).

Limited data can potentially hinder bicycle sharing programmes. In Metro Manila, some data are collected on a project-by-project basis. Varying collection methodologies from different government agencies and research organisations can also make assessing the performance of a bicycle sharing system complicated. The lack of systematic and comparable data may further serve to weaken data-sharing and programme monitoring and evaluation. The tendency to exclude walking and cycling in travel or person-trip surveys conducted to estimate total passenger-kilometer travelled and understand travel patterns is a related challenge.

A harmonised set of standards for planning across the 17 local government units of Metro Manila would greatly help address the above data issues. One possible way forward for bicycle sharing would be to apply a standard based on the five key success factors for bicycle sharing systems provided by the Institute for Transportation and Development Policy. Applying this standard to Marikina City in Metro Manila would mean setting up 215 stations about a five-minute walk apart from each other over a land area of 21.52 square kilometers. This arrangement would help since small-scale pilots limit the appeal of the system (Institute for Transportation and Development Policy, 2013). For instance, Taipei's YouBike system was re-launched at a larger scale because its initial 500 bicycles and 11 stations were spread over too small of an area to attract large groups of riders (Smith, 2014).

Because the streets of Metro Manila are shared by a variety of public transport modes, bicycle sharing will require coordinating multiple departments and agencies, including transport and communications, land use and planning, infrastructure, finance, health, and statistics. Planning for a bicycle sharing system in Metro Manila will also necessitate engaging different local government units and their constituents. Effective multi-stakeholder engagement could help demonstrate how a public transport system covering smaller roads and stations can be scaled up or down and relocated to accommodate quickly changing commuter demands. Similar to Toyama, this this will also demonstrate the diversity of benefits offered to different segments of society.

3.4 Thailand: Nationally Appropriate Mitigation Action (NAMA) for Sustainable Low Carbon Transport

3.4.1 Background

Thailand's transport sector is a major source of development and GHG emissions. In 2014, Thailand's energy-related CO_2 emissions were 218.6 Mt CO_2eq; the transport sector accounted for about 23% or 50.3 Mt CO_2eq of that total (Department of Alternative Energy Development and Efficiency, 2014). Within the transport sector, road transport was responsible for 97% of emissions (Office of Transport and Traffic Policy and Planning, 2012).

Several government agencies are responsible for reducing GHG emissions from the transport sector. The Ministry of Natural Resources and Environment (MONRE) serves as the lead agency for climate policy in Thailand. It cooperates with other line agencies such as the Ministry of Transport (MOT), Ministry of Energy (MOE) and Ministry of Agriculture (MOA). Meanwhile, the Office of Natural Resources and Environmental Policy and Planning helps formulate climate change policies as the secretariat of National Committee on Climate Change Policies Thailand's Climate Change Master Plan 2013-2050 resulted from collaboration across these agencies. Thailand's transport Nationally Appropriate Mitigation Actions (NAMAs) is a central feature of that Master Plan (Office of Transport and Traffic Policy and Planning, 2013).

3.4.2 The Co-benefits from Thailand's Transport NAMA

Thailand submitted its NAMA to the UNFCCC Secretariat in December 2014. The NAMA's domestically and internationally supported elements could achieve 7 to 20% CO_2 reductions or between 23 to 73 million tCO_2 per year by 2020. The avoid-shift-improve approach, six strategies, and five instruments are the main components of the NAMA (see Box 3.1 and Figure 3.6). A measurement, reporting and verification (MRV) system was also established to track the effect of the NAMA on GHGs and other co-benefits (Uabharadorn, 2013; Narupiti et al., 2014).

Box 3.1 The avoid-shift-improve approach

The avoid-shift-improve approach was originally developed to describe different kinds of transport policies in Germany. Since 2008, the approach has influenced transport planning in many other countries. Part of the appeal of the approach is it summarises actions that can be taken on the main factors influencing GHG emissions.

- **Avoid** unnecessary travel—Develop low carbon transport infrastructure, including urban transport systems with NMT, land-use zoning and TOD;
- **Shift** to more efficient modes—Manage travel demand, including policies promoting modal shifts and reductions in demand.
- **Improve** vehicle technologies and design—Increase efficiency in passenger and freight transport by creating incentives for energy efficient vehicles, instituting fuel economy standards and car labelling, and improving logistics efficiencies (Uabharadorn, 2013; Narupiti et al., 2014).

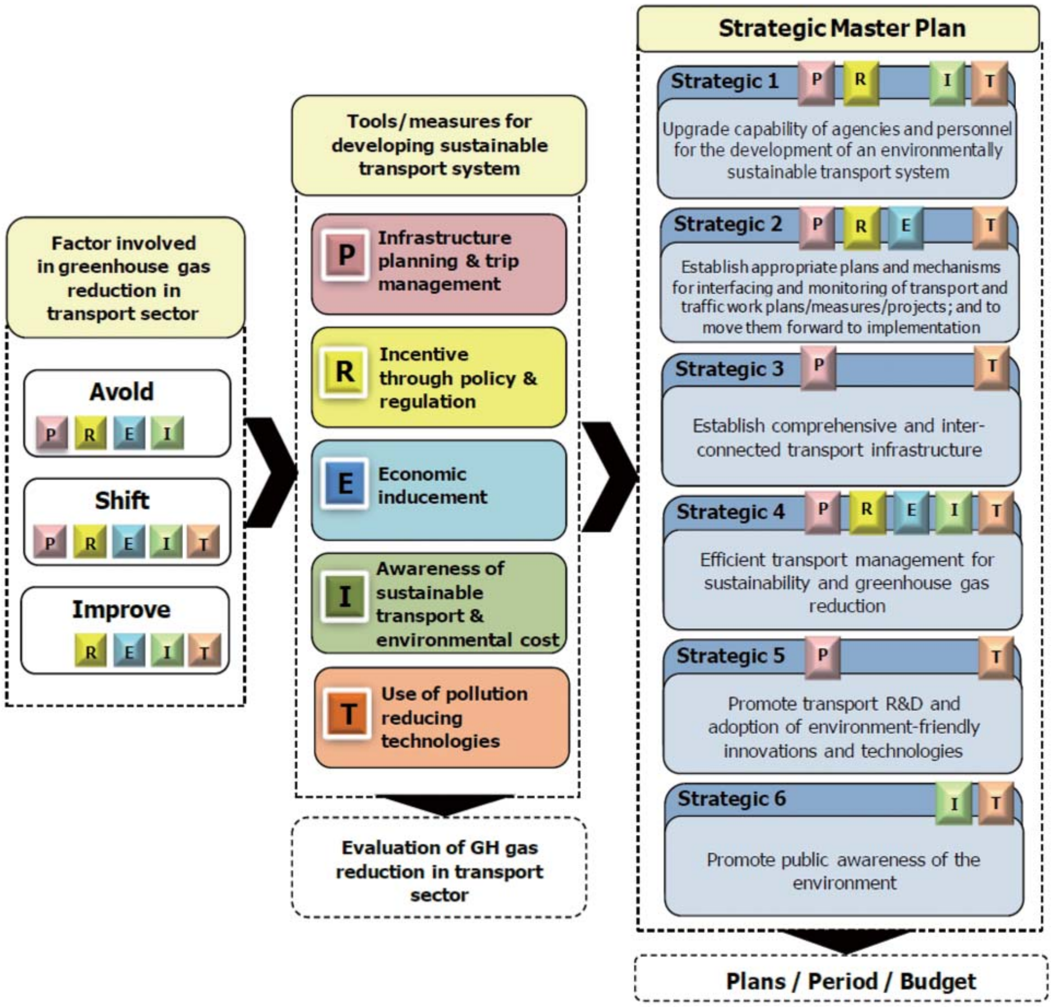

Figure 3.6 **The relationship between avoid-shift-improve, five instruments, and six strategies in the Master Plan for a Sustainable Transport System and Climate Mitigation** Source: Uabharadorn, 2013

