



# FUTURE CARBON FUND

Delivering Co-Benefits  
for Sustainable Development

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6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines  
Tel +63 2 632 4444; Fax +63 2 636 2444  
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# Foreword

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Asia and the Pacific is an evolving development story. While the region has made substantial gains in reducing income poverty in the recent decades, some 400 million people still live in extreme income poverty. Home to more than 60% of the world's population and 62% of the global economic output, the region still faces enormous development challenges. With economic growth, the region has also become a major source of greenhouse gas (GHG) emissions. This has exposed Asia and the Pacific to the vagaries of climate change, threatening to undo the development gains from economic prosperity over the past decades.

Action on climate change is central to the Asian Development Bank (ADB) vision of an Asia and the Pacific free of poverty and its mission to help its developing member countries (DMCs) improve the living conditions and quality of life of their people. ADB plays an important role in leading the region to a green growth path through financing and innovative technologies. Given the region's vulnerability to the impacts of climate change, ADB approved almost \$20 billion for climate financing from 2011 to 2016—\$17.2 billion from ADB's own resources while leveraging over \$2.7 billion from external resources. As commitment to supporting DMCs in confronting the climate challenges, ADB has set a more ambitious target of \$6 billion in annual climate financing from its own resources by 2020.

Aligning with this commitment, ADB established its Climate Change Operational Framework 2017–2030 to provide broad direction and guidance in enhancing resilience and strengthening climate actions in ADB operations and business processes. It positions ADB to facilitate, collaboratively and proactively, a regional shift toward a low GHG emissions and climate-resilient development path. It provides a framework for support to ADB DMCs in meeting their climate commitments and development objectives under the Paris Agreement, the United Nations Sustainable Development Goals, and the Sendai Framework for Disaster Risk Reduction.

ADB's engagement with carbon markets is one of the pillars of its climate change program. Operational since 2009, the Future Carbon Fund supports GHG emission reduction efforts in Asia and the Pacific by providing carbon finance through the prepurchase of certified emission reductions generated by Clean Development Mechanism projects from 2013

to 2020. The FCF is rendering bridging and enabling support to a portfolio of high quality mitigation projects by purchasing more than 10 million CERs, incentivizing successful implementation of the GHG mitigation efforts and enhancing the competitiveness of low-carbon technologies. This assumes all the more significance under the prevailing transitional phase for the international carbon market.

This report reflects how Clean Development Mechanism projects supported by the Future Carbon Fund not only reduce GHG emissions but deliver a host of social, environmental, and economic co-benefits for communities, all contributing to the sustainable development in the region.

It is my sincere hope that lessons learned from the successful operation of the Future Carbon Fund will inspire enhanced integration of sustainable development goals into low-carbon projects so that the complementary relationship between climate change mitigation and sustainable development can be further strengthened.



**Amy S.P. Leung**  
Director General  
Sustainable Development and Climate Change Department  
Asian Development Bank



# Preface

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In 2015, UN Member States formally adopted the Agenda 2030 for Sustainable Development and its 17 Sustainable Development Goals (SDGs) to end poverty, protect the planet, and ensure prosperity for all. The agenda is a roadmap for people and the planet to ensure sustainable social, environmental, and economic progress worldwide.

In the same year, the Parties to the UN Framework Convention on Climate Change adopted the Paris Agreement, which is the most ambitious effort so far to strengthen the global response to the threat of climate change. The Paris Agreement has re-ignited interest in market mechanisms and raised expectations for the resurgence of carbon markets. Article 6 of the Paris Agreement is the new window for market-based mechanisms, and defines a new international carbon offset mechanism.

The implementation of both the Paris Agreement and the Agenda 2030 thus provides a relevant context for assessing the co-benefits of the projects supported by the Future Carbon Fund (FCF).

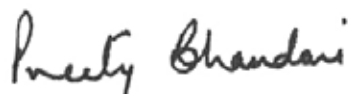
Until now there has been no systematic assessment of the contribution of the Clean Development Mechanism (CDM) established under the Kyoto Protocol to other aspects of sustainable development—the delivery of co-benefits. This is likely because assessment of the delivery of co-benefits was not mandated under the CDM reporting requirements. Consequently, there has been limited analysis of the project features and circumstances that allow co-benefits to be maximized. However, CDM was highly successful in facilitating greenhouse gas emission reduction activities, with 7,789 registered projects delivering over 1.89 billion tons of carbon dioxide equivalent. This report addresses that gap and demonstrates that it is possible to implement projects that both mitigate greenhouse gas emissions and foster sustainable development through an assessment of projects funded by the FCF.

The FCF is pursuing a diversified portfolio of 36 CDM projects implementing a spectrum of renewable energy, transport, waste management, and energy efficiency technologies in 12 developing member countries of the Asian Development Bank. This includes least developed countries and small island developing states where it has been historically difficult to implement CDM projects and there are relatively fewer project opportunities. The co-benefits being delivered by the FCF portfolio projects are assessed using a methodology to track the social, environmental, and economic impacts of the projects. These impacts are then mapped on to the relevant SDGs. The assessment demonstrates

that the projects supported by the FCF are providing a broad set of co-benefits to the beneficiary communities. Among others, these include improving energy access and energy security, employment generation, diffusion of low-carbon technologies, technological innovation, health benefits associated with reduction in air pollution, reduced dependence on imported fuels, reduced traffic congestion, and an increase in net trade of technologies and services.

This report comes at an important time in the context of the multilateral agendas on sustainability. Addressing climate change is intrinsic to the sustainable development agenda, as evidenced in SDG 13 on Climate Action. There are several other SDGs that also enable meeting the climate challenge. As the negotiations for establishing a rulebook for Article 6 of the Paris Agreement intensify with targeted finalization before the end of 2018, the assessment and recommendations provided in this publication could contribute to the development of new market mechanisms that explicitly address monitoring, assessment, and verification of sustainable development impacts of greenhouse gas mitigation projects using the SDG framework.

It is our hope that the simple yet robust methodology of assessment that has been presented in this publication reinforces the strong linkages between investments to mitigate climate change and delivery of sustainable development co-benefits. We are optimistic that this publication will be useful for the architects of new carbon market mechanisms as envisaged under the Paris Agreement.



**Preety Bhandari**

Director, Climate Change and Disaster Risk Management (CCDRM) Division and Chief of CCDRM Thematic Group, Sustainable Development and Climate Change Department Asian Development Bank



**Virender Kumar Duggal**

Principal Climate Change Specialist Fund Manager - Future Carbon Fund Sustainable Development and Climate Change Department Asian Development Bank

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Virender Kumar Duggal, FCF fund manager and principal climate change specialist, Climate Change and Disaster Risk Division, conceptualized and spearheaded the co-benefits assessment of the FCF portfolio projects and guided the development of this report.

The co-benefits assessment of the FCF portfolio projects would have not been possible without useful inputs and the support provided by the FCF counterparts in conducting field visits, which is greatly appreciated.

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# Abbreviations

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ABC	-	Angkor Bio Cogeneration
ADB	-	Asian Development Bank
AEPC	-	Alternative Energy Promotion Center
APCF	-	Asia Pacific Carbon Fund
BHED	-	Beijing Harmonious Energy Development Company Limited
CDM	-	Clean Development Mechanism
CER	-	certified emission reduction
COD	-	chemical oxygen demand
CSR	-	corporate social responsibility
DCM	-	DCM Shriram Limited
DHPC	-	Dagachhu Hydropower Corporation
DMC	-	developing member country
FCF	-	Future Carbon Fund
FCK	-	fixed chimney kiln
GHG	-	greenhouse gas
HHK	-	hybrid Hoffman kiln
ICS	-	improved cooking stove
IWM	-	improved water mill
JFJCM	-	Japan Fund for the Joint Crediting Mechanism
LPO	-	local partner organization
NDC	-	nationally determined contribution
NED	-	National Energy Development
PDD	-	project design document
POA	-	program of activities
PRC	-	People's Republic of China
SCADA	-	Supervisory Control and Data Acquisition
SDG	-	Sustainable Development Goal
SDP	-	Social Development Plan

SHG	-	self-help group
TPC	-	Tata Power Company Limited
TWM	-	traditional water mill
WAF	-	Water Authority of Fiji
UNFCCC	-	United Nations Framework Convention on Climate Change

# Weights and Measures

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km	-	kilometer
l	-	liter
MW	-	megawatt
MWh	-	megawatt-hour
tCO <sub>2</sub> e	-	tons of carbon dioxide equivalent

## CURRENCY UNITS

B	-	baht
CNY	-	yuan
F\$	-	Fiji dollar
KR	-	riel
NRs	-	Nepalese rupee
Nu	-	ngultrum
Rs	-	Indian rupee
SLRs	-	Sri Lanka rupee
Tk	-	taka

# Executive Summary

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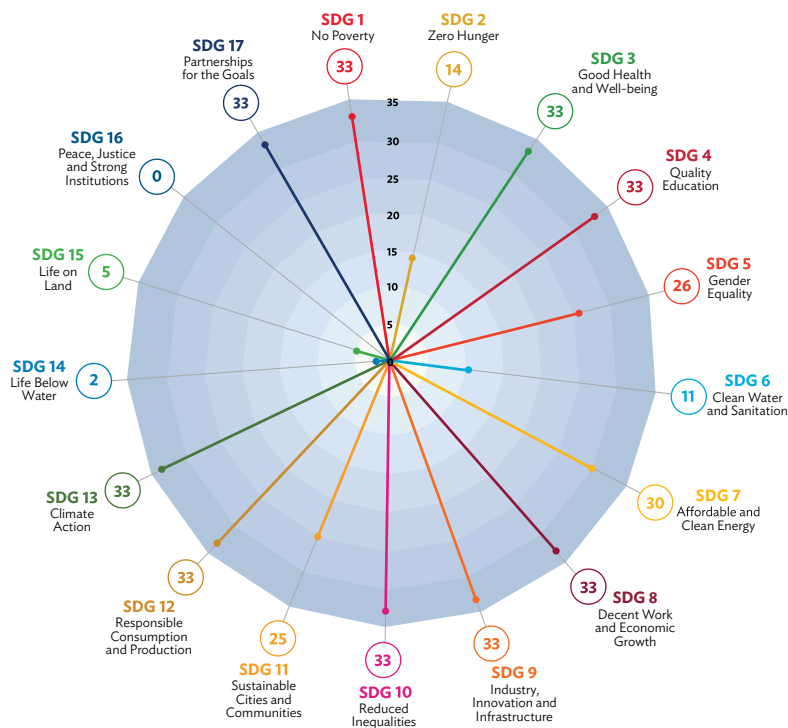
The Future Carbon Fund (FCF) has been supporting Clean Development Mechanism (CDM) projects in the Asian Development Bank's (ADB) developing member countries (DMCs) since 2009. This report presents the contribution of the FCF Portfolio Projects to sustainable development through the delivery of co-benefits. It includes qualitative and quantitative analysis of the social, environmental, and economic co-benefits being delivered by these projects. Lessons have been gathered and used to make recommendations on how co-benefits from greenhouse gas (GHG) mitigation projects could be considered in the design of a new market mechanism as envisaged under Article 6 of the Paris Agreement.

## Co-Benefits of the Future Carbon Fund Portfolio Projects

The extent to which sustainable development is considered in the monitoring and/or reporting of CDM projects varies significantly and is therefore complex to assess. This is largely due to the absence of mandatory requirements to report on co-benefits as it remains the prerogative of the concerned Non-Annex 1 Country to determine whether a CDM project assists in achieving its sustainable development. The FCF is pursuing a diversified portfolio of 36 CDM projects hosted in twelve different DMCs, with a collective potential to reduce 3.68 million tons of carbon dioxide equivalent per annum. In line with its objectives and the preference of its Fund Participants, the FCF has been selective in contracting certified emission reductions (CERs) from high-quality projects that not only meet CDM requirements and comply with ADB's social, environmental, and indigenous peoples safeguards policies, but also provide a range of local, regional, and trans-boundary co-benefits. The Fund's decision to prioritize certain project types and its careful due diligence in project selection ensures that the FCF's portfolio projects deliver co-benefits, although to different degrees depending on local and project circumstances.

A co-benefits assessment methodology was developed using the CDM Sustainable Development Tool, the Gold Standard Sustainable Development Tool, and the Social Carbon Standard. Based on the indicators used by these tools to define the social, environmental, and economic impacts of projects, a set of indicators suitable for the FCF portfolio projects was developed. Accordingly, 41 indicators were defined, covering 11 co-benefit impact areas. Individual projects were then assessed to determine which of the 41 indicators were relevant. Data was collected based on a literature review followed by field visits including one-on-one interviews with various stakeholders and beneficiaries associated with 33 of the total 36 projects that comprise the FCF project portfolio. The co-benefits being delivered by the FCF portfolio projects were then mapped against the

**Figure ES1: The Future Carbon Fund Portfolio Projects Contributing to the Sustainable Development Goals**



Source: Future Carbon Fund.

17 Sustainable Development Goals (SDGs). Both intended and unintended co-benefits were identified, and additional benefits delivered through project entities' corporate social responsibility (CSR) activities were also captured for this assessment (Figure ES1).

The FCF portfolio projects have been delivering a variety of co-benefits for the advantage of **more than 10.5 million people across Asia and the Pacific**.

- Renewable energy capacity of 1,200 megawatts has been added, generating approximately 2.89 million megawatt hours of renewable energy per year, meeting the yearly requirement of approximately 8.74 million people. This is enhancing energy security, contributing to energy diversity, and promoting the diffusion of low-carbon technologies in the region.
- More than 13,500 new job opportunities have been created by project entities in the construction as well as operations and maintenance phase of projects. Additionally, 900 jobs have been created by the service providers involved in the manufacturing, distribution, and servicing of the plant and machinery deployed for these projects.
- More than 5,000 community members, most of whom are women, have acquired skills to pursue income-generating opportunities through vocational training provided by



project entities. A further 150 entrepreneurs are earning additional income by providing auxiliary services to the projects.

- New infrastructure such as transmission lines, local roads, and street lighting has been built or existing infrastructure rehabilitated. This has brought about enhanced energy access, greater connectivity with economic activities, and improved safety for the communities.
- Improved educational facilities such as upgraded buildings, new resources, and e-learning facilities are benefitting more than 8,500 children.
- Around 300,000 commuters are benefitting from upgraded urban transport services.
- About 1.39 million people save time and effort in cooking-related activities at their households and preserve forest resources through reduced dependence on fuel wood.
- Improved air quality is benefitting about 1.31 million people, mostly women and children, reducing respiratory ailments and enhancing quality of life.
- Much needed access to health care is being provided to approximately 39,400 people through new or rehabilitated medical health facilities and/or medical camps.

## Key Lessons

**Project design that maximizes co-benefits.** Climate change mitigation and co-benefits can go hand in hand if considered and planned from the early stages of the project. If co-benefits are carefully integrated into a project's blueprint it can ensure their delivery.

**Importance of dialogue with local communities in the decision-making process.** Close collaboration with a range of local stakeholders from the early stages of project development is crucial as they all play a pivotal role in the success of the project and delivery of co-benefits.

**Corporate philosophy of the project entities.** Regular engagement with the local communities through well-considered CSR programs helps to create shared value for the business and society.

**Smart domestic policies bring synergy for multiple co-benefits.** Through the implementation of smart policies, governments can create an enabling environment to encourage a shift to a low-carbon approach by incentivizing investments in low-carbon technologies and providing the required stimulus to GHG mitigation projects for realizing their full potential.

**Incentivize high-quality mitigation projects.** The nature and scope of co-benefits and even the quantum of such benefits varies from project to project depending upon a variety of factors. It is the prerogative of CER buyers to assess co-benefits as part of their due diligence and take them into consideration in their CER transactions.