The results of research conducted by the Thailand Greenhouse Gas Management Organisation and verified by other models shows that Thailand has significant GHG mitigation potential from a transport NAMA (Selvakkumaran & Limmeechokchai, 2015). In addition to reducing GHGs, the NAMA could cut travel times and traffic accidents; the co-benefits have been estimated for two community-based pilots (See Box 3.2). To capture these benefits, a study on the Environmental Sustainable Transport and Climate Change Master Plan 2013-2030 recommended the implementation of the NAMA. However, the implementation requires a sufficient budget that has yet to be allocated.

Box 3.2 Community-based mass transport in Muang Klang Municipality, Rayong Province

In 2014, a study was conducted on Muang Klang Municipality's community-based mass transport system. The system, which include a recently opened tram car, could reduce personal vehicle use, smooth traffic flows, and minimise GHG emissions. The estimated co-benefits from that system were reductions in fuel consumption of 29 liters per day (or 7,250 liters per year) and GHG reductions of 65 kgCO_2eq per day (or 16 tCO_2eq per year). The project could also serve as a model for other organisations interested in integrating sustainable transport and community development (Office of Transport and Traffic Policy and Planning, 2014).

3.4.3 Challenges and the Way Forward

Unfortunately, the Master Plan may fail to achieve the NAMA transport goals on schedule. Some of the key challenges include the following:

- Financial challenges: The development of the NAMA does not take into account financial constraints. Sources of investment and capacities (human, technical, and organisational resources) are not always considered during the planning process. As a result, the actual budget is often less than planned.
- Technical challenges: Technologies need to be adapted to new conditions and skills to operate technologies need to be strengthened. Monitoring of transport investment performances, including GHG emissions, is not always fully implemented.
- Informational challenges: Information/awareness barriers are common in the transport sector, especially for mass transit. Increasing awareness of sustainable transport issues requires the continued experimentation and demonstration of successful approaches to potential users.
- Policy challenges: Many essential regulations involving behavioral change are left unimplemented due to stakeholder resistance. As a result, implemented projects tend to focus on infrastructure development rather than behavioral change. This may also be attributable to organisational structures that are better prepared for hard rather than softer infrastructures.

- Institutional challenges: The MOT, MOE, and MONRE do always collaborate when formulating policies. Thus, planning and implementation by the three ministries can be fragmented.

Several actions have been recommended to overcome these challenges (Narupiti et al., 2014) including:

- Data availability and accessibility: Data is currently collected for studies on an *ad hoc* basis. Going forward, the organisation(s) that directly manages data should aim to improve data quantity and quality. The National Transport Survey could help close data gaps. Increased cooperation with the National Statistics Office would further be useful. The development of an indicator database for the transport sector could also help quantify co-benefits for NAMAs (and related projects).
- Monitoring protocols: To improve the existing monitoring system, Thailand could establish an MRV working group. The working group could assess the current MRV system, produce MRV guidelines/templates, and develop credible transport baselines. These activities could be packaged along with other capacity building opportunities for governmental officials.
- Capacity building: More capacity building and knowledge exchange could help transport-related agencies with not only NAMAs and MRV, but green freight, fuel economy, and other relevant issues.
- Implementable policies: Many policies and plans end up being difficult to implement or ill-suited for Thailand. Policies need to be tailored to local conditions and cognizant of budget constraints. Furthermore, many existing transport and related policies end up duplicating each other. To strengthen policies, international organisations need better coordination among each other and with partner agencies.
- Institutional coordination: Cooperation among relevant institutions is essential to achieving co-benefits. Available institutional bodies such as the National Committee on Climate Change Policy can play an important role in this regard. Setting key performance indicators for the MOT, MONRE and MOE would improve institutional coordination.

3.5 Discussion and Conclusions

These three case studies illustrate the importance of financing not only to initiate but ensure the sustained implementation of a transport project or policy. In the compact city of Toyama, the financing for infrastructure construction and service operation of the LRT system was addressed through private sector participation. Metro Manila is also moving towards PPPs for developing infrastructure and transport solutions. In Thailand, insufficient funds, especially for human capacity development, remain a sizable challenge. In addition to PPPs, land value capture—a mechanism in which the public recovers the land value increments (i.e. unearned income of the private land owner) for public infrastructure from developers—may have considerable potential in Asia (Suzuki et al., 2015).

The case studies also suggest carbon finance as another possible source of funding—though it will likely need to be combined with other sources as transport emission reductions are generally too small to attract sufficient finance by themselves. Obtaining carbon finance funding depends on generating an emissions baseline and evaluating emissions reduction potential. Countries could take advantage of platforms that foster knowledge exchanges and technical cooperation to systematise data collection and monitoring procedures. These platforms can can also facilitate the transfer of ideas, technologies, funds and lessons learned, as well as strengthening institutions.

Finally, the cases underline that co-benefits should feature throughout the transport planning process. There is generally a limited of integration of co-benefits in transport projects and programmes. To make transport planning more holistic, the costs and the benefits of these projects must be translated into terms that are understandable to potential beneficiaries. This will help bring beneficiaries in the transport planning process. Greater inclusivity will also result in transport plans that are not merely environmentally but socially sustainable.

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Co-benefits in the Energy and Industrial Sectors

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4.1 Introduction

Few activities contribute more to global climate change and local environmental degradation than fossil fuel combustion. Countries in Asia are increasingly seeking energy efficiency improvements and low carbon technologies to avoid the adverse effects from these activities (Puppim de Oliveira, et al., 2013). But the magnitude of required investments and inertia in various parts of the energy system often lock policymakers into unsustainable development paths (Unruh, 2002). This chapter analyses the opportunities and challenges to achieving co-benefits for three cases in Asia's energy and industry sectors. Pragmatic suggestions for overcoming key hurdles are also offered.

The three case studies operate at different levels of analysis. The first looks at a project to upgrade coal burning heat only boilers (HOB) in Ulan Bator, Mongolia (supported by Japan's Joint Credit Mechanism (JCM)). The second focuses on waste heat recovery from a cement manufacturing plant in Chongqing, China. The third examines the future development of the urban energy system in Delhi, India. The cases underscore the need to develop local capacities and maintain sustained commitments to upgrading energy systems. Building capacities and commitments is especially critical during the initial planning phase as well as an intervention's scale expands. The cases further suggest the need to acquire financing and steadily improve enabling environments for funds to flow to energy efficient and low carbon investments. The less visible *non-technical* elements of that enabling environment often have a pronounced influence on the introduction and scaling of co-benefits technologies in the energy sector.