**Inclusion of co-benefits in the Emission Reduction Purchase Agreement.** CER buyers can structure their transactions to provide results-based carbon finance linked to certain development activities and/or delivery of pre-defined co-benefits. This can motivate stronger inclusion of co-benefits in GHG emission mitigation projects.

**Secured stream of carbon finance.** Long-term fixed price contracts and upfront payments can help project entities during project implementation and/or operations and therefore contribute to sustained delivery of the co-benefits.

## Way Forward

The 2030 Agenda for Sustainable Development (Agenda 2030) is an internationally agreed framework for countries to define and accelerate their pursuit of sustainable development. It is therefore reasonable to expect that future work on harmonized sustainable development standards will build on Agenda 2030. Through this assessment, the FCF has demonstrated that it is possible to link co-benefits from GHG mitigation projects to the SDGs, although it is more difficult for some SDGs than others, and quantification is often difficult. A universal standard for the monitoring and reporting of co-benefits will be of immense use for the project entities to look beyond the avoidance of GHG emissions and clearly demonstrate the contribution of their mitigation projects to the broader objective of sustainable development. This would be valuable for unlocking the hidden value of carbon for governments as well as the private sector.

The adoption of the Paris Agreement at the Conference of the Parties 21 raised expectations for the resurgence of carbon markets and has re-ignited interest in market mechanisms. At the same time, there has been a strong wish to build on the wealth of technical knowledge and experience(s) of the existing Kyoto Protocol mechanisms, such as CDM, as well as including elements in new mechanisms that were not part of the Kyoto Protocol mechanisms. Many have urged for an enhanced contribution to sustainable development.

Article 6.4 of the Paris Agreement provides for a new mechanism by which public and private entities can support GHG emission reductions and sustainable development.<sup>1</sup> The Paris Agreement mentions the intrinsic relationship between sustainable development and climate change actions in the preamble and in Article 2, and in general has a greater emphasis on sustainable development compared to the Kyoto Protocol. However, addressing sustainable development in practice in mitigation activities is yet to be elaborated under Article 6.4 of the Paris Agreement.

The new mechanism under Article 6.4 may require GHG mitigation projects to demonstrate that they will deliver co-benefits. This could be achieved in part through stronger emphasis and better guidance on local stakeholder consultations. The delivery of the expected co-benefits could be monitored using a simple methodology based on the SDG targets. Co-benefits may also be included in the scope of validation and verification. This would ensure transparency and could be an important reference for the carbon asset buyers.

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<sup>1</sup> Article 6.4, (a) the aim is “to promote the mitigation of GHG emissions while fostering sustainable development”.

An approach using the Agenda 2030 framework that puts stronger emphasis on monitoring and reporting of co-benefits could be considered while discussing “fostering sustainable development” under Article 6.4. One of the key issues is likely to be if it will be a mechanism for mitigation and sustainable development, but where only mitigation impacts will be quantified and verified, or if sustainable development will be integrated in the mechanism itself.

# 1

## Background





## 1.1 Introduction

The Future Carbon Fund (FCF) is a trust fund established and managed by the Asian Development Bank (ADB). It aims to support projects with long-term greenhouse gas (GHG) abatement benefits and enhance the affordability and attractiveness of low-carbon technologies through the reduction of initial capital barriers of GHG mitigation projects. Operational since 2009, the FCF has been actively supporting high quality Clean Development Mechanism (CDM) projects in ADB's developing member countries (DMCs) through the prepurchase of certified emission reductions (CERs) to be generated in 2013–2020 period.

This report is an endeavor to assess the contribution of the FCF Portfolio Projects to sustainable development through the delivery of co-benefits. It includes qualitative and quantitative analysis of the social, environmental, and economic co-benefits that these projects are delivering to various stakeholders in the region.

Co-benefits being delivered by individual projects have been mapped against the 17 Sustainable Development Goals (SDGs), which form part of the 2030 Agenda for Sustainable Development (Agenda 2030). The creation of the SDGs provides important momentum for integrating sustainable development into international agreements, and was specifically welcomed by the Conference of the Parties when adopting the Paris Agreement.

The report also presents case studies reflecting how the FCF Portfolio Projects are not only reducing GHG emissions but also improving the quality of lives of the people in local communities and beyond.

## 1.2 Clean Development Mechanism and Sustainable Development

The Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1997 was the first international agreement to commit countries to internationally binding GHG emission targets. Under the protocol, 37 countries<sup>2</sup> and the European Community (Annex I Countries) committed to specific emission reduction targets adapted to their unique circumstances. The average reduction required across Annex I Countries was 5.2% below 1990 emission levels over the first commitment period (2008–2012). Non-Annex I Countries were not bound to achieve any specific emission reduction targets but agreed to abide by the objectives of the Kyoto Protocol and help mitigate climate change through national reporting and voluntary measures, wherever possible.

The CDM, adopted under article 12, is one of three “flexibility mechanisms” of the Kyoto Protocol, designed to assist Annex I Countries to reduce their GHG emissions as cost-

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<sup>2</sup> There were 37 countries for the first commitment period.

effectively as possible. The CDM enables GHG emission reduction projects in Non-Annex I Countries to earn carbon credits, called CERs that can be traded and used by Annex I Countries to offset their GHG emission and meet obligations under the Kyoto Protocol.<sup>3</sup>

The CDM ensures that issued CERs represent real GHG reductions through stringent validation, registration, issuance, and certification processes. For validation and registration, the project must prepare a project design document (PDD) in line with an approved methodology, guidelines, and standards. The PDD must be independently validated by a designated operational entity and reviewed by the UNFCCC Secretariat and the CDM Executive Board prior to being registered. Once operational, the project must undertake robust monitoring, reporting, independent verification, and certification before successful issuances of CERs.

A key requirement of the CDM is that projects must contribute to the sustainable development of the host country. However, the Kyoto Protocol does not explicitly define sustainable development, or how it can be achieved through the CDM. Projects require approval by the host country to be registered and it is through this approval that each country ensures that the project aligns with its sustainable development agenda. The process typically assesses CDM projects against social, economic, and environmental criteria of the host country.

While CDM projects have been successful in reducing more than 1.89 billion tons of carbon dioxide equivalent (tCO<sub>2</sub>e)<sup>4</sup> since 2000, its contribution to other sustainable development aspects—the delivery of co-benefits—varies widely and is complex to assess.<sup>5</sup> There is no mandatory requirement to report on co-benefits under the CDM as it remains the prerogative of the concerned Non-Annex 1 Country to determine whether a CDM project assists in achieving its sustainable development. However, the CDM Executive Board has adopted a voluntary tool for sustainable development assessment to facilitate co-benefits reporting.<sup>6</sup>

## 1.3 The Paris Agreement and the Sustainable Development Goals

In December 2015, the Parties to the UNFCCC adopted the Paris Agreement, which entered into force in November 2016.<sup>7</sup> The Paris Agreement builds upon the efforts undertaken under climate action and sets GHG emissions mitigation targets, and adaptation and climate finance aspirations starting in 2020.

The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping global temperature rise in this century well below 2 degrees Celsius above pre-industrial levels as well as pursuing efforts to limit the temperature increase even further to 1.5 degrees Celsius. The Paris Agreement requires all parties to

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<sup>3</sup> One CER is equivalent to one ton of carbon dioxide equivalent.

<sup>4</sup> Meeting report: CDM Executive Board ninety-seventh meeting. <https://cdm.unfccc.int/EB/index.html>.

<sup>5</sup> UNFCCC. CDM. <https://cdm.unfccc.int/>.

<sup>6</sup> CDM Sustainable Development Co-benefits Tool. <http://cdmcobenefits.unfccc.int/Pages/SD-Tool.aspx>.

<sup>7</sup> UNFCCC. The Paris Agreement. [http://unfccc.int/paris\\_agreement/items/9485.php](http://unfccc.int/paris_agreement/items/9485.php).



put forward their best efforts in pursuing domestic mitigation measures through nationally determined contributions (NDCs). The Paris Agreement also requires that all parties report regularly on their emissions and on their implementation efforts.

The Paris Agreement is designed to serve as an important tool in mobilizing finance, technological support, and capacity building for developing countries. It is expected to help scale up global efforts to address and minimize loss and damage from climate change. Article 6 of the Paris Agreement envisages new cooperative approaches where countries can voluntarily work together to achieve their respective NDC targets, and a new market mechanism that contributes to the mitigation of GHG emissions and supports sustainable development, while ensuring environmental integrity and transparency.

In 2015, UN member states formally adopted the Agenda 2030 and its 17 SDGs to end poverty, protect the planet, and ensure prosperity for all. The agenda is a roadmap for people and the planet to ensure sustainable social, environmental, and economic progress worldwide.

The creation of the SDGs provides important momentum for integrating sustainable development into international agreements, and was specifically welcomed by the Conference of the Parties when adopting the Paris Agreement. The SDGs provide a useful tool-set for countries to better define and streamline their pursuit of sustainable development under the Paris Agreement. Figure 1 illustrates the 17 SDGs.

**Figure 1: The Sustainable Development Goals**



Source: UN SDG. <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>.



The Agenda 2030 recognizes that implementation of the Paris Agreement is essential for the achievement of the SDGs and that the Paris Agreement provides a roadmap for climate actions that will reduce emissions and build climate resilience.

The implementation of both the Paris Agreement and the Agenda 2030 provide relevant context for considering the co-benefits of the FCF portfolio projects. The lessons from the assessment enables an understanding of what may be replicated from the FCF's experience in supporting GHG mitigation projects under the new mechanism envisaged under Article 6.4 of the Paris Agreement. This process of transferring lessons from existing mechanisms (i.e., the CDM) would also be consistent with the spirit of the Paris Agreement, indicating that the experience gained can serve as the foundation for developing the new mechanism.

## 1.4 Understanding Co-Benefits

In the context of climate change, co-benefits are the additional positive social, environmental, and economic benefits attributed to climate mitigation projects above and beyond the main benefit of expected GHG reduction.<sup>8</sup> Co-benefits are commonly identified under the three pillars of sustainability—social, environmental, and economic—and include benefits such as improved air, water, or soil quality; employment generation; improved livelihoods; improved energy security and access to energy services; infrastructure development; and technology transfer.

**Co-benefits can be delivered on a local or regional level.** Co-benefits can be delivered at multiple levels. As GHG emission reductions yield positive impacts for the global environment, co-benefits are delivered for the local, regional, and even trans-boundary beneficiaries. Reduced odor and well-being from improvements at a wastewater treatment plant are examples of a local co-benefit. The supply of clean energy to an electricity grid from a renewable power project or the reduction of dependency on imported fossil fuels are examples of regional co-benefits.

**Co-benefits can be intended or unintended.** Intended co-benefits are brought about by the project itself. Examples include access to clean and reliable energy from a solar photovoltaic or wind power project, or the improved indoor air quality to households from the distribution of energy efficiency technologies. Unintended co-benefits are brought about by additional activities undertaken during project implementation and/or operation. Examples include construction of access roads, training local residents in new livelihood skills, or setting up medical camps for the benefit of local communities. Project entities may also voluntarily undertake corporate social responsibility (CSR) initiatives for the benefit of local people. These are activities outside the project but specifically aimed at providing additional benefits for the local communities. Contributing efforts to improve education facilities in the local community are an example of CSR activities.

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<sup>8</sup> Co-benefits are also referred to as “side benefits,” “secondary benefits,” “collateral benefits,” and “associated benefits.”

# 2

## Future Carbon Fund— Supporting Climate Action with Community Co-Benefits



Heqing Solar Cooker Projects, People's Republic of China.  
Photo credit: Beijing Harmonious Energy Development.

## 2.1 ADB's Carbon Market Program

ADB launched its Carbon Market Program (CMP)<sup>9</sup> in 2006 to foster long-term partnerships between ADB, project developers, and carbon market participants for increasing renewable energy, energy efficiency, and other GHG emission reduction projects in Asia and the Pacific. CMP has four components that support ADB DMCs in maximizing market-based opportunities to transit toward low-carbon economies through a comprehensive package of financial, technical, and capacity development support. These include the (i) Technical Support Facility; (ii) Asia Pacific Carbon Fund (APCF), (iii) Future Carbon Fund (FCF), and (iv) Japan Fund for the Joint Crediting Mechanism (JFJCM).

### Technical Support Facility

Set up in 2006, the Technical Support Facility is the main instrument through which ADB provides capacity building support to its DMCs for enhancing mitigation actions through carbon markets.<sup>10</sup> Under the ongoing technical assistance, ADB responds to the needs of DMCs by (i) supporting the development of domestic emissions trading schemes and facilitating linkages where possible; (ii) building the capacities of DMCs to participate in new market mechanisms while providing continued support to existing carbon markets and maximizing the transfer of knowledge and skills to the new mechanisms; (iii) facilitating climate change action by nonstate actors such as cities, regions, private companies, and investors; and (iv) supporting cooperation among DMCs for learning from each other's experiences.

### Asia Pacific Carbon Fund

In 2007, ADB launched the APCF with a capital commitment totaling \$151.8 million from seven sovereign participants—the Government of Portugal, the Government of Sweden, the Government of Luxembourg, the Government of Switzerland, the Government of Finland, the Government of Belgium for the Flemish Region of Belgium, and the Government of Spain. APCF provided carbon finance to high-quality CDM projects through the purchase of pre-2013 CERs for its participants and was closed in 2014.

### Future Carbon Fund

In 2008, ADB established the FCF to enhance the competitiveness of low-carbon technologies and contribute to GHG emission reduction efforts in Asia and the Pacific by providing carbon finance through the prepurchase of CERs generated by CDM projects in 2013–2020 period. Established as a trust fund, the FCF has six contributing participants who have collectively committed \$115 million. These participants include Eneco Energy Trade (a Dutch utility), the Government of Finland, the Government of the Republic of Korea, Participati Maatschappij Vlaanderen NV (an investment company fully owned by the Flemish Region of Belgium), POSCO (a Korean steel company), and the Swedish Energy Agency.

<sup>9</sup> Then called Carbon Market Initiative.

<sup>10</sup> ADB. Regional: Supporting Low Carbon Development in Asia and the Pacific through Carbon Markets. <https://www.adb.org/projects/49270-001/main>.

### Japan Fund for the Joint Crediting Mechanism

In June 2014, the ADB established the JFJCM to provide financial incentives for the adoption of advanced low-carbon technologies in ADB-financed projects. The JFJCM can provide grants and technical assistance to projects utilizing the JCM—a new bilateral market mechanism initiated by the Government of Japan for which it has signed bilateral agreements with 17 countries, 11 of which are in Asia and the Pacific. The JFJCM, the first trust fund for this bilateral market mechanism JCM by any of the multilateral development banks, is funded by a contribution of \$51.7 million made by the Government of Japan.

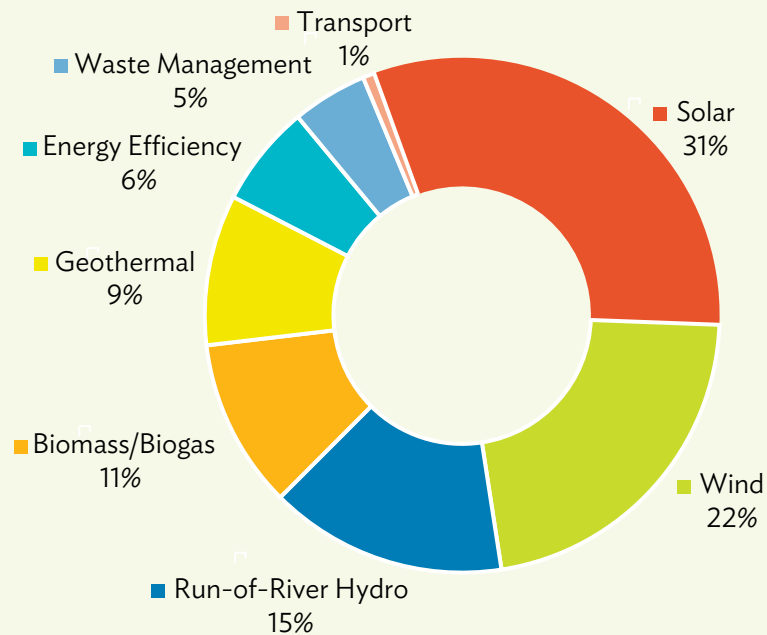
## 2.2 The Future Carbon Fund Project Portfolio

The FCF was established to support projects with long-term GHG abatement benefits and enhance the affordability and attractiveness of low-carbon technologies by reducing initial capital barriers to GHG mitigation projects. As trustee of the FCF, ADB is providing carbon finance support to high-quality CDM projects in the region through the prepurchase of post-2012 CERs for the FCF participants. The FCF has been offering several unique features aimed at addressing regulatory and price uncertainty, required to incentivize CDM project development and implementation beyond 2012. The FCF's ability to pay upfront as well as payment-on-delivery has been supporting project entities to meet project implementation and/or operational costs. Furthermore, its assurance of an agreed fixed price for the CERs purchased adds price certainty and limits the downside for the project developers as compared to floating price mechanisms linked to the future spot price of emission reductions. These features provide significantly greater assurance of co-financing support and results-based performance incentives during project operations not only for the successful implementation of GHG mitigation activities but also for the delivery of corresponding co-benefits.

Operational since 2009, the FCF is pursuing a diverse portfolio of 36 CDM projects, located in 12 of ADB's DMCs across Asia and the Pacific. These include least developed countries such as Bangladesh, Bhutan, Cambodia, and Nepal; and small island developing states such as Fiji and Papua New Guinea, where it has been historically difficult to implement CDM projects and there are relatively fewer project opportunities. Others include India, Indonesia, the Philippines, the People's Republic of China (PRC), Sri Lanka, and Thailand.

The FCF portfolio is composed of a spectrum of GHG emission reduction projects largely implementing various renewable energy technologies, followed by energy efficiency, waste management, and transport sector projects. Figure 2 shows the share of CERs by project types in the FCF project portfolio. The FCF is providing carbon finance support to projects ranging in size from small-scale community-based projects such as the installation of improved water mills in Nepal to large scale infrastructure projects such as Asia's largest concentrated solar power plant in India.

**Figure 2: The Future Carbon Fund Project Portfolio—Share of Certified Emission Reductions by Project Types**



Source: Future Carbon Fund.

## 2.3 Methodology Adopted for Assessing Co-Benefits

The FCF portfolio projects were assessed using a co-benefit assessment methodology that was developed using the CDM Sustainable Development Tool, the Gold Standard Sustainable Development Tool, and the Social Carbon Standard tool.<sup>11</sup> Based on the indicators used by these tools to define the social, environmental, and economic impacts of projects, a set of indicators suitable for the FCF portfolio projects was developed. In total, 41 indicators were defined, covering 11 co-benefit impact areas. Individual projects were then assessed to determine which of the 41 indicators were relevant. The subset of relevant indicators for each project formed the basis of the data collection.

Information on individual projects contracted by the FCF was then gathered through review of existing literature and publicly available information. This was followed by field visits for

<sup>11</sup> The CDM Sustainable Development Co-Benefits Tool. <http://cdmcobenefits.unfccc.int/Pages/SD-Tool.aspx>; The Gold Standard Foundation's Sustainable Development Tool. <https://www.goldstandard.org/>; Social Carbon Standard. <http://www.socialcarbon.org/>.

data collection and personal interviews with various stakeholders which included first-hand narratives of co-benefit impacts on the project beneficiaries associated with 33 of the total 36 projects that comprise FCF project portfolio.

The FCF assessment then mapped the co-benefits being delivered by individual projects against the 17 SDGs as presented in Table 1. The criteria for a co-benefit indicator to be mapped against a specific SDG were derived from the definition of the targets of each SDG.<sup>12</sup> This allowed FCF to assess each project's contribution toward the achievement of the SDGs, highlighting the link between climate action and sustainable development.

The following limitations of the assessment of the FCF portfolio projects were identified:

- (i) **Stakeholder responses.** All attempts were made to ensure stakeholders felt comfortable while being interviewed and precautions were taken to avoid any external influence by conducting one-on-one interviews. However, there is a chance that the responses received from stakeholders were limited by the respondent's inability to express themselves, or inaccuracies in the interpretation of responses. Furthermore, there is a possibility that some stakeholders did not feel comfortable to fully share their experiences.
- (ii) **Lack of information on the baseline situation of co-benefits.** The assessment was conducted while most of the FCF projects are in advanced stages of operation. Since there is limited documentation or only anecdotal data is available describing the baseline situation, co-benefits cannot be compared to a baseline.
- (iii) **Quantification of co-benefits can be difficult.** Not all co-benefits can be quantified due to the inherent nature of the co-benefits. Further, there can also be an element of uncertainty in the measurement and evaluation procedures adopted, due to lack of standardized approaches.

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<sup>12</sup> Targets are listed under each SDG, as found on United Nations. Sustainable Development Goals. <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>.



**Table 1: Co-Benefits Assessment Methodology for the Future Carbon Fund Portfolio Projects**

IMPACT AREA	CO-BENEFITS INDICATORS	CONTRIBUTION TO SDGs
Air Quality	Avoidance of SO <sub>x</sub> , NO <sub>x</sub> , SPM, flyash, PM, TSPM	SDG 3 - Good Health and Well-being
	Improved indoor air quality	SDG 3 - Good Health and Well-being
	Reducing odor	SDG 3 - Good Health and Well-being
Water Quality and Quantity	Improved management or control of wastewater	SDG 6 - Clean Water and Sanitation SDG 12 - Responsible Consumption and Production
	Saving or conserving water	SDG 6 - Clean Water and Sanitation SDG 12 - Responsible Consumption and Production
	Improved water balance	SDG 6 - Clean Water and Sanitation
	Improvement of water quality parameters such as BOD/ COD/coliform/other pollutants	SDG 6 - Clean Water and Sanitation SDG 14 - Life Below Water
	Improved accessibility and reliability of water	SDG 6 - Clean Water and Sanitation
Soil Quality or Land Use	Improved soil fertility/ Improved organic content of soil	SDG 2 - Zero Hunger
	Preventing soil contamination/ decreased level of soil pollutants	SDG 12 - Responsible Consumption and Production SDG 15 - Life on Land
	Preventing soil erosion	SDG 15 - Life on Land
Natural Resources	Protecting or enhancing forests or plant life	SDG 15 - Life on Land
	Protecting or enhancing depletable natural resources	SDG 12 - Responsible Consumption and Production
Employment Quality	Improved working conditions/Improved health and safety	SDG 8 - Decent Work and Economic Growth
	Job-related trainings or project-related knowledge dissemination	SDG 4 - Quality Education
	Improved income levels	SDG 10 - Reduced Inequalities SDG 8 - Decent Work and Economic Growth
Employment Quantity	Number of jobs created	SDG 8 - Decent Work and Economic Growth
	Local employment opportunity	SDG 8 - Decent Work and Economic Growth
	Skilled and unskilled jobs	SDG 8 - Decent Work and Economic Growth
	Creates jobs for women	SDG 5 - Gender Equality
Improved Livelihoods	Improvement in living standards/poverty alleviation	SDG 1 - No Poverty SDG 8 - Decent Work and Economic Growth
	Enhanced health services	SDG 3 - Good Health and Well-being
	New sources of income generation	SDG 8 - Decent Work and Economic Growth
	Improving sanitation and waste management	SDG 3 - Good Health and Well-being SDG 6 - Clean Water and Sanitation
	Income and/or time savings from using clean technology	SDG 1- No Poverty SDG 5 - Gender Equality
	Reducing health impacts from indoor air pollution	SDG 3 - Good Health and Well-being
Human and Institutional Capacity	Optimized women empowerment	SDG 5 - Gender Equality
	Community or rural advancement	SDG 11 - Sustainable Cities and Communities SDG 2 - Zero Hunger
	Reduced traffic congestion	SDG 11 - Sustainable Cities and Communities
	Increased local government/ municipal revenues	SDG 17 - Partnerships for the Goals
	Enhanced education facilities	SDG 4 - Quality Education

*continued on next page*

Table 1: continued

IMPACT AREA	CO-BENEFITS INDICATORS	CONTRIBUTION TO SDGs
Energy Services	Improved access to energy	SDG 7 - Affordable and Clean Energy
	Affordable and reliable supply of energy	SDG 7 - Affordable and Clean Energy
	Number of clean technology units distributed	SDG 7 - Affordable and Clean Energy
	Reduced blackouts and power fluctuations	SDG 7 - Affordable and Clean Energy
Technology Transfer	Introducing/diffusing local or imported technology	SDG 17 - Partnerships for the Goals
	Know-how activities for a technology	SDG 4 - Quality Education
Growth and Innovation	New investments	SDG 9 - Industry, Innovation and Infrastructure
	Improved infrastructure	SDG 9 - Industry, Innovation and Infrastructure
	Enhanced productivity/services	SDG 8 - Decent Work and Economic Growth
	Strengthening of local economy/new commercial activities	SDG 9 - Industry, Innovation and Infrastructure

BOD = biochemical oxygen demand, COD = chemical oxygen demand, NO<sub>x</sub> = nitrogen oxides, PM = particulate matter, SDG = Sustainable Development Goal, SO<sub>x</sub> = sulphur oxides, SPM = suspended particulate matter, TSPM = total suspended particulate matter.

Source: Future Carbon Fund.

## 2.4 Co-Benefits of the Future Carbon Fund Portfolio Projects

In line with the preference of its participants, the FCF has been selective in contracting CERs from high-quality projects that not only meet CDM requirements and comply with ADB's social, environmental, and indigenous peoples safeguards policies, but also provide a range of local, regional, and trans-boundary co-benefits.<sup>13</sup> These co-benefits include energy access and energy security, employment generation, diffusion of low-carbon technologies, technological innovation, health benefits associated with reduction in air pollution, reduced dependence on imported fuels, reduced traffic congestion, and increase in net trade of technologies and services, among others.

As projects contracted by the FCF are implemented as CDM projects, they all contribute to climate change mitigation as envisaged under Climate Action (SDG 13). Collectively, the FCF project portfolio is reducing approximately 2.95 million tCO<sub>2</sub>e<sup>14</sup> per annum. The volume of GHG reductions by individual projects vary significantly—from 6,700 tCO<sub>2</sub>e per annum by a solar photovoltaic project in Thailand to more than 382,000 tCO<sub>2</sub>e per annum by a run-of-river hydro power project in Bhutan.

<sup>13</sup> Trans-boundary co-benefits are those that cross international boundaries to benefit countries.

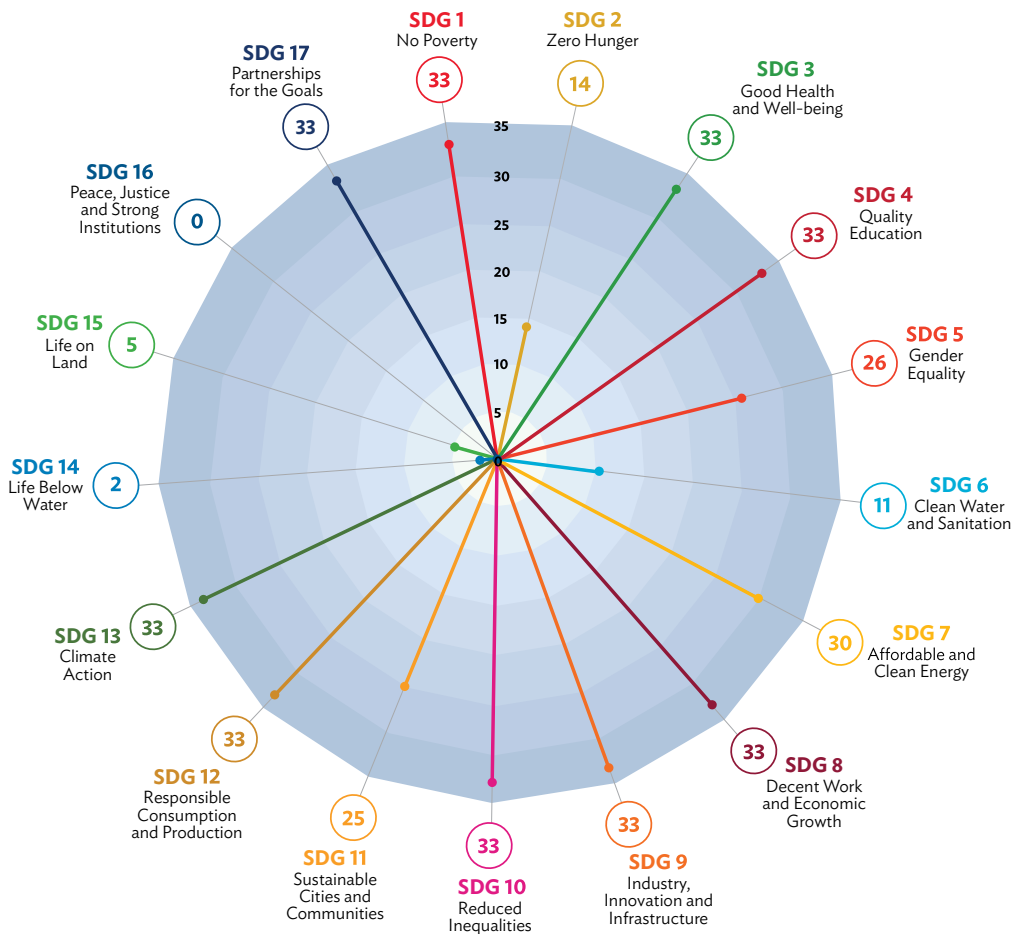
<sup>14</sup> As per the registered PDDs, the FCF project portfolio of 36 CDM projects collectively has a potential to reduce 3.68 million tCO<sub>2</sub>e per annum.



The majority of co-benefits delivered by the FCF's portfolio projects are intended co-benefits resulting from the way in which the projects are designed and operated. However, these projects also deliver other unintended co-benefits including benefits to the local communities through additional CSR activities undertaken by the project entities.

In addition to directly contributing to Climate Action (SDG 13), the FCF portfolio projects are also making a significant direct contribution to No Poverty (SDG 1); Good Health and Well-Being (SDG 3); Quality Education (SDG 4); Affordable and Clean Energy (SDG 7); Decent Work and Economic Growth (SDG 8); Industry, Innovation, and Infrastructure (SDG 9); Reduced Inequalities (SDG 10); Responsible Consumption and Production (SDG 12); and Partnerships for the Goals (SDG 17). Figure 3 shows how 33 of the FCF's portfolio projects are contributing to the SDGs. The lines for each SDG mark the number of FCF projects that are contributing to that specific SDG.

**Figure 3: The Future Carbon Fund Portfolio Projects Contributing to the Sustainable Development Goals**



Source: Future Carbon Fund.