4.2 Advanced Boilers in Mongolia

The retrofitting and renovating technologies will be critical to achieving co-benefits in many sectors in Asia. This is clearly the case in Mongolia's energy sector. Mongolia currently relies on abundant supplies of coal to meet fast-growing energy demands (such as residential and public building heating). In Ulan Bator, the capital and most populous city in Mongolia, the low calorific value of the coal used for heating increases the amount of coal required for those purposes. This is one reason that Mongolia's 6.5 tons of CO_2/year per capita emissions (from fossil fuel combustion) are higher than the global average of 4.5 tons of CO_2/year per capita (IEA, 2015). The burning of this coal by Ulan Bator's growing population has also led to heavy smog and worsening public health. A co-benefits approach could help address these problems at once.

In 2011, Mongolia and Japan agreed to a partnership to promote the JCM for low-carbon development. As part of the agreement, the Ministry of the Environment, Japan (MOEJ) initiated a 'study on co-benefits pollution control for heat only boiler (HOB)' in 2014. The study was designed to demonstrate the co-benefits from improving a small to medium sized coal-burning HOB in public facilities in Ulan Bator. The study also aimed to build capacity and provide training to strengthen environmental management in Mongolia.

4.2.1 Co-benefits

The locally manufactured HOB at No.65 school in Ulan Bator was selected for the study. Improving coal feeding devices (stokers), flue ducting, and facilities upgrading (such as heat exchange tubes, cyclone separators, and combustion air blowers) were the main interventions that the study recommended to achieve co-benefits. The improvement of this HOB was then scheduled to move forward over a three-year period (Figure 4.1).

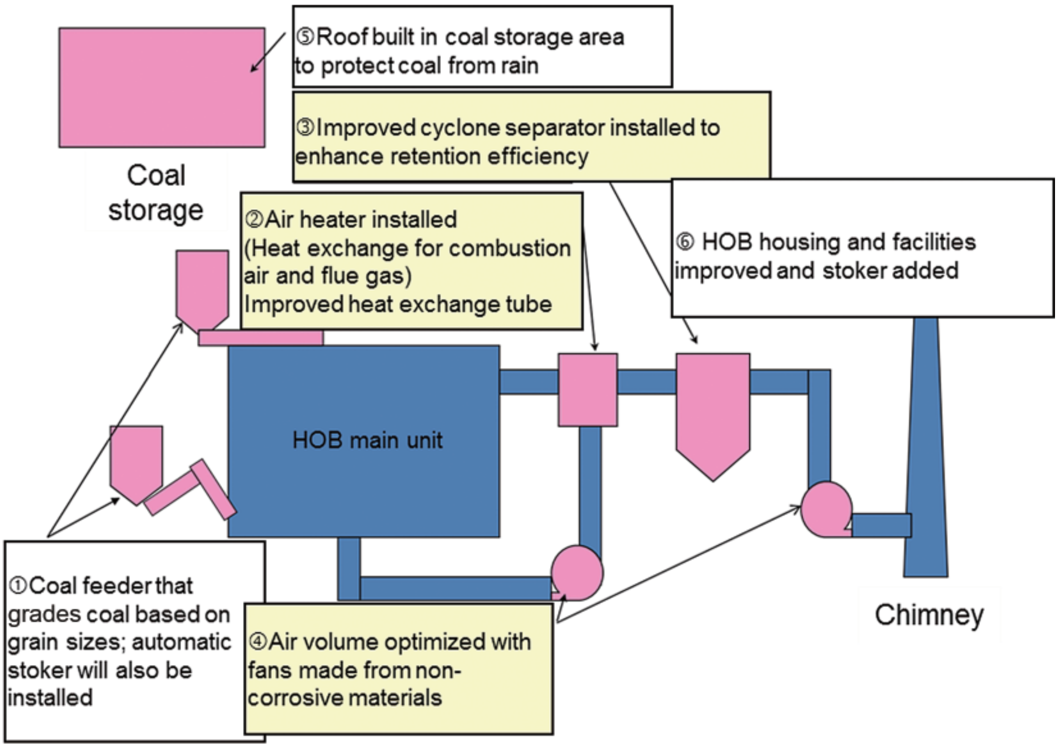


Figure 4.1 A diagram of changes designed to achieve co-benefits from a HOB Source: MOEJ, 2015

In cooperation with a Japanese boiler maker, a remodelled air heater, cyclone separator, and combustion air blower were installed on the HOB in 2014. An induction fan with an inverter was also installed to retain negative internal pressure in the furnace. These changes resulted in an approximately 50 to 70% improvements in boiler efficiency. Dust concentrations were reduced to a tenth of previous levels; nitrogen oxides (NOx), sulfur dioxide (SO_2) and particulate matter (PM) also fell sharply (See Figure 4.2 for an illustration of the improvements that led to these reductions).

Figure 4.2 **Controlling combustion by adjusting coal levels** (left: before, right: after) Source: MOEJ, 2015

At present, automatic coal feeding devices for separating pulverised from uncrushed coal are being considered to achieve other benefits. However, because large lumps of coal were included during the demonstration test, a coal lump crusher and changes to the mesh size of the sieving machine may be used to separate different sized pieces of coal. Moreover, how coal is carried from storage to the coal feeding hopper is also being carefully examined.

As a HOB has many new moving parts, regular monitoring and maintenance is important. An instruction manual was prepared in Mongolian for the HOB management company to support this regular upkeep. In addition, a training session was held for local boiler operating personnel. A workshop for operation and maintenance methods was organised not only for the boiler operating personnel but also the operating management company and boiler manufacturer technicians. Apart from these sessions, Mongolian government personnel, Ulan Bator city personnel, and technicians from a local boilermaker were invited for a study tour and technical training in Japan. During the trip, participants visited local environmental agencies, a small scale boiler manufacturing factory, and a pollutant analysis equipment manufacturer.

The study used the following methods to calculate the co-benefits from the activities in 2014. The amount of heat supply can be measured by installing a heat meter in the boiler's piping (this is a certified measurement method in Mongolia). For the parameters not related to heat supply, the calculation and settings can be estimated from actual measurement and related study results.

In the project, the weight of coal consumption, characteristics of coal, and the amount of heat supply were recorded to serve as a reference for HOBs in another Ulan Bator school. Exhaust gas was also measured to determine air pollutants and boiler efficiency emission factors. The differences between the HOBs with and without the new technology for an eight-month operation period was then used to quantify the co-benefits (results are shown in Table 4.1).

Table 4.1 **Emission reductions during the HOB operating period**

Pollutants	Emission reductions
CO_2	259 t-CO_2
SO_2	665 kg-SO_2
NOx	415 kg-NOx
CO	36,549 kg-CO
Dust	1,603 kg

Source: MOEJ, 2015

4.2.2 Challenges and the Way Forward

Factors beyond the technology improvements to the boilers will play an important role in delivering co-benefits from HOBs. These factors start with the sound operation and regular maintenance of the HOB. The efficiency of combustion depends on the operation and maintenance. Although a training and operation manual was provided, a continuous effort to steadily build capacity will be needed. In addition to the operators' capacity, higher quality coal will be critical. While an automatic coal feeder for better combustion will likely be introduced, efficient combustion will be difficult with the current quality of coal.

Another set of factors involves finance. Better financial incentives will be necessary to promote co-benefits from HOBs. Japan provides financial assistance through the embassy or the Japan International Cooperation Agency (JICA) for heating systems. Other assistance such as financing for JCM model projects may be useful as well. Demonstrating the magnitude of the co-benefits from HOBs may also bring the resources needed to spread HOBs to other installations in Mongolia.