**Energy security.** Asia and the Pacific is experiencing economic growth that is essential for sustainable development and poverty reduction. However, this economic growth is coupled with growth in energy consumption and energy demand in the region is projected to almost double by 2030. Compounding the problem is the widespread energy poverty across Asia, with almost a billion people still without access to electricity.<sup>15</sup> The FCF portfolio projects are addressing this problem by enhancing generation and access to clean energy using renewable energy technologies. The FCF portfolio projects are improving energy security, contributing to the diversity of energy sources, and demonstrating the economic viability of advanced renewable energy technologies. **Renewable energy capacity of 1,200 megawatts (MW) has been added** generating about 2.89 million megawatt hours (MWh) of renewable energy per year. This clean energy is estimated to meet the yearly requirement of approximately 8.74 million people thus enhancing energy security and contributing to energy diversity.<sup>16</sup> In addition, energy efficiency technologies such as improved cook stoves, solar cookers, and improved water mills enable about 1.39 million people to save time and effort in cooking-related activities in their households and preserve forest resources through reduced dependence on fuel wood.

Box 1 shows how a small-scale renewable energy program of activities in Thailand is ensuring energy security.

### Box 1: Solar Power Installations—Ensuring Energy Security in Thailand



IFEC Solar PV project has 110,000 modules harvesting energy from the sun throughout the year. Photo credit: Future Carbon Fund.

Investments in renewable energy projects under the Small-scale Renewable Energy POA across different provinces in Thailand are enabling a steady diffusion of clean energy technologies as an alternative source of power generation across the country. These installations are enabling new investments in remote and underdeveloped regions of the country, fostering growth and economic transformation of the stakeholder communities.

Somnuk Suebinn, living in Bor Ploy district, Kanchanburi Province says, ‘It was common to have power cuts for up to 2 hours daily, but this is no longer the case with a stable power supply to our homes.’

The 11-megawatt IFEC Solar Photovoltaic Project has a potential to light up 5,891 households and reduce 7,918 tons of carbon dioxide equivalent per annum. This has

helped reduce blackouts and fluctuations in the supply of electricity to households. Since the project began its operation, residents have less instances of blackouts and appliance breakdown which used to be a regular occurrence.

Source: Future Carbon Fund.

<sup>15</sup> ADB. Energy Issues in Asia and the Pacific. <https://www.adb.org/sectors/energy/issues>.

<sup>16</sup> Estimated using the national average household size data (2016 Data. Esri’s ArcGIS. <http://www.arcgis.com/home/index.html>) and national average electricity consumption per electrified household data (Enerdata. 2014 Data. <https://wec-indicators.enerdata.net/household-electricity-use.html>).

**Diffusion of low-carbon technologies.** There are numerous barriers to the implementation of low-carbon technologies, especially technologies that are new or not widely used in a host country. Diffusion of low-carbon technologies plays an important role in achieving the national climate change goals of the host countries and directly contributes to broader sustainable development goals. Technologies used in 25 FCF portfolio projects were not widely available or had limited penetration at the time of project implementation. These technologies include solar power, energy-efficient brick kilns, improved water mills, energy efficient-cook stoves, solar cookers, and biomass-based power generation. Many of these projects have also contributed to strengthening national institutional capacity and enhancing environmental planning. Box 2 shows how a 125-MW Concentrated Solar Power Plant in Rajasthan is demonstrating the diffusion of low-carbon technologies in India.

### Box 2: The 125-Megawatt Concentrated Solar Power Plant in Rajasthan, India—Demonstrating Diffusion of Low-Carbon Technology



The 125-megawatt CSP Project at Dhursar village in Rajasthan.  
Photo credit: Future Carbon Fund.

The 125-MW concentrated solar power (CSP) plant established by Rajasthan Sun Technique Energy Pvt. Ltd. is designed to address power shortages, improve access to electricity, and help reduce dependency on domestic and imported fossil fuels in India.

The project introduced the innovative Compact Linear Fresnel Reflector (CLFR) technology to India from France. This is the first and the largest CSP project using CLFR technology not only in India but in the whole of Asia. CLFR has lower environmental risks than other CSP technologies mainly due to the use of direct steam generation with water as the working fluid instead of synthetic oil heat transfer fluid commonly used for other CSP technologies.

Source: Future Carbon Fund.

**Employment generation and job quality.** The FCF portfolio projects have created new job opportunities for more than 13,500 people in the construction as well as operation and maintenance phase. These opportunities range from unskilled, labor-intensive jobs to managerial roles, while it was confirmed that 16 projects provide employment opportunities for women. Most of these positions occur during the operation and maintenance phase of the project as the jobs required during the construction phase are mostly labor intensive and tend to employ men. Additionally, 900 jobs have been created by the service providers involved in the manufacturing, distribution, and servicing of the plant and machinery deployed for these projects.

Projects contracted by the FCF are enhancing the professional skills and corresponding income levels of the people associated with these projects. These benefits not only improve working conditions but also facilitate long-term and tangible benefits for the individuals as well as the respective communities. Such benefits enable people to upgrade their skills, enhance professional opportunities, and create a greater sense of professional security. The FCF portfolio projects are also enabling their employees to enhance their skills through various training programs including on-the-job training. Box 3 provides an example of a waste management project in India that generates job opportunities at various stages of the project implementation.

### Box 3: Municipal Solid Waste Treatment Plants in Tamil Nadu, India—Generating Jobs



Women ragpickers at one of the six composting sites of IL&FS Environmental Infrastructure and Services Limited.  
Photo credit: Future Carbon Fund.

M. Masilamani, a 39-year old unskilled worker at the Pollachi waste treatment plant in Tamil Nadu, India, struggled for many years to make a decent living through temporary jobs. In 2010, she started working on a permanent basis at this plant that converts municipal solid waste into organic manure. She is happy that with the support of her steady income, one of her daughters has graduated with an engineering degree. Her other daughter is pursuing a commerce degree and is preparing for chartered accountancy. “My daughters can even read and talk in English and I am very proud of them,” she says, smiling widely. Through the Employee State Insurance scheme, a social security scheme subscribed by IL&FS Environmental Infrastructure and Services Limited (IEISL), she is also able to cover medical costs for her family.

The project creates 184 jobs at various stages, from waste segregation, waste maturing, compost screening, compost testing, to loading of the compost into trucks for transportation. Under the Installation of Bundled Composting Project in the state of Tamil Nadu, IEISL developed composting facilities at six project sites with an aggregated processing capacity of 545 tons of waste per day or 190.75 kilotons of waste per annum, servicing a population of over one million in Tamil Nadu, the southernmost state in India.

Source: Future Carbon Fund.

**Access to local infrastructure.**<sup>17</sup> Investments in infrastructure are crucial for achieving sustainable development and empowering communities. Deficiencies in basic infrastructure, such as poorly developed roads or scarce health facilities, deprive people of access to markets and employment opportunities or much needed medical care and pose a major impediment to development. New infrastructure (such as transmission lines, local roads, and street lighting) have been developed or existing infrastructure rehabilitated in the course of implementing 25 projects. This has brought about enhanced energy access, greater connectivity with economic activities, and improved safety for the local communities. Improved educational facilities such as upgraded buildings, new resources,

<sup>17</sup> This also combines the co-benefit indicators pertaining to Human and Institutional Capacity in the co-benefits assessment framework.

and e-learning facilities are benefitting more than 8,500 children. Around 300,000 commuters are benefiting from upgraded urban transport services. Box 4 shows how Erlongshan Hydropower Project in Gansu Province, the PRC is providing access to new roads for the local community.

#### Box 4: Erlongshan Hydropower Project in the PRC—Providing Access to New Roads for the Local Community



A view of the Erlongshan Hydropower Plant site from above.  
Photo credit: Gansu Zhangye Erlongshan Hydropower Co., Ltd.

Erlongshan Hydropower Project in Gansu Province is a 50.5 megawatt run-of-river project, 70 kilometers (km) from Zhengye City, Gansu Province in the PRC.

For the construction of the project, 60 km of new roads were constructed while 35 km of existing roads were rehabilitated. This enhanced infrastructure is improving the day-to-day lives of local communities with greater mobility and interactions with other areas. This also means more income-generating opportunities for the local residents. “The road conditions here were very poor in the past. So travelling to Zhangye City was something difficult that required prior planning and preparation.” Zhigang Liu, a farmer living in Louzhuangzi Village, recalls tougher times. “A new road constructed some years ago, linked my village to Minle County from where travelling to Zhangye City is convenient. This has made living here in the village much easier as we can go to Minle County

or even Zhangye City to work. For me, I can go to Minle County easily and more frequently to sell my maize during harvest season.”

Source: Future Carbon Fund.

**Improved livelihoods.** The FCF portfolio projects are improving people’s livelihoods, making a lasting contribution to socioeconomic development. More than 5,000 community members, most of whom are women, have acquired skills to pursue income-generating opportunities through vocational training. This is empowering women to participate in social and economic activities and has resulted in sustainable sources of their income. A further 150 entrepreneurs are earning additional income by providing auxiliary services to the projects.

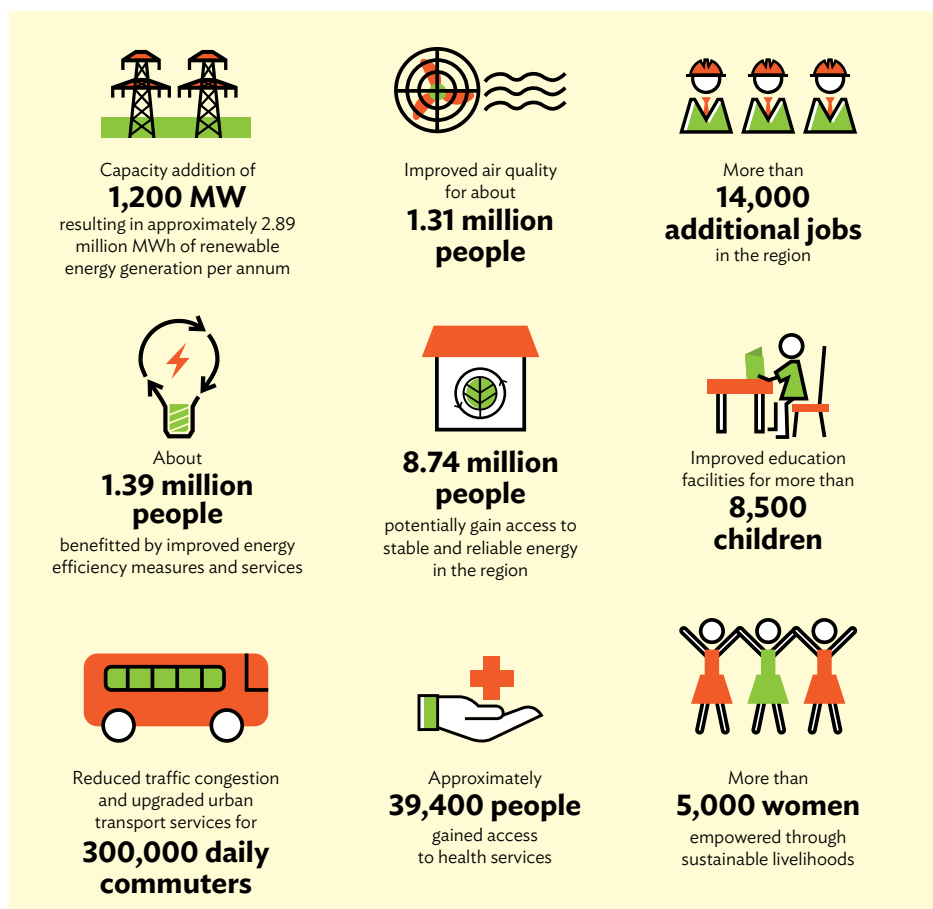
**Enhanced quality of life.**<sup>18</sup> Projects such as improved cooking stoves and solar cookers significantly reduce black carbon, particulate matter, and carbon monoxide through reduced consumption of indoor firewood or coal. These projects have improved the indoor air quality for approximately 1.29 million people, mostly women and children, reducing the risk of respiratory ailments and improving their well-being. Local air quality has improved

<sup>18</sup> These results were assessed under Air Quality and Improved Livelihood indicators of the co-benefits assessment framework.

through reduced odor from upgraded solid waste and wastewater facilities, which are improving the quality of life of nearly 20,000 people. Much needed health care services are being provided to approximately 39,400 people through new or rehabilitated medical health facilities and/or medical camps around 19 project sites.

Figure 4 provides a consolidated view of the key co-benefits being delivered by the FCF portfolio projects.

**Figure 4: The Future Carbon Fund Portfolio Projects Delivering Co-Benefits for Sustainable Development**



Source: Future Carbon Fund.



## Box 5: The Future Carbon Fund Participants

### ENECO ENERGY TRADE

Eneco Energy Trade is participating in the FCF with a commitment of \$15 million. The Eneco Group is a group of companies operating in the field of sustainable energy and innovation. Together with its customers, partners, and its 3,500 employees, it strives to achieve its mission: “Everyone’s sustainable energy.” The Eneco Group invests in wind and solar farms, biomass plants, and green district heating with the aim to increase the share of sustainable energy. The Eneco Group also develops innovative products and services that enable its customers to be in charge of how they generate, store, use, or share energy. Headquartered in Rotterdam, the Netherlands, the Eneco Group operates in the Netherlands, Belgium, the United Kingdom, Germany, and France. The Eneco Carbon Desk supports a variety of emission reduction projects around the world, including a number of projects in Southeast Asia through its investment in the FCF. The Carbon Desk invests in projects based on a thorough review and due diligence to ensure that only projects that make a genuine contribution to GHG abatement and visibly improve the livelihoods of surrounding communities are accepted into its portfolio. With that, Eneco can be assured offsets are of the highest quality. Eneco emission reduction projects not only reduce global GHG emissions, but also tell exciting stories about communities that are benefiting from the purchase of carbon credits. This is made visible by reporting its linkages to the SDGs. Carbon offsetting allows organizations and companies to take responsibility for 100% of today’s emissions, by working alongside internal abatement efforts, where any emissions that cannot be reduced internally can be compensated for with high quality carbon credits.



### GOVERNMENT OF FINLAND

Finland participates in ADB’s FCF through its Ministry for Foreign Affairs, as a part of its Kyoto mechanism purchase program that covers the period 2006–2020. The Ministry for Foreign Affairs is also represented on the FCF Board of Directors. Finland’s carbon market related cooperation with ADB and its Carbon Market Program goes back to 2007 when Finland joined APCF with an investment of \$25 million. Through APCF, Finland purchased CERs for the first commitment period of the Kyoto Protocol. Finland is also providing grant funding for ADB’s TSF which has been the main instrument through which ADB provides capacity building support to its DMCs for enhancing mitigation actions through carbon markets. In 2009, building on its encouraging experiences from these partnerships, Finland decided to make a commitment of \$20 million to the FCF for purchasing CERs for the second commitment period of the Kyoto Protocol.



For the Government of Finland, it is of vital importance that the projects contracted by the FCF not only generate verifiable emission reductions but also create developmental benefits and contribute to sustainable development in a wider context.

### GOVERNMENT OF THE REPUBLIC OF KOREA

The Government of the Republic of Korea is driving development policies and incentives to build enhanced cooperation with developing countries in achieving the common goal of low-carbon, climate-resilient development. In line with this, the Ministry of Strategy and Finance signed the Participation Agreement with ADB on 13 November 2009 with a commitment of \$20 million to the FCF while entrusting the Export-Import Bank of Korea as the implementing agency. The Government of the Republic of Korea joined the Organisation for Economic Co-operation and Development and Development Assistance Committee on 1 January 2010, and now looks ahead toward making a greater contribution to the global development agenda.



With its participation in the FCF, the Government of the Republic of Korea would like to contribute to (i) support and encourage energy efficiency and renewable energy projects with long-term GHG emission reduction benefits, (ii) leverage additional financing for climate change-related projects, and (iii) replicate innovative technology-based projects in developing countries. The Government of the Republic of Korea’s pursuit of green growth combined with the knowledge and experience gained from its development cases aim at meeting the shared goals of the UNFCCC; that is, combating climate change and achieving sustainable development.

Box 5: continued

### **PARTICIPATIE MAATSCHAPPIJ VLAANDEREN NV**

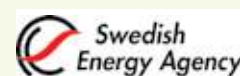
A company fully owned by the Flemish government, Participatie Maatschappij Vlaanderen NV (PMV) is an investment company that is shaping the future of Flanders, the Dutch-speaking region in the north of Belgium. With the Flemish government being the sole proprietor of its shares, PMV provides finance for promising businesses, from their very start, through their various growth stages and even on to operating internationally. Working with and for the Flemish government and other partners, PMV also implements projects that are important for future prosperity and well-being in Flanders. The company has €1.181 billion of capital under management. In 2016, PMV invested €238.1 million in the Flemish economy. Building on its very satisfying experience with ADB's APCF, PMV participated in the FCF in 2008 as the region of Flanders needed a backup volume of emission rights to comply with European Union-imposed quantities in case of insufficient volumes. PMV was impressed by ADB's due diligence procedures for the selection of projects and robust procedures to monitor progress through the project implementation including compliance with ADB's safeguards policies for social, environmental, and indigenous peoples. Through its participation in the FCF with a commitment of \$20 million, PMV is contributing to the implementation of new sustainable energy capacity in developing countries in Asia and the Pacific.



**POSCO** POSCO is a multinational steel making company promoting new growth engines based on permanent new material and steel, with an ongoing commitment to upholding new values. POSCO was established in 1968 and is headquartered in Pohang, the Republic of Korea. The company demonstrated the fifth largest crude steel production capacity in the world. In line with its vision to engage in promising industries of the future such as green growth projects and in support of the government's initiatives in GHG emissions reduction in developing countries, POSCO is doubling its efforts to cope with the emissions trading system in the Republic of Korea as well as the new climate regime. POSCO is also participating in the FCF with a commitment of \$20 million for purchasing CERs. These activities are meaningful for the company as it puts into practice its social responsibility such as shared growth, policy cooperation, and emissions reduction.



**SWEDISH ENERGY AGENCY** The Swedish Energy Agency has been responsible for the Swedish Programme for International Climate Initiatives for almost 20 years. The objectives of the programme have evolved together with the development of the international climate negotiations and the international carbon markets. However, the core mission of the program is still to (i) support continued and expanded international climate cooperation, (ii) achieve cost-effective GHG reductions, and (iii) contribute to sustainable development in developing countries. The Swedish Energy Agency's program has contracted approximately 40 million tons of carbon dioxide equivalent emission reductions through the flexible mechanisms of the Kyoto Protocol. The program includes over 90 bilateral CDM projects as well as participation in 10 multilateral carbon funds. Priority project types include renewable energy, energy efficiency, and waste management. For the Swedish Energy Agency, the FCF was launched when positive political signals concerning the carbon market were needed and its participation in the FCF was such a signal. The Swedish Energy Agency has strived to compose a portfolio with geographical distribution. Participation in the FCF has given the Swedish program a broader engagement in the South Pacific, in least developed countries and small island developing states, as well as the whole Asian region. Similarly, participation in the FCF has also given the Swedish Energy Agency an opportunity to collaborate with new partners, from both the government and the private sector. The Swedish Energy Agency is participating in the FCF with a commitment of \$20 million to purchase CERs that has, among others, helped it gain additional insights and experience regarding the practical implementation of CDM.



Source: Future Carbon Fund.





# 3

## Key Lessons



The CDM was successful in achieving its objectives of raising awareness of climate change, facilitating GHG emissions reduction activities, and enhancing diffusion of low-carbon technologies.<sup>19</sup> Through the CDM both the public and private sectors have built a wealth of technical knowledge and institutional frameworks for the implementation of GHG mitigation activities.

One of the key objectives of the CDM is to contribute to sustainable development in host countries. However, the CDM has no mandatory requirements for projects to include, deliver, or report co-benefits achieved, and it is the prerogative of the host country to confirm a GHG mitigation project's contribution to sustainable development.

From its inception in 2009, the FCF has taken a strategic approach in selecting high-quality CDM projects that can deliver co-benefits and contribute to sustainable development in the region. The FCF experience reflects that CDM projects can deliver a wide range of local, regional, and trans-boundary co-benefits. It indicates that the effectiveness, outreach, and positive impacts of GHG mitigation projects can be further strengthened through integrated design and delivery of co-benefits for the stakeholder communities. If appropriate measures are adopted to enhance the integration of sustainable development targets into mitigation projects through project selection, project design, and stakeholder consultations, the complementary relationship between mitigation and sustainable development can be further strengthened.

The assessment of the FCF portfolio projects clearly shows that projects contracted by the FCF are delivering social, environmental, and economic co-benefits; and enhancing the quality of life of various stakeholders. With its clear preference for contracting projects that not only reduce GHG emissions but also promise to deliver a host of co-benefits, the FCF is demonstrating the role carbon credit buyers can play to encourage, support, and even incentivize design and delivery of co-benefits by the CDM projects.

The FCF experience also demonstrates that CDM project entities are generally aware of the nature and scope of the co-benefits that their projects are likely to deliver, but they do not necessarily have a systematic way of tracking and fully assessing their contribution to sustainable development.

A key aspect of the lessons would be to understand where and why co-benefits occur. Based on the FCF assessment it is evident that several stakeholders are involved in accomplishing co-benefits. Project entities play an all-important role in the design and delivery of co-benefits. National and local governments also play a significant role in setting a strategic direction and expectations from projects while creating an enabling environment with facilitative policy frameworks and required guidelines for their effective implementation. It is pertinent to note that the supportive and encouraging role played by the carbon credit buyers (the FCF in this case) is also crucial for the delivery of co-benefits by the GHG mitigation projects.

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<sup>19</sup> UNFCCC. 2016. CDM Boosts Climate Action in Many Ways: Key Messages for COP22. 16 September. <http://newsroom.unfccc.int/paris-agreement/cdm-can-reduce-emissions-in-many-ways/>.

## 3.1 Role of Project Entities

As CDM projects are designed, developed, and implemented by individual project entities including those from the private sector, government or nongovernment organizations, they play a key role in the delivery of sustainable development outcomes of their respective projects. Their corporate philosophy, selection of project types and technologies, and active engagement with local stakeholders greatly influence how well they can plan and deliver co-benefits for the advantage of communities they serve.

**Project design that maximizes co-benefits.** Project entities can demonstrate that climate change mitigation and co-benefits can go hand in hand if considered and planned from the early stages of the project. While it is mandatory to demonstrate that the project contributes to the sustainable development of the host country, the CDM does not require project entities to monitor and report on co-benefits. However, project entities can establish corporate guidelines to optimize the delivery of co-benefits. As the scope and scale of co-benefits may vary with project types and more importantly with the local circumstances, thoughtful consideration of all possible co-benefits integrated into a project's blueprint can significantly influence their delivery.

**Importance of dialogue with local communities in the decision-making processes.** As the mix of stakeholders associated with GHG mitigation projects is usually quite diverse, it is not surprising that some of them do not have an in-depth understanding of low-carbon technologies. In such circumstances, close collaboration with a range of stakeholders—including government authorities, private enterprises, nongovernment organizations, and the beneficiary communities—from the early stages of the project is crucial as they all play a pivotal role in the success of the project and delivery of co-benefits. Extensive consultations with various stakeholders contributes to the understanding of the objectives in setting up the plan for a sustained delivery of community benefits and ensures effective implementation and delivery of co-benefits.

**Corporate philosophy of project entities.** Project entities, public as well private, are increasingly adopting **CSR strategies in addition to much needed** financial bottomline and shareholder return-on-investments criteria in the larger interest of their business. The FCF experience reflects that project entities are integrating their CSR activities more closely with their broader business activities, including planning for their mitigation projects. Several projects in the FCF portfolio provide working examples of novel initiatives undertaken by such self-motivated institutions to provide benefits to local communities in the areas of education, healthcare, women empowerment, and improvement of local livelihoods. In the FCF's experience, regular engagement with the local communities through well-considered CSR programs helps to create shared value for the business and society. This is a key success factor in achieving GHG mitigation and delivery of co-benefits. Box 6 presents one of the many examples of CSR activities carried out by one of the project entities FCF has contracted to purchase CERs from.



## Box 6: Tata Power Company—Delivering Co-Benefits through Corporate Social Responsibility Initiatives



Students having their lunch in a canteen facility constructed by TPC in Ranjani School. Photo credit: Future Carbon Fund.



Sanitation awareness programs encourage local residents to construct toilets in their homes. Photo credit: TPC.

In 2008, Tata Power Company Limited (TPC) developed a 50.4-megawatt wind farm in the state of Maharashtra, India. The project exports an average of 89,570 megawatt hours of electricity to the regional grid of India per year thus reducing approximately 84,215 tCO<sub>2</sub>e annually.

Driven by a vision to contribute to sustainable development, TPC is implementing a comprehensive corporate social responsibility program to improve the living standards of communities located near the project site. Under the program, TPC has funded 30 solar street lighting systems, 6 watershed systems to preserve rain water, and 16 medical camps in a year for the benefits of communities living in four villages in the project area.

Under the program, TPC is supporting four state government-owned primary schools close to the project site, benefitting more than 500 students. Basic infrastructure such as drinking water supply, water storage tanks and toilet facilities as well as canteen facilities have been upgraded. TPC has also provided e-learning kits in the regional language for the school children, further enhancing their learning experience.

In 2015 and 2016 TPC undertook several initiatives focused on women's empowerment in the area. This included training 23 self-help groups (SHGs) for women in six villages in the vicinity of the project, training 295 women in new skills for potential income earning opportunities. Around 80% of the women

in these SHGs have already initiated their own income-generating activities and are encouraging other women to get involved in these activities. TPC has also funded an awareness program on sanitation run by local volunteers to educate residents on the importance of building toilets within their houses. As a result, about 40 women from SHGs have availed of the Government of India's scheme to construct toilets within their houses.

Source: Future Carbon Fund.

## 3.2 Role of Governments

CDM projects are designed and implemented within the regulatory framework of the host countries. Governments therefore have an important role in providing policies that set out overall targets for sustainable development in their respective countries. The governments play a key role in providing legislation and regulations that support, enhance, and enforce implementation of such policies as well as reporting on the accomplishment of sustainable development.

**Smart domestic policies bring synergy for multiple co-benefits.** Smart policies can combine the effect on the global atmosphere with local impacts, realizing that these issues are interrelated and require an integrated solution. For example, a policy that promotes the development of renewable energy projects in remote areas does not only address energy security but also GHG emission reductions, creation of jobs, and facilitation of women's participation in energy planning. In this context, international carbon finance may be considered in a strategic way, taking advantage of results-based finance in promoting both GHG mitigation and delivery of co-benefits.

Governments can create an enabling environment to encourage low-carbon growth by incentivizing investments in low-carbon technologies and providing the required stimulus to GHG mitigation projects for realizing their full potential. With the Paris Agreement, the NDCs have emerged as the key policy document for setting the terms for low-carbon development. An ambitious NDC sends a clear signal to the private sector, and to national and provincial governments, that actions are needed within a given timeframe. However, the NDCs need to be developed into sector-specific policy frameworks and investment plans to deliver on their targets.

Carbon pricing is a key instrument for creating incentives for investing in low-carbon technologies. Governments can create national frameworks for putting a price on GHG emission reductions through a combination of carbon pricing instruments such as emissions trading and/or a carbon tax to define a cost for GHG emitters in their respective jurisdictions.

The Paris Agreement acknowledges the use of market-based instruments as one of the cost-effective solutions to address climate change and to enhance ambition. Article 6.2 of the Paris Agreement allows for countries to voluntarily cooperate to meet their NDCs through cooperative approaches and Article 6.4 envisages development of a new international carbon offset mechanism. The development of domestic emissions trading systems and a new international carbon offset mechanism, as well as existing and future bilateral mechanisms, can help countries to access climate finance and pursue a low-carbon development path to help achieve the ambitions set out in their respective NDCs.

Box 7 shows how the solar power projects in Thailand developed under the government's Very Small Power Producers scheme are delivering sustainable development benefits to the local communities.

**Institutional initiatives such as those by local government toward greenhouse gas mitigation.** Projects such as the improved cooking stove and improved watermills program in Nepal show that the effectiveness of the CDM projects is maximized when there is a strong overlap between national development goals and GHG mitigation options. These projects were developed and implemented by the Government of Nepal with an aim to reduce GHG emissions, bring about improvements in air quality and forest conservation, reduce dependency on fossil fuels, and enhance economic outcomes at local and household levels. These types of initiatives not only realize GHG mitigation goals but also contribute to the improved welfare of communities and sustainable development in the region.

### Box 7: Government Scheme in Thailand—Facilitating Delivery of Co-Benefits for the Local Community



SPP projects supply electricity to nearby villages through a local transmission network. Photo credit: Future Carbon Fund.

Under the Very Small Power Producers scheme of the Ministry of Energy of the Government of Thailand, the Electricity Generating Public Company Limited (EGCO) has installed 30-megawatt solar power facilities under four special purpose vehicles (SPP 2, 3, 4, and 5). These projects sell power to the Provincial Electricity Authority through a local transmission network. Through this network, the Provincial Electricity Authority prioritizes a certain amount of electricity to villages within a 5-10 km radius of the respective project. The remaining electricity is supplied to other areas through the grid. The SPPs also contribute toward the Power Development Fund initiated by the Energy Regulatory Commission of Thailand. The funds collected are distributed among communities living within 5 km of the project to support education, public health, and environmental management for the local population.

Having started operations in 2012, these four projects are currently generating 61,340 MWh of green electricity preventing 34,070 tCO<sub>2</sub>e per annum.

Source: Future Carbon Fund.

## 3.3 Role of Carbon Credit Buyers

The role of the carbon credit buyers, the FCF and its participants in this case, is directed more toward incentivizing the design and delivery of co-benefits through their preference for certain project types and selection of host countries. Carbon credit buyers can contribute to the delivery of co-benefits by prioritizing project types that are expected to have considerable social, environmental, and economic co-benefits. The CER buyer could also offer incentive pricing for CERs generated by projects that can demonstrate significant co-benefits for the concerned communities. For government buyers, such incentives may stem from their development policy priorities, while corporate buyers may pursue their respective company policies. In certain cases, CER buyers can also negotiate their CER purchase agreements to include conditions related to the delivery of measurable actions that may further enhance such co-benefits.

The FCF has made due efforts to contract CERs from high quality CDM projects that not only reduce GHG emissions but have additional positive impacts by delivering co-benefits. In a few cases, the FCF has also been able to structure its transactions to support inclusion of some additional measures by the project entities to enhance co-benefits. With a balanced approach, the FCF has been able to demonstrate how well-designed CDM projects can deliver co-benefits and contribute to sustainable development.

**Incentivize high-quality mitigation projects.** CDM projects can achieve GHG emission reductions and also generate multiple co-benefits for the local communities, countries, and regions in the long term. However, the nature and scope of co-benefits and even the quantum of such positive impacts vary from project to project depending upon a variety of factors including the local or national circumstances under which these projects are implemented. It is the prerogative of the CER buyers to assess co-benefits as part of their due diligence and take them into consideration in their CER transactions. CER buyers may even consider paying incentive pricing for the purchase of CERs from certain high-quality projects that match their institutional preferences and corresponding selection criteria. Regardless of their scale, these projects typically provide increased livelihood opportunities, boosts in local infrastructure, stable power supply for communities, enhanced social cohesion, and inclusive economic growth, all of which contribute to sustainable development.