Different components of the HOBs will be improved over the next three years to understand how upgrades contribute to co-benefits. For the remaining part of the study, improvements such as installing a coal crusher with rotary sieve that sorts coal at various sizes will be introduced; a more appropriate coal supply system from the coal yard will also be installed. If the co-benefits from each set of technical changes can be identified, HOB operators will be able consider the cost effectiveness of different investments.

To enhance capacity building, seminars in Ulan Bator and study tours to Japan (including welding training for technicians) will be held. While it is expected that this project leads to more JCM projects, recording the achievements and challenges can help shape recommendations for strengthening environmental management in Mongolia.

The development of such policies can also stimulate action in larger scale industries. This is important as action needs to be taken and replicated across the energy-industrial system. An increase in scale may also lead to more co-benefits. The next case examines the experience of a larger scale intervention, a Chinese cement plant's efforts to use waste heat.

4.3 Waste Heat Power Project in Chongqing, China

The energy intensity and carbon intensity targets included in China's 11th and 12th five-year plans have helped reduce emissions from heavy industry. Many of the efforts to improve energy efficiency and carbon intensity to meet the targets have had additional positive impacts on air quality and the surrounding environment. Recognising the potential for co-benefits, China's Ministry of Environmental Protection has promoted projects in the iron, steel, cement, and transportation industries that can simultaneously control air pollution and greenhouse gas (GHG) emissions (Peng, 2011). One of the key 'co-control' demonstration projects is located in Chongqing.

Chongqing, with an area of 82,400 square kilometres and 30 million people, is western China's largest and most populous city. Due to its size and population, it is classified as one of four provincial levels cities—thus sharing the same administrative rank as China's provincial governments. Like many other cities in western China, Chongqing is rich in coal and gas, making it home to several heavy industries. The Chongqing Fufeng Cement Waste Heat Recovery for Power Generation Project, a 9MW installation developed by Chongqing Fufeng Cement Group Special Cement Co., Ltd, is one such project (CDM Executive Board, 2006, 2013; Tepia Corporation, 2010). The Fufeng plant is located in the Hechuan district in Northwestern Chongqing (see indicated section in yellow in Figure 4.3)

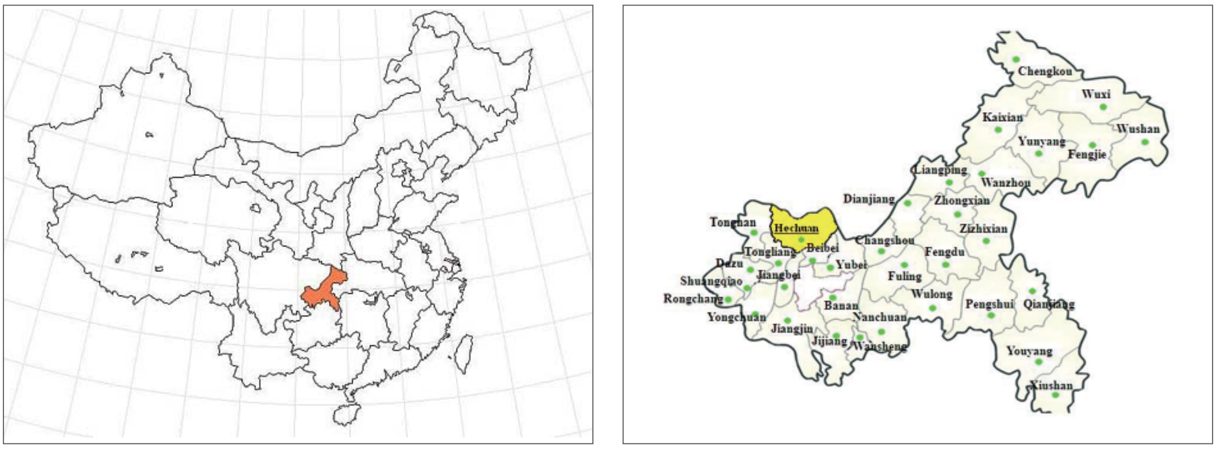


Figure 4.3 **Chongqing's location in China and Hechuan's district location in Chongqing**

Source: Tepia Corporation, 2010

4.3.1 Co-benefits

The owner of the Fufeng plant installed a waste heat recovery system, which included a 9MW electricity generation system set up on two cement production rotary kilns, with capacities of 1500 and 4500 tons/day respectively. The electricity system consisted of two preheater boilers, two air quenching coolers boilers, and a 9MW steam turbine and generator for power generation. All of the generated power was used for cement production. Ultimately, the owner was able to replace the purchase of energy with combined cycle power generation (CCPG). This, in turn, reduced the project's GHG and SO_2 emissions; thus effectively achieving co-control (*Ibid*).

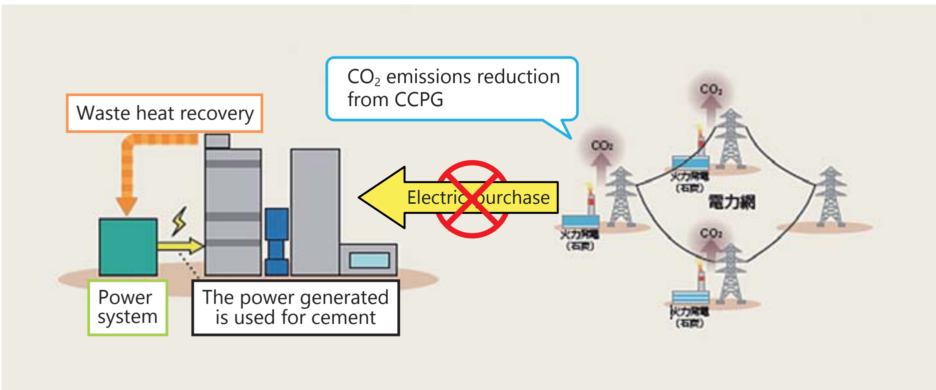


Figure 4.4 **Illustration of the Chongqing Project** Source: Tepia Corporation, 2010

The project started operation on November 22, 2011. Over the following years, Chongqing Fufeng Cement Group Co., Ltd. power purchased CCPG 61,236MWh annually. It is therefore expected to reduce 52,225 tons of CO_2 emissions and 590.5 tons of SO_2. The net electricity exported by the project during this monitoring period was 24,480 MWh and the emission reduction was 18,866 tons of CO_2 (between November 2012 and July 2013). An environmental impact assessment also showed noise, waste water and exhaust gases complied with relevant Chinese national standards. Another co-benefit from the project was the improved stability of the power supply and fewer blackouts (CDM Executive Board, 2013; Tepia Corporation, 2010).[1]

1 These estimated reductions were similar to those made by the Tepia Corporation Japan Co., Ltd. Those estimates suggest that the project would generate 62,320 MWh of electricity and reduce 44,392 tCO2e.