**Inclusion of co-benefits in the Emission Reduction Purchase Agreement.** Carbon credit buyers can also structure their transactions to provide results-based carbon finance linked to certain development activities and/or delivery of pre-defined co-benefits that can motivate stronger inclusion of co-benefits in mitigation projects. It is a regular practice to ascertain expected emission reductions at the time of project design or inception, but not necessarily a regular practice to ascertain the co-benefits these projects may be able to deliver over their lifetime. Similarly, while emission reductions may be monitored or reported as a part of the usual business processes (e.g., implementation of power purchase agreements), systematic monitoring and reporting of co-benefits on a regular basis may not be an established practice. In this context, CER buyers can play a facilitative role by linking their CER purchase agreements to pre-defined co-benefits. By adopting a systematic approach to evaluating the co-benefits of a project, tangible developmental benefits can be better designed, realized and/or maximized throughout the lifetime of the project. Therefore, the assessment of project co-benefits and their enforcement at the onset of Emission Reduction Purchase Agreement negotiation can lead to substantial development gains for the project beneficiaries.

**Secured stream of carbon finance.** Toward the end of the first commitment period of the Kyoto Protocol, international carbon prices began to decline due to lower demand for CERs in the Annex I Countries (demand contraction) and a steady growth in the number of CDM projects registered by the CDM Executive Board, significantly raising CER generation (supply expansion). This, together with a delay in international negotiations on a new climate regime, has created uncertainty about future carbon finance inflows into such mitigation projects. Under this transitional phase for the international carbon market, the FCF has continued to provide results-based carbon finance through the prepurchase of post-2012 CERs for its



participants.<sup>20</sup> The FCF's continued operations under such adverse market conditions, in particular its ability to enter long-term fixed price contracts, helped its portfolio projects to secure carbon finance, guarding them from exposure to carbon market fluctuations. This has helped project developers factor the carbon finance into their project implementation plans including delivery of co-benefits. Moreover, the FCF's ability to provide upfront payment not only helped project developers reduce their financial burden especially in the initial phase, but made a significant impact on the viability of their projects during the design phase. The upfront payments also helped sustain project operations and therefore ensured continuous delivery of the co-benefits. Box 8 shows how an upfront carbon financing can make a significant impact on the viability of a CDM project.

### Box 8: Carbon Finance—Ensuring Viability of Solar Cooker Projects in the PRC



Jihong Feng cooking a meal using her solar cooker.  
Photo credit: Beijing Harmonious Energy Development.

Jihong Feng, a resident of Liyuan Village in Linze County, in the PRC, is one among the tens of thousands of people who now own a solar cooker. Thanks to Beijing Harmonious Energy Development Company Limited (BHED), the developer of the Heqing Solar Cooker Projects, and the local government authorities responsible for promoting clean energy, thousands of people like Feng are reaping tangible benefits every day. “Now that I have a solar cooker, I need to buy less coal,” she shares. “This saves me more than CNY1,000 (about \$152 equivalent) every year. I can buy my husband and myself more medicines that are not covered by our medical insurance schemes.”

The solar cooker that Feng uses to cook simple meals particularly during noontime, is one of the 98,000 solar

cookers installed by the projects, ultimately benefiting about 400,000 villagers and covering approximately 80% of the local population.

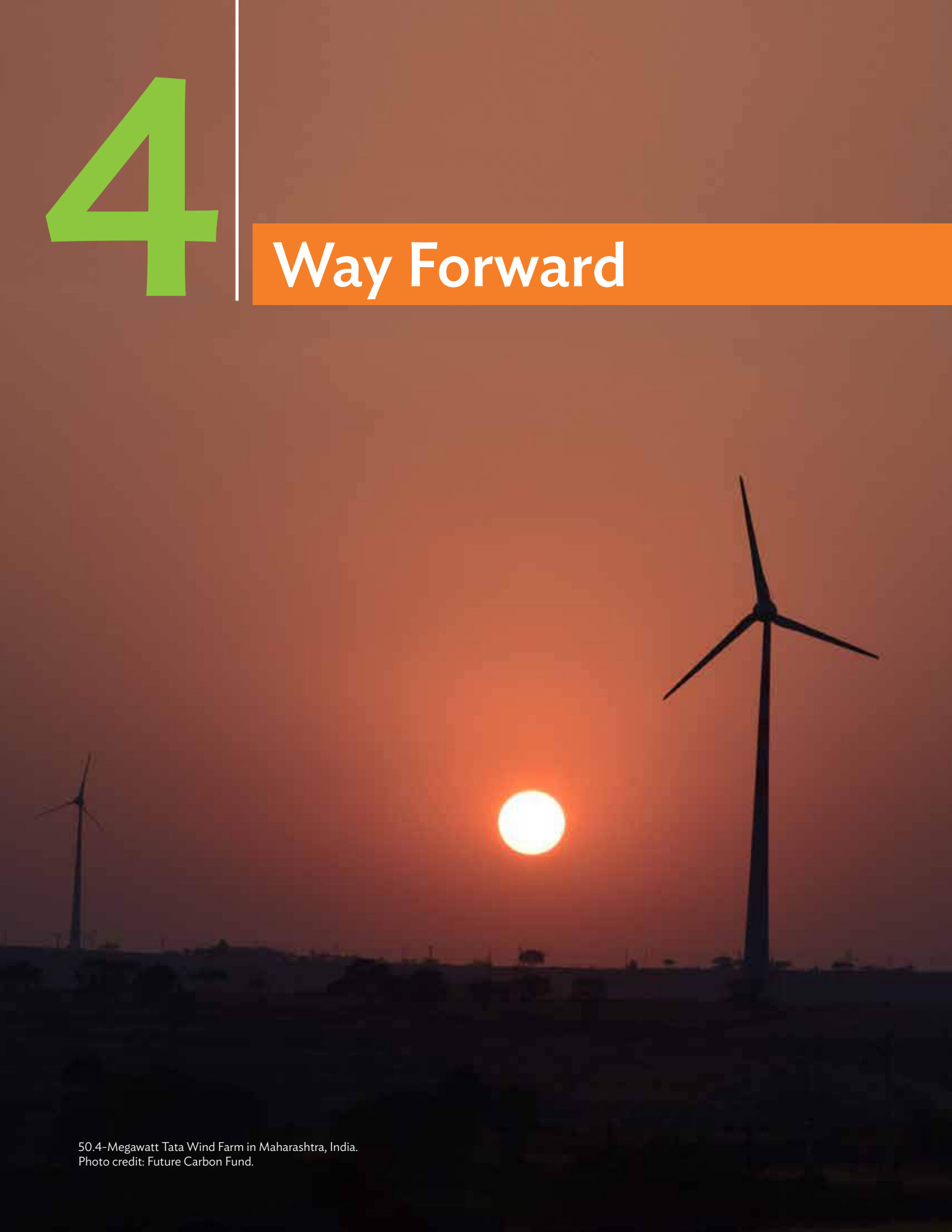
A solar cooker costs approximately CNY400 (about \$61 equivalent) including manufacturing, transportation, installation, and maintenance for the first 3 years. The cost was shared between the project entity (CNY365, or about \$56 equivalent) and each participating household (CNY35, or about \$5 equivalent), with the project entity financing these costs through upfront payments from the CER transactions. This project demonstrates how carbon finance can be the primary source of funding GHG emission mitigation projects and can directly contribute to sustainable development for the benefit of local communities.

Source: Future Carbon Fund.

<sup>20</sup> The results-based carbon finance approach of the FCF works in two ways: (i) advance financial resources for project development and implementation through the prepurchase of emission reductions from the contracted CDM projects in DMCs; and (ii) payment of a preagreed fixed price for each CER purchased, which removes price uncertainty and limits the downside for the project developer compared with the alternative of floating price mechanisms linked to the future spot price of emission reductions, which is the market standard.

# 4

## Way Forward



50.4-Megawatt Tata Wind Farm in Maharashtra, India.  
Photo credit: Future Carbon Fund.

## 4.1 Linking the Agenda 2030 to the Paris Agreement

The adoption of the Paris Agreement at the Conference of the Parties 21 raised expectations for the resurgence of carbon markets and has re-ignited interest in market mechanisms. At the same time, there has been a strong wish to build on the wealth of technical knowledge and experience(s) of the existing Kyoto Protocol mechanisms, such as CDM, as well as including elements in new mechanisms that were not part of the Kyoto Protocol mechanisms. Many have urged for an enhanced contribution to sustainable development.

Article 6.4 of the Paris Agreement provides for a new mechanism by which public and private entities can support GHG emission reductions and sustainable development.<sup>21</sup> The Paris Agreement mentions the intrinsic relationship between sustainable development and climate change actions in the preamble and in Article 2, and in general has a greater emphasis on sustainable development compared to the Kyoto Protocol. However, addressing sustainable development in practice in mitigation activities is yet to be elaborated under Article 6.4 of the Paris Agreement.

One of the important expectations out of a future mechanism is that it should provide a systematic approach to plan, monitor, and report sustainable development in a harmonized and transparent way. A number of different standards and tools exist but the international community has so far not agreed to a common standard for reporting sustainable development impacts in relation to mitigation projects and programs.

## 4.2 Using the Agenda 2030 Framework to Understand the Value of Mitigation Activities for Sustainable Development

In the future, GHG mitigation projects will take place within the framework of the Agenda 2030, which is an internationally agreed framework for defining national targets and indicators. The framework can also be used to elaborate systems for monitoring and reporting at subnational levels and could thus form the basis for a coherent approach to GHG mitigation and sustainable development. At the national level, the SDGs can provide a tool to assist countries in defining their sustainable development priorities, selecting and approving activities for support under market mechanisms, and subsequently monitoring their implementation. There is movement both at the national and corporate level toward recognizing SDGs in the context of climate change that could be reflected in the new mechanism under Article 6.4.

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<sup>21</sup> Article 6.4, (a) the aim is “to promote the mitigation of greenhouse gas emissions while fostering sustainable development.”

Developments in the voluntary carbon market show that standards, indicators, and metrics can be adopted to function under the SDGs. While institutions such as the International Organization for Standardization<sup>22</sup> and the Global Reporting Initiative<sup>23</sup> provide detailed requirements for reporting, the overall framework for sustainability reporting is now to a larger extent the Agenda 2030 and the 17 SDGs. The FCF has already adopted a similar approach by selecting indicators from several standards and tools—including the CDM Sustainable Development Tool—and customizing them for the purpose of the assessment of the FCF portfolio within an SDG framework. This has demonstrated that reporting of co-benefits related to the Agenda 2030 is possible, albeit difficult for some of the indicators and relatively straightforward for others.

Project-level sustainable development assessment under future frameworks should include quantification of sustainable development impacts when feasible. While some of the FCF portfolio projects attempt to address the social, environmental, and economic parameters qualitatively, quantification of co-benefits was more challenging. Furthermore, some parameters were more difficult to track than others due to their intangible nature. Project entities would have benefited from a framework and guidance on how to report on co-benefits. There is a need to develop a globally approved standard for co-benefit reporting, including quantification methods. Accounting for co-benefits can highlight the inter-relationships between GHG mitigation projects and effects on the economy, society, and the local environment. This would be valuable for unlocking the hidden value of carbon for governments, corporates, and the private sector.

Applying the Agenda 2030 framework could facilitate better communication of co-benefits. According to the Global Commission on the Economy and the Climate, more than 50% (or up to 90%) of the reductions in GHG emissions required to prevent temperatures rising above 2 degrees could be achieved through measures that are in the direct interest of countries undertaking them, once benefits other than mitigation are taken into account.<sup>24</sup> Approaches that better communicate the value of the projects beyond emission reductions with the evolving instruments can provide a stronger foundation for climate action and sustainable development.

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<sup>22</sup> International Organization for Standardization. 2014. ISO 26000:2010—Guidance on Social Responsibility. <https://www.iso.org/standard/42546.html>.

<sup>23</sup> Global Reporting Initiative. <https://www.globalreporting.org/Pages/default.aspx>.

<sup>24</sup> Global Commission on the Economy and Climate. 2014. *Better Growth, Better climate: The New Climate Economy Report—Executive Summary*. [http://static.newclimateeconomy.report/wp-content/uploads/2014/08/NCE\\_ExecutiveSummary.pdf](http://static.newclimateeconomy.report/wp-content/uploads/2014/08/NCE_ExecutiveSummary.pdf).

## 4.3 Implications for the Design of a New Market Mechanism under Article 6 of the Paris Agreement

The new mechanism under Article 6.4 may require mitigation projects to demonstrate that, in addition to reducing GHG emissions, they also make a contribution to sustainable development goals through the delivery of co-benefits.

This could be achieved in part through stronger emphasis and better guidance on local stakeholder consultations. Efforts could also include mandatory reporting of co-benefits. The PDD could contain sections for the description of the SDG that will be addressed by the implementation of the proposed GHG emission mitigation project activity. This would encourage project entities to design their projects in such a way that co-benefits are thoroughly assessed, designed, and delivered.

As discussed above, the delivery of the expected co-benefits of a project could be monitored using a simple methodology based on the SDG indicators incorporated in the PDD together with a methodology on the monitoring of the expected co-benefits. In order to ensure transparency, validation and verification of co-benefits may be included in the scope of work to be undertaken by a third-party entity accredited or approved by the designated body supervising the mechanism under Article 6.4. Findings of the third-party entity would then be reported in the validation and verification reports.

The approach implies that co-benefits, as presented through the SDG framework, are not only considered in the design of the project but also monitored and reported periodically. The validation and verification reports on the co-benefits could be an important reference for carbon credits buyers when evaluating projects. Their decision could depend on several factors including the type of co-benefits they expect to be delivered and the extent of the impact of these co-benefits. Carbon asset buyers may also consider such certified information on the nature and extent of co-benefits in the pricing of carbon credits. However, any verification of co-benefits would be for reporting purposes only and should not impact the issuance of emission reductions.

The additional burden this could place on project developers needs to be considered. Many CDM project developers already struggle to report against CDM requirements. However, at the same time, larger companies are already reporting on sustainable development impacts through standards such as the Global Reporting Initiative. A harmonized approach using the SDG framework would make reporting easier and requirements could be scaled to the size of the project or project entity.

An approach using the Agenda 2030 framework that puts stronger emphasis on monitoring and reporting of co-benefits could be considered while discussing “fostering sustainable development” under Article 6.4. One of the key issues is likely to be if it will be a mechanism for mitigation and sustainable development, but where only mitigation impacts will be quantified and verified, or if sustainable development will be integrated in the mechanism itself.



# 5

## Case Studies



Kinoya Sewerage Treatment Plant Greenhouse Gas Emission Reduction Project, Fiji.  
Photo credit: Future Carbon Fund.

# Double A Ethanol Wastewater Treatment Plant, Thailand

## Enhancing the Community's Quality of Life

Sitting in the courtyard of his home in Prachinburi Province in Thailand, 72-year old village leader and retired cassava farmer Puek Lebpayak describes how people from his village would relocate to urban areas in search of better jobs. Until a few years ago, agriculture was the main source of income for local residents. Now, nearly 200 meters (m) away from the village lies an industrial park that houses the E85 ethanol plant and its Wastewater Treatment Plant, formerly the Double A Ethanol Wastewater Treatment Plant. The project is located in Srimaphote, Prachinburi Province, 190 km east of Bangkok. “Life has improved for my people” Puek recounts. “There are many industries here. The project helped provide an additional opportunity for my people to work near their home town instead of moving away for work.” Although the project does not require huge manpower, it presents an opportunity for the locals to diversify their skills and gain new experiences. Ten employees, representing a third of the project's staff, come from the local community.