Table 4.2 Reductions from Chongqing Fufeng Waste Heat to Power Generation Project between November 2012-July 2013

Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered project design document		31,074 tons of CO_2
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period		18,866 tons of CO_2
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during:	the period up to December 31, 2012	4,663 tons of CO_2
	the period from January 1, 2013 onwards	14,203 tons of CO_2
Monthly CO_2 reductions	2012	3,331 tons of CO_2
	2013	2,029 tons of CO_2

Source: CDM Executive Board, 2013

4.3.2 Challenges and the Way Forward

While the project achieved the above co-benefits, it also encountered several challenges. In 2008, an review of financing revealed that the project would not meet the standard internal return on revenue (IRR) benchmark of 11% IRR (Wang et al. 2007). This is often the case with small-scale energy projects. Fortunately, the project investors sought additional finance from the Clean Development Mechanism (CDM). Under the CDM, the reductions could then be applied as certified emissions reductions to offset a comparable amount of emissions in developed countries. Beginning in 2005, China devoted significant amounts of time and energy to building capacity for CDM projects (CNCCCC, 2005). In this case, the additional funding meant that the IRR improved from 6.96% to 12.64%.

A separate set of challenges involved the scalability of the project. The initial plan for CPA-1 Chongqing plant waste heat power generation project was to engage more than one company; this would reduce more emissions and generate more carbon credits. But the lack of a fully operational coordination mechanism meant that only the *lone* CPA-1 Chongqing Fufeng cement plant waste heat power generation project was implemented. There were also concerns as to whether Tepia Corporation Japan Co., Ltd, one of the main investors in the project could comply with local administrative regulations and rules—incompatibility between the CDM and domestic regulations has been a problem in other projects (Wang, 2010). This potential hurdle was eventually cleared due to effective communication between the Chongqing CDM Technology Service Centre, the Chongqing Fufeng Cement Group Company, the municipal government, the municipal environmental protection bureau, the economic and trade commission, and surrounding businesses and residents.

Frequent changes in the leadership of the cement plant presented one final challenge. Although turnover did not have a direct impact on the implementation and operation of the project, it did have an indirect effect because managers needed to understand how the CDM functioned and operated. However, knowledge of the CDM proved difficult to pass on from one manager to another.

In the end, several general lessons can be distilled from this case study. First, there is significant potential to save energy, reduce GHG emissions, and achieve other local environmental benefits from heavy industries. This potential can at times be difficult to realise because the current investment landscape does not always put a monetary value on climate and other co-benefits. Carbon offset mechanisms can help change the financial landscape, offering enough investment to push funding levels over needed IRR thresholds. At the same time, the amount of carbon finance would probably be even greater if there were stronger between the allocated resources and the co-benefits of a project.

Another lesson involves the institutional arrangements. Implementing a project necessitates not only greater finance but also institutional arrangements that facilitate communication between multiple stakeholders at multiple levels. It would also be helpful if these arrangements can be strengthened in order to sustain institutional memory. Creating multi-year capacity building programmes within the allocation of climate finance could help greatly with this endeavour, and promises to play an even greater role in countries that have less experience and commitment to the CDM than China (Lewis, 2010).

As the ambition for emissions reduction grows, so do the complexities of the interventions. Long-term planning and modelling of different scenarios can provide pathways to achieve efficiencies and co-benefits across sectors. Some of the barriers mentioned here regarding coordination and regulation can be anticipated in scenarios that factor in potential constraints for implementation. The final case study of this chapter employs an integrated modelling approach examines the range of options and level of co-benefits available to cities.

4.4 An Integrated Urban Energy Model for Delhi, India

Cities are increasingly being recognised as major contributors to climate change, consuming two-thirds of global primary energy and generating about 71% of energy-related CO_2 emissions—a figure that is expected to rise to 76% by 2030 (IEA, 2008). Furthermore, even though cities are typically viewed as net energy consumers supplied by external resources, there are actually significant opportunities for local energy generation within cities. Therefore, both supply and demand sides of the energy equation should be taken into account when defining an urban energy system. A myriad of technology options and control strategies are available in both these realms that should be considered for future urban energy systems.

An urban energy system is defined as the combined processes of producing and using different forms of energy to satisfy the demand of a given urban area (Keirstead et al., 2012). In such a complex environment, there are a range of sources of both emissions and energy generation. Delhi, India has the highest per capita power consumption of electricity among the Indian states. The per capita consumption per annum of electricity in Delhi has increased from 1259 kWh in 2000-01 to 1340 kWh in 2010-11 with domestic customers dominating the electricity consumption profile (WEC, 2014). The total consumption of electricity in the domestic sector (residential, commercial and transportation) as a percentage of total demand increased to 80% in 2010. Total consumption of electricity in Delhi during 2011-12 was 21,700 GWh, out of which 17,766 GWh was used for domestic uses, 2989 GWh for industry and the remainder for other uses (DESGNCTD, 2012). Delhi's government faces a big challenge in the near future when it comes to managing the significant social and environmental consequences of the rapidly rising demand for energy in the domestic sector.

4.4.1 The Co-benefits Model

Delhi faces two concurrent electricity sector problems that are very likely escalate: 1) the rapid increase of electricity demand; and 2) the lack of sufficient generating capacity to meet the demand with a high level of system losses. To analyse how this can be managed an integrated energy model was developed considering the city's urban form, its economic activities, and how this translates into both energy supply and demand. The technical details of the model are given in Farzaneh et al. (2016) and a schematic diagram is shown in Figure 4.5. The model aims to balance supply and demand into the future by considering a range of technologies and their costs. The model is also set up to focus on the efficiency of end-use technology and low-carbon energy generation.

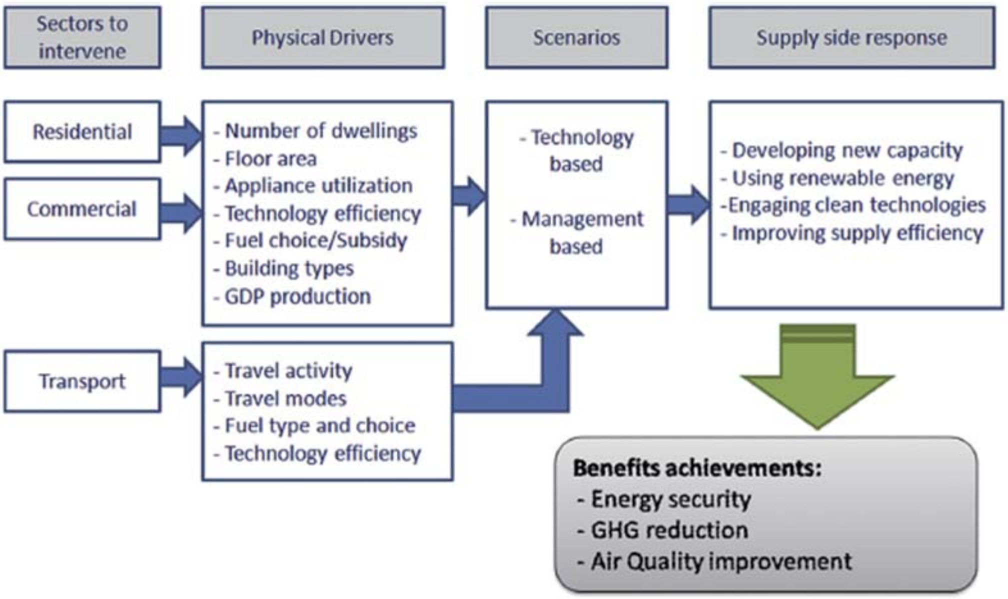


Figure 4.5 Framework for the implementation of energy related policies in the model

Source: Farzaneh, et al. 2016 (see acknowledgements)

The baseline scenario computes energy consumption assuming the availability of energy resources and then estimates the emissions for the base year 2012. It is notable that, in spite of about 63.62 petajoules (17,660.9 GWh) electricity supply, Delhi struggles to meet increasing electricity demand. The energy demand and supply gap in 2012 was calculated at about 0.378 petajoules (105.1 GWh).

At present, renewable energy contributes around 10% share of the total power generating capacity of Delhi. With co-benefits in mind, this case focuses on solar energy, which has the advantage of facilitating the decentralised generation of electricity. Although Delhi has sufficient potential for solar energy, solar photovoltaics (PV) make up a negligible contribution to the region's electricity generation mix at present. The potential to build rooftop solar PV in Delhi is estimated at about 2.5 GW using only 1.6% of the city's roof space (Gambhir et al., 2012). The Indian government has a stated goal of achieving 175GW of installed renewable energy capacity by 2020, of which 100GW will be solar (Mittal, 2015).

With many options available, the analysis considers an optimal scenario proposed with the objective of developing an urban energy system with zero electricity deficiency and lower carbon emissions. The scenario is also consistent with a co-benefits approach (See Table 4.3).

Two major policy interventions are considered in this scenario as alternatives to load-shedding which are listed as follows:

- On-site generation of electricity to supplement the power with more of a focus on alternative energy sources (supply side).
- Reducing electricity consumption in households and buildings through improvements to end-use efficiency (demand side).

The large amount of municipal solid waste in Delhi would also allow for development of waste-to-electricity technology to supplement local installed power generating capacity. Solid waste management remains one of the most neglected sectors in the state of Delhi, the largest producer of solid waste in India. Delhi's total municipal solid waste is estimated about 8,000 tonnes per day, contributing about 80% of the total CH_4 emissions (CERAG, 2011). About 65% of this amount is disposed of in landfills, and the remaining part is available for composting and waste-to-electricity.

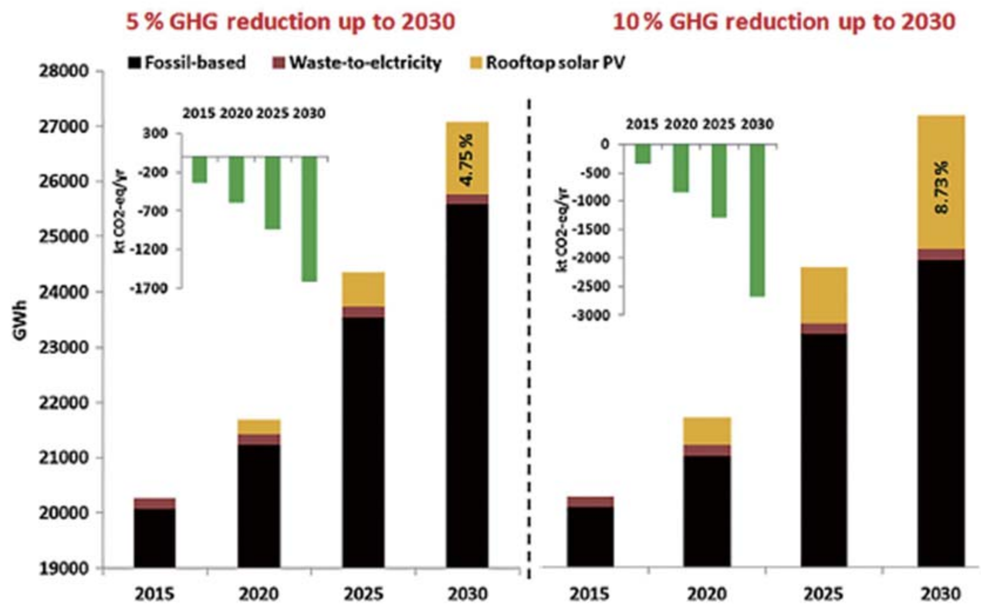
With regard to energy efficiency, the primary strategies considered are improving lighting efficiency by replacing regular lights with compact fluorescent lighting and improving the efficiency of air conditioners.

Table 4.3 **Co-benefits of increased demand being met by renewables and end use efficiency**

Kt/yr	Baseline	After Intervention	Co-benefit
CO	48.10	47.31	-0.79
NMHC	2.17	2.16	-0.01
NOx	77.80	77.18	-0.62
SO_2	205.50	202.68	-2.82
PM_{10}	9.53	9.43	-0.1
$PM_{2.5}$	2.98	2.93	-0.05

Source: authors

The optimal scenario is designed to account for planned installed capacity; it therefore represents a likely scenario. Further reducing Delhi's carbon emissions could be achieved through the promotion of end-user efficiency and the deployment of rooftop solar PV; this would allow excess generating capacity to reduce the dependency on power from outside or even to be sold back into the grid. Figure 4.6 shows how the future might work towards 5% and 10% GHG emissions reduction by 2030 through establishing a zero electricity deficiency system with progressive support from the use of rooftop PV technology in Delhi's electricity supply.



Modeling assumptions 1) The promotion of EEE at end-user level is same (220 GWh per annum) for both scenarios
2) The annual grid tariff escalation is considered to be 5% by 2030
3) The annual reduction in solar cost is considered to be 5.5% by 2030

Figure 4.6 **Electricity source mix in the two scenarios to 2030**

Source: Farzaneh, et al. 2016 (see acknowledgements)

4.4.2 Challenges and the Way Forward

The results show that demand-side promotion of energy efficient electricity (EEE) is much faster to implement, making it the cost-effective option to meet the electricity deficit since the implementation of the plan is estimated to be 2015.

A major challenge when using such a model lies in its data requirements (and especially matching electricity supply to the urban boundary). Nonetheless, the deployment of the model at the preliminary stages of design can help local governments and property owners assess and prioritise interventions and develop appropriate policies for the urban energy system.

While some of the analysed energy policies are clearly technical, many require social changes, especially in the transport and waste sectors. Improving energy efficiency and public transport usage will not happen without behavioural and lifestyle changes. Ensuring that waste is of a high enough quality may require household-level interventions. It is therefore incumbent upon cities to understand how to design and implement policies that go beyond technologies to achieve the solutions that lead to a more sustainable urban future.

4.5 Discussion and Conclusions

The three cases highlighted in this chapter cover different scales from the local (firm-level) to city-level management issues. The cases all start with a modification to existing practices. The Mongolian case shows the complexity of even a seemingly simple retrofit of a single boiler. Entrenched practices and availability and the poor quality of local resources often means that the search for co-benefits has to start at a rather elementary level before considering more advanced approaches to energy generation. Similarly, the Chinese case also brings up issues of capacity and the broader enabling environment that is required for successful achievement of co-benefits. In both cases, coordination with the municipality was needed for the interventions to be effective.

Finance features as an ever-present theme in most projects; the two cases of implementation both show that getting adequate support is critical in getting projects off the ground. In the Chongqing case, an entire waste heat recovery system found supplementary funding from the CDM, but in Mongolia the project was designed and implemented in a modular fashion, which may provide a more affordable way of at least generating some co-benefits.

The Delhi case highlights the central role that the energy system can play in connecting different sectors at the city level, emphasising that both clean generation as well as end use efficiency are necessary to maximise co-benefits. The theme of co-generation featured in the both the Indian and Chinese cases mitigated the risk of blackouts to the host city. Such technologies are seen as attractive to rapidly growing cities where energy demand can quickly outstrip supply. The need to balance these considerations is an important theme in the Delhi case, which is already experiencing electricity shortages.