The ethanol plant can produce 500,000 liters (l) of ethanol per day from cassava, a tropical crop cultivated extensively for its tuberous starch. The production of ethanol results in an average wastewater flow of 5,000 to 6,000 cubic meters per day. The large volume of wastewater is warm, concentrated, biodegradable, and nontoxic, with a chemical oxygen demand (COD) of approximately 50,000 milligrams per liter. It is therefore highly suitable for high-rate anaerobic treatment in the internal circulation anaerobic digesters installed at the project site. This is the first project in Thailand to use an advanced technology internal circulation reactor. The digesters convert the COD to biogas, yielding approximately 79,340 normal cubic meters of biogas per day. This is exported via pipeline and combusted in a limekiln boiler to generate heat close to the project site.<sup>25</sup> The digested slurry produced by the internal circulation reactor is used as a fertilizer.

In the absence of the project, open anaerobic lagoons would have been used to treat the wastewater from the ethanol production. In Thailand, inexpensive, conventional open anaerobic lagoons are a common approach to treating wastewater from industrial plants. These result in high methane emissions. Methane is a potent GHG, with a global warming potential of 21 times that of carbon dioxide (CO<sub>2</sub>).<sup>26</sup>

Developed by the E85 Company Limited (E85), a daughter company of the National Power Supply Public Company Limited,<sup>27</sup> the project was envisioned to avoid emitting 170,983 tCO<sub>2</sub>e per annum through the reduction of methane emissions from the wastewater

<sup>25</sup> Biogas is used to replace fuel oil (bunker C) at the limekiln boiler of a paper plant adjacent to the project.

<sup>26</sup> Over a 100-year time horizon.

<sup>27</sup> The NPS is the main operating energy business under the Double A Group. On 28 March 2013, Double A Ethanol Company registered the change of its name to E85.



treatment plant. The project results in additional GHG emission reductions by using biogas to avoid 19,758 tons of bunker oil in the boiler every year, although this is not claimed under the CDM project to ensure conservatism.

Handling water quality matters at an ethanol facility is an intricate task. The treated effluent from the project has a COD of less than 120 milligrams per liter, meeting Thailand's industrial effluent standards.<sup>28</sup> At the project, wastewater sampling and analysis for pH, COD, biological oxygen demand, suspended solids, and total dissolved solids before and after treatment is done regularly to ensure optimal operations. This also ensures that the treated effluent complies with applicable standards set by the Ministry of Environment. The project also undertakes voluntary monitoring of the water quality in the Klong Rung canal which passes nearby the project area to ensure that it has no adverse effect on aquatic life. Further, a part of the wastewater generated at the facility is being used to irrigate the Double A eucalyptus plantation nearby, resulting in 5,000 m<sup>3</sup> of water savings every day. The wastewater is distributed to the farms 10 km away through pipelines, thus preventing any discharge to a surface water resource.

A zero-waste policy is observed by the plant, ensuring that the 100 tons of sludge generated per day is sent for land application. Activated sludge is applied as soil conditioner in two ways: (i) directly to land as it is rich in organic matter; and (ii) transferred to a fertilizer plant where it is used as raw material. Before 2017, the plant only disposed of its sludge through a fertilizer plant. In February 2017, the company began applying a part of the sludge to the Double A eucalyptus plantations. As part of its CSR activities, the company aims to distribute 10% of its daily sludge volume to local farmers, free of charge. A total of 14 farmers so far have procured 200 tons of sludge. This has reduced their planting costs as the sludge replaces expensive chemical fertilizers.

Foul odor commonly emanates from wastewater treatment plants that use open lagoons, causing problems for surrounding areas. With the installation of the internal circulation reactor technology, E85 is able to manage the odor and avoid creating a nuisance for residents who live nearby.



A worker taking out the pond scum at the E85 Wastewater Treatment Plant. Photo credit: E85.



A local farmer uses the sludge at her farm. Photo credit: E85.

<sup>28</sup> Industrial effluent standard in Thailand according to Water Environment Partnership in Asia ([http://www.wepa-db.net/policies/law/thailand/std\\_industrial.htm](http://www.wepa-db.net/policies/law/thailand/std_industrial.htm)).



The Wat Buyaibai Primary School helps shape the minds of 140 children from nearby villages. Photo credit: Future Carbon Fund.

The project employs 30 people to ensure smooth operations on a day-to-day basis, including both skilled and unskilled staff. Projects such as this wastewater treatment facility are helping skilled people find local employment opportunities, thus encouraging people to move back from urban areas. Sulawan Juntim, a 33-year-old environmental engineer has been working at the plant for the past few years. The job allows her to hone her skills with a more sophisticated technology used at the project site. Since Juntim is from Srakaerw province, the job allowed her to move back home from Bangkok (where she used to work) to be closer to her family. “This job helped me gain a work-life balance,” she says. With the lower cost of living, Juntim was able to afford a new house.

Through the activities of the NPS, the E85 is an active participant in the community and undertakes activities that signify its commitment to improving the quality of life of the residents. E85 participates in the regular maintenance of the concrete road within the industrial complex. This not only ensures easy mobility for heavy vehicles but also reduces the diffusion of dust particles resulting from continuous movement of vehicles. They also strive to bring prosperity to the community through regular donations to three primary schools and temples each year. Donations are also extended to the elderly for the purchase of household utilities such as fans, clothes, and medicine.

The Wat Buyaibai primary school, a learning center for 140 children from nearby villages, has received a grant of B180,000 (\$5,400 equivalent) for the past 6 years. The grant has helped improve school facilities and purchase new equipment to support the education of the students.

## Angkor Bio Cogen Rice Husk Power Project, Cambodia

### Providing Energy Security to the Local Communities

Until a few years ago, it was common for residents of the Phum Ang Snoul village in Cambodia to light up their homes using batteries or gas. The unstable power supply in the area meant residents usually had to endure blackouts for up to 2 days at a stretch. When the Angkor Bio Cogeneration (ABC) project began to export power to the mini grid in Ang Snoul village, it helped alleviate the power supply issue faced by the local residents. “I used a battery for lighting up that was used up in a few hours,” Suon Nat recalls. “But when the ABC project began operations, I bought a refrigerator so my food can be kept for a long time.”

More than 20 years ago, the Angkor Rice Mill (AKR) was founded in Ang Snoul district, Phnom Penh. For several years, the AKR remained dependent on diesel for electricity generation and grid supply to ensure a consistent power supply. However, the diesel oil generator was polluting, uneconomical, and offered no solution for waste (rice husk) disposal. Alternate options for cleaner, cost-effective, and superior husk disposal mechanisms were explored. The rice husk-based cogeneration project was a logical conclusion. However, such a project had never been implemented in the country before.

The project involved the installation and operation of a 2 MW electricity generator, which uses rice husk as a renewable fuel source. The project achieves GHG emission reduction in three ways:

- (i) The largest GHG reduction is achieved through the use of rice husk which was previously left in the open to decay, resulting in methane emissions.
- (ii) The generated power is exported to the AKR, which partially replaces power generated by their captive diesel power generator, contributing to GHG emissions associated with the diesel power plant.
- (iii) The surplus power is supplied to the local mini-grid, providing electricity to the community living outside the project premises.

All these measures result in potential annual reduction of 51,620 tCO<sub>2</sub>e.



With the electricity supply in Ang Snoul village stabilized, Suon Nat was able to buy a refrigerator to keep food for her family for a long time. Photo credit: Angkor Bio Cogen.



Angkor Rice Mill installed a 2-megawatt electricity generator which uses rice husk as a renewable fuel source. Photo credit: Future Carbon Fund.





Keo Sarom enjoys a meal with his family. They no longer have to use a wood-fired cook stove to prepare their food since the more reliable power supply means they can use a rice cooker instead. Photo credit: Angkor Bio Cogen.



Staff at the cogeneration project wear safety equipment while working with the highly flammable rice husk. Photo credit: Angkor Bio Cogen.

Prior to the installation of the cogeneration unit, AKR used to meet its electricity requirement through a captive diesel-based power plant and imported expensive power from the national grid. The AKR mill now utilizes electricity generated by ABC at a price almost 40% lower than the national grid. Excess electricity generated by ABC is sold to the mini-grid.

The mini-grid used to import all of its power requirement from the national grid before it started importing power from the project. The new connection benefits the users in two ways:

- (i) By selling the power from the project at a price lower than the national grid, the mini-grid can reduce the tariff rate for the end users.
- (ii) By providing an alternative source of power to the mini-grid, it has reduced the frequency of blackouts.

People have noticed an improvement in the power supply and report fewer power interruptions. Surrounded by his grandchildren, 60-year old village chief Keo Sarom is happy about the change. “The 24-hour power supply means we can now own an electric rice cooker and a television,” he relates. “We used to fetch wood every day to cook our meals before ABC project started exporting power to the grid.”

Seang Ngoun Long, who owns an electric appliance shop near the national highway, has also noticed an improvement in recent years, with much fewer blackouts than before. It has also been good for

business. “With the stable electricity supply, the expansion of the local mini-grid coverage together with reduced tariff, the demand for electric appliances has increased noticeably,” he says.

Furthermore, Sarom says that more than 200 families enjoy the reduced power tariff and a regular grid supply in the area. Among other factors such as the project’s close vicinity to the highway, the implementation of the project has brought about the establishment of many local businesses such as food shops and grocery stores. Such transformation illustrates how a sustained power supply can bring progress and enhance the quality of life of the people comprising local communities.

The installation of the cogeneration system also provides a sustainable and cheaper source of power for the AKR operations compared to electricity imported from the grid. As a

consequence, AKR has been able to double its production of export quality jasmine rice, resulting in additional income for the farmers who supply rice to the mill.<sup>29</sup>

The ABC managing director Adisorn Chieu says, “The use of rice husk for firing in steam-driven turbines was a pioneering technology in Cambodia in 2011. One of the challenges of using sophisticated machinery is finding the suitable human resources to operate it. At the same time, it also provides an opportunity to enhance the technical skills of the local people.” ABC provides regular staff training for upgrading technical and operational skills of its people, and observes all occupational health and safety measures required in the operation of the cogeneration plant.

The husk constitutes about 20% of a rice grain’s weight and is considered a waste product upon milling. Rice husk is toxic, easily flammable, and affects groundwater quality when stored over a long period. This waste product is usually left to decay in the open, which results in methane emissions. However, rice husk can be used for various purposes, including as fuel for generating power. The ash from the burned husk can also be put to use as fertilizer for improving quality of the soil, an organic practice that makes the soil more suitable for vegetable farming.

The ABC project is an example of what pioneering technological interventions such as the use of biomass for power generation in a least developed country can contribute to the social and economic betterment of local communities.

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<sup>29</sup> Angkor Rice. <http://angkorrice.com/>.

## Lopburi Solar Power and Wang Phloeng Solar Power Projects, Thailand

### Prosperity and Partnerships through Clean Energy Projects

Lying amid lush green fields of sugarcane and tapioca plantations in Lopburi province are huge sprawling solar photovoltaic panels utilizing sunshine as an energy source. These panels supply green electricity to the national grid at the Chaibadan 2 substation, almost 180 km north of Bangkok. Sitting adjacent to each other with a combined capacity of 63 MW,<sup>30</sup> the electricity generated by the Lopburi solar power plant project and the Wang Phloeng solar power plant project is enough to light up 52,970 households.<sup>31</sup> This is equivalent to meeting the demand of 20% of the total population of Lopburi province.<sup>32</sup> Collectively, the projects are not only avoiding more than 70,000 tCO<sub>2</sub>e per annum but are also providing sustainable livelihoods and support to the local communities.

Local grocery shop owner Apiya Muaklam was elated when her daughter found work as a security staff at the National Energy Development Company Limited (NED), the developer of the solar power projects. For the past 46 years, Muaklam has been living at Moo 3, less than a kilometer away from the projects.<sup>33</sup> Her gratitude is palpable. “Families get detached when they have to travel for work elsewhere. My daughter doesn’t have to leave as she has been working since construction began for the Lopburi project in 2010 and receives a decent income,” she says proudly. “We are grateful to NED for giving revenue back to the local people through the project.”

Thitima Yoosuborn, who graduated with an electrical engineering degree, feels fortunate to get a job near her home immediately after college. She is happy to be part of the team maintaining and servicing more than 600,000 solar panels at the plant.

Chon Muang village headman Saichol Thanomsak feels that the projects have played a pivotal role in diversifying employment opportunities in their predominantly agrarian region. Many people have been employed to cut grass and for general repair services at the projects. He also describes how the workshops organized by NED are empowering local people to develop high-value products such as fragrant oils, shampoos, mosquito repellents, balms, and soaps using locally available resources under the *One Tambon, One Product*, a local entrepreneurship program. “Men buy the raw material such as lemongrass, honey, tamarind, milk, etc. and women make the products,” Thanomsak says. By making these products twice a year at the workshops, a group of 32 members is able to gain training

<sup>30</sup> The 55-megawatt Lopburi solar power project and the 8-megawatt Wang Phloeng solar power project are both Clean Development Mechanism registered projects.

<sup>31</sup> This is estimated using the average household size in Thailand in 2016 (Esri's ArcGIS. <https://www.arcgis.com/home/item.html?id=2ccc11c25bf24b0b8b40f3259ef18cb9>) and the average electricity consumption per electrified household in Thailand (consumption in Thailand (Enerdata. 2014 Data. <https://wec-indicators.enerdata.net/household-electricity-use.html>).

<sup>32</sup> The average household size in Thailand is 3.2 according to Esri's ArcGIS (2016 Data). The population of Lopburi province is 769,925 according to the 2010 census (City Population. Lopburi. <http://www.citypopulation.de/php/thailand-admin.php?adm1id=16>).

<sup>33</sup> A Moo is a village in Thailand. Each moo in a district is differentiated by its number, e.g., Moo 1, Moo 2.

and generate additional income, which has opened a new window of livelihood opportunities for them.

An occasional sight in the rural areas of Thailand are solar panels finding their way to schools in the Wang Phloeng subdistrict. Solar panels that no longer operate at maximum capacity and need to be replaced are donated to schools. “We save about B1,000 per month (\$ 30) on electricity bills of the school,” says Sureevat Boonprasert, a teacher at the Bankhaotein School. The school has 14 solar panels, which are also used to power water sprinklers for a mushroom farm in the school premises. These vegetables are cooked and served to schoolchildren for lunch while the extra produce is sold in the local markets.

Thanomsak says the knowledge gained on solar energy has tremendously improved their way of life. He used to cook at home using gasoline, but has now replaced his stove with one run by a solar battery. Solar panels donated by NED are also used to power irrigation pumps at his farm. For the past 5 years, Thanomsek has been using two solar panels for irrigation pumps to sprinkle water and two additional solar panels for operating the submersible pump on his 0.8-hectare farm. This saves him approximately B6,000 (\$181 equivalent) per annum by replacing electricity from the grid. His experience serves as an inspiration for other villagers.

“We want to empower local communities and help them become self-sufficient by engaging them through our ambitious corporate social responsibility program,” NED director Oats Natthidet says. “Among other initiatives, we are also piloting organic farming methods to educate and transfer the know-how to the local farmers for promoting sustainable agriculture practices and transforming their infertile lands into productive organic farms for high value crops.”

NED has also built a 750-square meter GreeNEDucation renewable energy learning center within the solar power plant. It is one of the largest renewable energy learning centers in Southeast Asia, designed to educate visitors on the benefits of clean



Thitima Yoosuborn is an operator maintaining and servicing the solar panels. Photo credit: National Energy Development.