While general planning cannot neglect local conditions (such as coal or waste quality), the more salient point is how to use the output of models to guide the current modes of operation (and to generate plausible scenarios) in order to come up with strategies that are both implementable and ambitious. The often neglected issue of training and continuous professional development of both operators and managers features prominently in the implementation cases. The recognition of this need, and of the need for stable management, is encouraging—not just at the firm but also city level if long-term visions are to be translated into tangible actions. The cases also reflect the varying level of ambition in how activities need to be rapidly replicated and scaled up to achieve the level of emissions reductions that will fulfil the potential of carbon mitigation and make a meaningful impact on local air pollution and other co-benefits.

Acknowledgement

The text and figures (except Table 4.3) in section 4.4 are reprinted from the Farzaneh, H., Doll C.N.H., Puppim de Oliveira, J.A. (2016) An integrated-systematic model for optimization of energy flow in the urban energy system. *Journal of Cleaner Production*, 269–285, Copyright (2016), with permission from Elsevier

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Conclusion and Key Messages

Eric Zusman, Kaoru Akahoshi, and So-Young Lee/IGES

5.1 Introduction

Since the 1990s, policymakers and researchers have exhibited a growing interest in co-benefits—defined as the multiple benefits of actions that mitigate climate change and achieve other development objectives (Ayres & Walter, 1991; Krupnick et al., 2000; Mayrhofer & Gupta, 2016; Nemet et al., 2010; Pearce, 2000). A sharp rise in interest in co-benefits in Asia over the past decade (Takemoto et al., 2012) arguably reflects desires to mitigate climate change while simultaneously achieving other environmental and socioeconomic priorities. It also likely stems from the realisation that many policies and measures that abate short-lived climate pollutants could help avoid near–term warming while improving local air quality and public health in Asia (UNEP/WMO, 2011; UNEP, 2011). Because of this momentum, there is a growing opportunity to align climate change responses with development imperatives in Asia (ACP, 2014).

Part of this opportunity stems from deepening interactions between governments and international policymaking processes. The approval of the Paris Agreement, for instance, has strengthened incentives to acquire development-friendly carbon finance through a new Sustainable Development Mechanism (the successor to the Clean Development Mechanism). The Paris Agreement's 'integrated and holistic' non-market approaches may similarly incentivise multi-benefit climate solutions (UNFCCC, 2015a). References to sustainable development in the recently pledged Intended Nationally Determined Contributions (INDCs) suggest countries are making climate-development linkages when formulating national climate responses (UNFCCC, 2015b). The international community's embrace of a new set of Sustainable Development Goals (SDGs) and the 2030 Development Agenda could further aid countries in taking actions that leverage interactions across multiple goals, including climate and other development targets (UN, 2015). The fact that the SDGs promote moving 'beyond sectors' complements the principles underpinning co-benefits (IGES, 2015; Waage & Yap, 2015).

But even with growing national and subnational interest and expanding international incentives, there remain gaps in how co-benefits can be achieved in practice (Zusman et al., 2012). The second Asian Co-benefits Partnership's (ACP) White Paper helps identify critical challenges in the Asia's transport, waste management, and energy sectors. It also offers pragmatic suggestions for how policymakers and other stakeholders can overcome these hurdles. This chapter concludes with a review of main findings and key messages from the case studies presented in Chapters 2 to 4. Directions for future research are also described briefly.

5.2 Chapter Summaries

Chapter 2 focused on cases in the waste sector. It began with the case of Kawasaki City as an illustration of Japan's transition to increasingly eco-friendly solid waste management policies and practices. The chapter asserts that long-term budgeting for recycling processes and the innovative monitoring of illegal dumping may help Kawasaki City realise additional climate and other co-benefits. The next case study, on solid waste management in Dhaka, Bangladesh, discussed leveraging international carbon finance to fill funding shortfalls and acquire capacity building and technical support to facilitate the construction of waste management facilities. The final case study in Chapter 2, on Indonesia's palm industry, underlined how national and local stakeholders are turning palm oil into revenue streams, new employment opportunities, and low carbon fuels. At the same time, it recommended careful consideration on the siting of palm oil mills to avoid releasing GHGs from peatlands and gradually enhancing compliance with existing environmental regulations.

Chapter 3 focused on case studies in the transport sector. It started by highlighting the multiple benefits from transport-oriented development in the compact city of Toyama, Japan. It nonetheless suggested greater co-benefits could be achieved by employing a broader range of environmental, social, and economic indicators to assess the performance of urban planning solutions as well as securing long-term finances for improving infrastructure construction and service operation. The next case looked at opportunities for bicycling sharing in Metro Manila, Philippines. The case demonstrated the need for robust and harmonised data collection routines; strengthening public and private partnerships (PPPs) for non-motorized transport (NMT); and multi-stakeholder planning to tailor NMT programmes to varying local contexts. The final case in Chapter 3 covered the formulation Nationally Appropriate Mitigation Actions (NAMAs) in Thailand's transport sector. It underscored the importance of considering finance in the early stages of the NAMA planning. It further recommended continuous capacity building for sustainable transport and working with international partners to strengthen alignments between existing sectoral and newly formulated climate policies such as NAMAs.

Chapter 4 concentrated on cases of gradually greater scale within Asia's energy and industrial sectors. It began with the case of heating oil boilers (HOB) in Mongolia, highlighting the energy savings, air quality improvements, and climate protection benefits provided by more efficient boilers. Capturing these benefits will require harvesting better quality coal, strengthening financial incentives for investing in efficient technologies, and sustaining capacity building programmes related to the installation and dissemination of the HOBs. The next case examined a waste heat-to-energy project in Chongqing, China. It underscored the importance of institutional architectures that encourage multi-stakeholder engagement; multi-year capacity programs to retain institutional memory; and pursuing expanding pools of climate finance to improve the initial financial outlook for energy efficiency projects. The final case concentrated on the potential co-benefits from a series of reforms to the urban energy sector in Delhi, India. As with other cases in Chapter 4, it called for mechanisms facilitating communication between property holders and the local government as well as continual awareness raising regarding the benefits of energy saving and conservation.

Table 5.1 Summary of case study challenges and solutions

	Country/City	Challenges	Solutions
[Chapter 2] Waste Management	Japan/ Kawasaki	• Limited long-term budget • Illegal dumping of chargeable waste	• Market expansion for recyclables and stable procurement practices • Promotion of waste separation/collection and green purchasing • Innovative monitoring and awareness raising of dumping • Strengthening extended producer responsibility laws
	Bangladesh/ Dhaka	• Lack of public awareness • Scarcity of land for solid waste facilities • Limited financial standing and institutional capacity	• Raising international capital for waste disposal site improvements • Re-engineering landfills to realize climate and other co-benefits
	Indonesia/ Palm Oil Industry	• Lack of methane capture regulation • High initial investment costs • Net carbon increases from siting of palm oil mills on peatland • Absence of electricity grid	• Strengthen capacities to improve regulatory compliance • Expanding the market for palm oil
[Chapter 3] Transport	Japan/ Toyama	• Necessity of upgrading public transport • Moderate levels of public awareness	• Applying performance evaluation frameworks with environmental, social, and economic indicators • Securing finances for infrastructure construction and service operation
	Philippines/ Metro Manila	• Lack of protected infrastructure for safe cycling • Limited financial/ institutional capacity • Lack of robust data and data gathering protocols	• Strengthening of PPPs • Promoting multi-organisational mobility planning • Harmonising data collection protocols
	Thailand/ NAMA	• Lack of financial planning • Lack of technical skills • Resistance from groups affected by NAMA	• Long-term engagement and capacity building • Aligning existing policies with the NAMA
[Chapter 4] Energy/Industry	Mongolia/ Ulan Bator	• Lack of operator capacity • Lack of financial incentives • Low quality coal	• Institutional capacity building programmes • Improved data availability/accessibility
	China/ Chongqing	• Lack of sufficient financing • Frequent leadership changes • Project scalability	• Acquiring carbon finance • Multi-year capacity building programme
	India/ Delhi	• Lack of data • Multiple stakeholders involved multi-sector energy saving programme	• Multi-stakeholder engagement mechanism • Continuous awareness raising • Improved data collection and monitoring practices

5.3 Key Messages

Overall the case studies shed light on the growing number of activities that could achieve climate and other development objectives in Asia. These activities can be found in Asia's densely populated cities and sparsely populated communities. They can be seen in small-scale energy projects and large-scale national transport plans. And they are being pursued by governmental and non-state stakeholders. Even with this diverse collection of locations, scales, and actors, several unifying messages can be distilled from the chapters. The eight most salient messages follow below.

1. **Policymakers need to steadily improve co-benefits data collection and monitoring processes.** Many cases highlighted the need for robust data and standardised reporting protocols as crucial to quantifying co-benefits. Several cases also suggest that multiple—as opposed to single—sets of performance indicators would make management and programme operations more sustainable. Improving the quality and quantity of data as well as capacities to work with modelling results will be critical to achieving these goals. Better data collection and monitoring processes are equally essential. An increasingly rigorous process that helps governments work toward better data is thus much needed in Asia.

2. **Governments should seek local expertise and international collaboration when gathering, analysing, and sharing co-benefits data.** Collaborative partnerships with local universities and international organisations can support and help routinise data gathering processes. A growing number of informal networks and partnerships emphasise co-benefits directly (C40 Cities, 2015) or are launching programmes that can help achieve them (ICLEI, 2015). These networks can lend support and raise the profile of data gathering efforts. The ACP could also play a facilitating role in gathering and analysing co-benefits. For many projects and plans, this could be done relatively easily with data gathering for climate change actions such as NAMAs and INDCs. Case studies showing how data was compiled for NAMAs and INDCs and then translated into estimates of other development outcomes could help spread valuable knowledge.

3. **Capacity building of co-benefits needs to be sustained and fit-for-purpose.** Many of the cases illustrated that the most significant challenge is not introducing a project and policy that can achieve co-benefits, it is continuing to sustain its operations. It will be particularly critical for projects that are financed with international technical assistance that these longer-term needs are taken into account. It would be preferable if the data gathered were tailored to suit the requirements of government and/or other stakeholders. At the same time, improving the quantity and quality of data may be necessary but not sufficient. Policymakers need to think carefully about the institutional reforms required to realise co-benefits across a wide variety of sectors.

4. **Institutional reforms across multiple levels and sectors are critical for maximising the co-benefits of innovative solutions.** Many of the cases focused on innovative solutions to climate and development challenges. Several of the cases also highlighted certain supportive or enabling technologies needed to introduce innovative technologies with co-benefits—for example, the limited electricity grid inhibits the potential for palm oil in Indonesia. It is nonetheless usually the less visible institutional, as opposed to technological, arrangements that make possible the innovations needed to maximise co-benefits. In terms of institutions, many of the chapters suggest that policies or projects with multiple benefits require better coordination within and across government agencies, businesses, and civil society organisations. This message resonates with work on multi-stakeholder, multi-level governance (Betsill & Bulkeley, 2006; Bulkeley & Betsill, 2005).

5. **Scaling up with co-benefits innovations requires aligning diverse stakeholder interests.** Many of the cases suggested the need to replicate successful approaches to energy generation, public transport, and recycling. Doing so will require a clear understanding of how different agencies and non-governmental stakeholders can work together toward a common goal. It will be increasingly important to look at how decentralising administrative and fiscal reforms over the past two decades has influenced the multi-directional sharing of ideas across cities and communities in Asia. There should also be careful attention to whether an approach that is successful in one context is likely to perform well in another.

6. **Policymakers need consider not only the magnitude, but also the distribution of co-benefits.** Decisions related to co-benefits are made by politicians whose interests are often to retain their jobs rather than maximise climate and other benefits. Because of this reality, it is critical to not just identify the magnitude, but also the recipients of benefits. This can be done by looking closely at the distributional effects of co-benefit reforms on existing jobs and revenue streams. Re-training programmes that help communities' transition from energy-intensive industries promise to be a growing area of need. Compensatory programmes for stakeholders who stand to lose out on innovative reforms could prove equally essential. Studies on sustainability transitions can also help reveal how links between local and global benefits can help break energy-intensive infrastructure lock-ins and achieve scalable change (Markard et al., 2012).

7. **Public finance can help start a co-benefits project; the private sector is critical for making a project financially viable in the medium to long-term.** Several chapters underlined the need for sustaining financing following an initial injection of public finance. Investments from the private sector can improve the medium- and longer-term funding outlook for a project or policy. Securing additional capital could involve, for instance, PPPs or land value capture. Carbon finance through many of the climate finance mechanisms profiled in Chapter 1 can also help make projects and programmes commercially viable. In many cases, acquiring and maintaining finance will be facilitated by engaging the private sector early in the planning process.

8. **Continued public awareness raising can also improve the performance of a project or policy.** In much the same way that private finance can give a project momentum, continual awareness raising is needed to make a project or programme politically attractive. Making sure key stakeholders are aware and conversant with the benefits over the long-term will help ensure politicians work toward realising those benefits. Low levels of awareness make it more difficult and costly to monitor the progress of a project or policy. Innovative ways of raising awareness will also help limit non-compliance with key policies—for instance, illegal dumping of waste or protecting cyclists.

5.4 Concluding Thoughts

Though the key messages are presented separately, they build off each other. In fact, when they are linked together they highlight the steps that policymakers and other actors will need to achieve development priorities at the same time as climate objectives. That is, messages 1 through 8 offer a sequence of considerations that stakeholders need to initiate, formulate, implement, and spread co-benefits solutions.

The messages also underline a subtle shift in research on co-benefits. That shift involves moving from quantifying co-benefits to the institutional reforms needed to bring them to fruition. This suggests there is a growing role for fields of research that have not interacted much with work on co-benefits. This includes some of the already referenced research in multilevel, multi-stakeholder governance and sustainability transitions (Betsill & Bulkeley, 2006; Bulkeley & Betsill, 2005; Markard et al., 2012). It also involves links with more established fields of study such as political economy and sociology (Mayrhofer & Gupta, 2016). The challenge for the next generation of researchers will be to integrate research that focuses on actors and institutions that play a role in realising co-benefits into modelling frameworks that, by necessity, assume them away. Just as it is critical to bring co-benefits estimates to policymakers, it will be essential to bring the policymaking processes into models analysing them. This second ACP White Paper takes important steps in that direction.

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