Saichol Thanomsak displays the products made by the local community. Photo credit: Future Carbon Fund.



Solar panels donated by the NED to Bankhaotein school. Photo credit: National Energy Development.





Students learn about renewable energy particularly solar power at GreeNEDucation. Photo credit: National Energy Development.



NED conducts workshops on educating local residents on the benefits of solar panels. Photo credit: National Energy Development.

energy and raise awareness about using renewable energy. It also provides visitors an opportunity to learn how our lives depend on energy—and what life would probably be like after depletion of all fossil fuels—through interactive media and visual effects. The learning center focuses on solar power and how it can be used as an alternate energy source. The center is open to the public and is frequently visited by students from various schools and universities in the region.

Through its CSR program, NED has provided 150 student scholarships to four schools, built a school library, supported workshops for teacher training, empowered local residents, and organized a renewable energy camp for students and teachers. To promote the ancient singing tradition which is losing its popularity amongst the new generation, NED also supports local students who possess an ability to sing at its cultural center.

The projects also contribute B0.01 per kilowatt hour of electricity generated to the Power Development Fund administered by the Electricity Regulatory Commission. These proceeds are used by local authorities to fund area development activities such as road construction, lighting, and water supply. From this fund, a 10 km concrete road has been constructed in the vicinity.

The Lopburi Solar Power Project pioneered by NED was one of the largest solar power projects in the country at the time it was built. Leading the way in solar technology, it has demonstrated that solar power is a feasible

technology for Thailand that can also deliver numerous co-benefits for communities. Such initiatives are also influencing regulatory policies in the country.<sup>34</sup> The Government of Thailand has set a national target of 30% share for renewable energy in its energy mix by 2036.<sup>35</sup>

<sup>34</sup> Royal Thai Embassy, Washington, DC. Thailand raises renewable energy target. <http://thaiembdc.org/2017/07/03/thailand-raises-renewable-energy-target/>.

<sup>35</sup> Government of Thailand, Ministry of Energy. *Alternative Energy Development Plan 2015–2036*. <http://www.eppo.go.th/images/POLICY/ENG/AEDP2015ENG.pdf>.

## Dagachhu Hydropower Project, Bhutan

### Connecting Grids, Connecting People

Nimgyeltshen, a former subsistent farmer and daily wager who lives in Baleygang village, could still recall how hard life was for him and his wife before 2010. “There was nothing here,” he says. “It took us 1 hour to cook rice because we had no electricity.”

In 2010, he began working as an unskilled helper for the contracting company Andritz, which was involved in the construction of the Dagachhu Hydropower Plant. He eventually got a job at the plant itself, and is now a skilled plumber responsible for maintaining the water pipelines and providing support during annual maintenance work inside the powerhouse. His wife works in the plant too and life in their village isn’t as hard as it used to be. “With the opening of the Dagachhu Hydropower Project, we have everything: electricity, water supply, rations. We can cook rice in 15 minutes because we have electricity and can use a rice cooker now,” he shares happily.

“We had to walk down to far-off places to buy food at reasonable price, as it was expensive locally due to limited demand,” relates Kunzang Wamgdi, who also works at the plant. The district would also remain cut off from other parts of the country during monsoons due to landslides, forcing people to travel on foot to Kalikhola to buy rations. “It took a day to walk to buy 1 kilogram of salt,” he relates. With the development of the area, he can find affordable food locally. “Our village is a heaven now because of the project.”

The Dagachhu Hydropower Project is a 126-MW run-of-the-river project located on the Dagachhu River in Dagana *dzongkhag* (district) in the southwestern part of Bhutan and developed by the Dagachhu Hydropower Corporation (DHPC). The project is the first public-private partnership venture with Druk Green Power Corporation, Tata Power Company Limited, and National Pension and Provident Fund of Bhutan. The power generated from the project is exported to the national grid of India, making the project the first cross-border project activity under the CDM. Electricity used to be generated by grid-connected power plants in India, many of them fossil fuel-based, resulting in additional GHG emissions. The project exports 392 gigawatt-hours of renewable electricity to India per annum through an existing cross-border grid. This results in reduction of approximately 382,000 tCO<sub>2</sub>e emissions per annum.

Until 2008, the only source of power for Dagana *dzongkhag* was from a 200-kilowatt mini-hydropower project constructed with a grant from Japan, connected through a 6.6-kilovolt transmission line. This mini-hydropower plant was able to electrify only about 400 households. Due to its low capacity, the Bhutan Power Corporation had restricted the use of power for lighting purposes only.



Diversion weir (downstream view) and connection channel of Dagachhu Hydropower Plant. Photo credit: Dagachhu Hydropower Corporation.



With new access to electricity, Tilarupa can now use a rice cooker replacing the traditional cook stove that caused poor indoor air quality. Photo credit: Future Carbon Fund.

In order to facilitate the project construction, Bhutan Power Corporation constructed a 33-kilovolt double circuit line between the Tsirang substation and Dagana Dzongkhag to supply electricity from other hydropower plants. One circuit was used for the project while the other circuit was used for the local community. With this, the number of electrified households has increased from 400 to about 5,000, without any restriction, achieving 99% electrification in the district. The project has expedited the electrification of the region and contributed toward the government target of achieving 100% electrification of other rural regions, using revenue from power exports to India.

Prior to grid connection, the community relied on firewood for their energy needs such as cooking and heating. In 2005, firewood contributed 42% of the total energy consumption in the country, exceeding consumption of electricity, which was at 39%.<sup>36</sup> A 2008 study found that 91% of households used kerosene for lighting while 98% used firewood for cooking in Bhutan.<sup>37</sup> The electrification of households has enabled people in the region to shift from using firewood to electrical appliances.

“Before we had electricity, we used a kerosene lamp for light and firewood for cooking in traditional cookstoves,” recalls Tilarupa. “That produced a lot of smoke.” Today, she prepares her meals with an electric rice cooker. The traditional cook stoves were often inefficient and without a proper smoke ventilation system. Burning of firewood in traditional

cook stoves release a high amount of black carbon, causing poor indoor air quality leading to respiratory problems, especially among women and children.

With access to stable and low-cost power from the project, Tilarupa is no longer relying on firewood for her energy requirement. She can now use a rice cooker and electric lamps for lighting rooms without compromising her family’s health. Local residents, especially women, are now free from their daily duties of collecting firewood and are able to use the time

<sup>36</sup> Government of Bhutan, Department of Energy, Ministry of Economic Affairs. . 2009. *Overview of Energy Policy of Bhutan*. Thimphu.

<sup>37</sup> Government of Bhutan. 2008. *Environmental Monitoring Report. Green Power Development Project*.

so saved for more productive activities such as farming or childcare. This has also reduced dependence on firewood and therefore deforestation in the area.

Due to poor road condition in the villages in Dagana Dzongkhag, the travel time used to be very long and inconvenient. DHPC senior foreman Rinzin Drukpa, who lives in Khagochen village, recalls that in the late 1990s and early 2000s, there were only two bus services plying the route between Dagana and Sunkosh. The 80-km journey which usually took 1 day can now be covered in around 3 hours.



Myna Devi Chhetri in her orange plantation. Photo credit: Future Carbon Fund.

The DHPC has provided Nu123.694 million (\$1.9 million) to the Department of Roads for the construction of a new 40-ton bridge over the Dagachhu River and improving road conditions from Sunkosh to Chineythang. The bridge and the road improvement have immensely benefited the people of Dagana Dzongkhag.

Before the project was set up, vehicles had to travel to Tsirang, about 60 km from the project site for refueling. Along with the opening of the project, Bhutan Oil Distributor has opened up a fueling outlet at Dagapela, which is beneficial for the people of Dagana. The outlet also provides services for refilling of liquefied petroleum gas cylinders used for household cooking, among others, for which people had to travel to Tsirang previously.

Before the implementation of the project, there were no communication facilities in the area. Only a few government offices were connected with landline telephones and these were not accessible to most of the people in the district. In case of emergencies, messengers and people had to travel for hours to the nearest telephone booth. In 2008, with the influx of around 2,000 people to the area during the project construction phase, telecommunication providers improved infrastructure for mobile and internet services, resulting in better communication facilities. Today, the people of Dagana Dzongkhag have 4G services from two services providers.

Most of the people living in Dagana Dzongkhag have seen new business opportunities since the start of the project. With growing population in the area, demand for agriculture goods has increased, which has largely benefited local farmers. To meet the growing demand, farmers living around the project area have increased their farm produce directly enhancing their income.

Myna Devi Chhetri saw income from her orange plantation go up fourfold. With a big smile, she says, “*Ujala bhayo*,” which roughly translates to “Sun is shining.”

Pemba, a certified painter, and his wife, Sonam, from Gomla village near the project site had moved to Thimpu for work. In 2008, they came back and Pemba was able to get painting work at the project site while Sonam opened a shop nearby. The couple also have a pick-up





New neighborhood shops such as this have opened up in the project area. Photo credit: Future Carbon Fund.



Baleygang Lower Secondary School inspiring young minds for a brighter future. Photo credit: Future Carbon Fund.

truck which they use to transport people for a fee. “Savings are better here as compared to Thimpu, owing to lesser expenses” says Sonam.

Before the implementation of the project, very few children were able to attend school. Since most of the schools do not have boarding facilities, students would have to walk for hours every day to school in the absence of transportation facilities.

The DHPC is providing bus services for students living far from their schools.

“We had to wake up at 5 a.m. to send our kids to school, it took kids 1 hour to walk to school,” says Tashi Wangchu. “The bus service provided by the project has saved us and the children from this hardship.”

To meet growing requirement of an increased number of schoolchildren, DHPC further supported the construction of additional classrooms and the renovation of school buildings in Dagapela Middle Secondary School and Baleygang Lower Secondary School; constructed drinking water facilities at the Baleygang Lower Secondary School; and provided budgetary support for the improvement of roads to all these schools.

“The DHPC has helped build three classrooms, bring electricity to our school, construct a water tank and taps, and put up a fence around the football grounds,

among others” Says Nidup Dorji, principal of the school with 8 teachers and 130 students.

## Heqing Solar Cooker Projects, People's Republic of China

### Providing Clean Energy to Rural Households

Dexin You, a 68-year old resident of Wangjia Village in Gaotai County, is one among the tens of thousands of people who now own a solar cooker, thanks to Beijing Harmonious Energy Development Company Limited (BHED) and the Gaotai County Rural Energy Station. BHED is the developer of the Heqing Solar Cooker Project I and Heqing Solar Cooker Project II. The Gaotai County Rural Energy Station is the local government authority responsible for promoting access to clean energy in rural areas through solar cookers and the repair and maintenance of the cookers covered by the projects.

You is very happy with her solar cooker and is grateful for having received it and being taught how to use it. "I save about one-third of my expenses on coal every year now," she says. "Using the solar cooker is straightforward and hassle-free, even for old people like myself. There is substantial reduction in dust and ash now and the air quality in my house is better than before." By using a solar cooker, each participating household saves CNY800 to CNY1,600 (about \$122 to \$244 equivalent) per year due to reduced coal consumption. You adds that the money she saves has made her less concerned about the gradually increasing cost of hospitalization and medicines.

The solar cooker that You uses to boil water throughout the day and cook simple meals particularly during noontime is one of the 98,000 solar cookers installed under the Heqing Solar Cooker Projects. The projects targeted underdeveloped counties of Ganzhou, Gaotai, and Linze in Zhangye City, Gansu Province. Most residents are considered low-income rural households, whose main source of livelihood is farming. The 98,000 solar cookers distributed are benefitting about 400,000 villagers covering approximately 80% of the local population.

Each solar cooker has a rated capacity of 910 watts and a thermal efficiency of over 65%. On a normal day it takes around 15 to 20 minutes to boil a full kettle of water (around 3 to 4 liters) around noon time. These solar cooker projects are a great example of successful CDM projects where carbon revenue is the main source of funds required for the project development. The cost of a solar cooker is approximately, CNY400 (about \$61 equivalent) including manufacturing, transportation, installation, and maintenance for the first 3 years. The cost was shared between the project entity (CNY 365, about \$56 equivalent)



Dexin You with Ming Wang, director at Gaotai County Rural Energy Station, which taught You and other project beneficiaries how to use the solar cookers. Photo credit: Future Carbon Fund.

and each participating household (CNY35, about \$5 equivalent), BHED financed these costs through upfront payments received from CER buyers toward long-term forward transactions. Under the projects, participating households are entitled to full ownership of the installed cookers over its entire lifetime, which is expected to be longer than 10 years. Maintenance after the first 3 years is provided by the BHED with the assistance of local rural energy stations and solar cooker manufacturers.

Gaotai County Rural Energy Station director Ming Wang says the solar cooker projects are a great success but this would not have been possible without the involvement of carbon finance. “Before the projects, the Gaotai county government had been trying to promote the use of solar cookers in local villages,” Wang says. “Solar cooker is a very simple technology but is very relevant and practical in the local context. However, little progress was achieved because our fiscal budget was extremely tight and the available subsidies were too small to provide material support to the households, for whom the price of a solar cooker was unaffordable. Thanks to carbon financing, households were required to pay CNY 35 (about \$5 equivalent) only a small fraction of the total cost, which was also reduced due to bulk purchases.

Without the solar cooker, these households would have continued to rely solely on coal-fired stoves for their daily necessities like water boiling and cooking, which would have resulted in higher consumption of coal. The solar cookers installed under the projects partially replace the use of coal-fired stoves and therefore reduce coal consumption, directly avoiding approximately 302,710 tCO<sub>2</sub>e emissions per annum. The projects have also generated a range of co-benefits that collectively contribute to the sustainable development of the local communities they serve.



A typical parabolic solar cooker, one among the 98,000 distributed to low-income households across three counties in the PRC. Photo credit: Beijing Harmonious Energy Development.

For an average household, using a solar cooker every day can mean a reduction in the use of 1,000 to 2,000 kilograms of coal every year.<sup>38</sup> This also contributes to the reduction of emissions of nitrogen oxides, sulphur oxides, and the release of fly ash and dust into the atmosphere, thereby reducing air pollution and improving air quality.

Households now experience much better indoor and outdoor air quality thanks to the solar cookers. “Since I began using the solar cooker, I use my coal-fired stove less frequently,” says Jianming Zhang, a 56-year-old villager in Lanbao Village of Linze County. “There is lesser amount of dust in my house than before. As I’ve been coughing less, I think the air is cleaner now.”

<sup>38</sup> Estimate provided by Gaotai County Rural Energy Station and BHED.



The nominal one-off payment of CNY35 (about \$5 equivalent) per solar cooker saves each participating household about CNY800 to CNY1,600 (about \$122 to \$244 equivalent) per year due to reduced coal consumption. This is a substantial saving especially for low-income households, as the average fuel cost in the local communities prior to the implementation of the projects was approximately CNY2,000 to CNY3,000 (about \$304 to \$457 equivalent) per household per annum.

For Jihong Feng, a resident of Liyuan Village in Linze County, her savings make a considerable difference. “With the solar cooker, I now need to buy less coal,” she shares. “This saves me more than CNY1,000 (about \$152 equivalent) every year. With this, I can buy more medicines for my husband and myself that are not covered by our medical insurance schemes.” Other households spend the extra disposable income on education of their children. The projects have created a number of employment opportunities at preparation, development, and implementation stages. The demand for 98,000 solar cookers over a relatively short timeframe resulted in the creation of over 100 jobs at the two local solar cooker manufacturers. BHED recruited 10 people as semi-permanent staff and 40 people as temporary staff from local communities to help with the distribution and installation of the solar cookers. Eight permanent Zhangye-based jobs have also been created to carry out the day-to-day monitoring and reporting activities. All employment arrangements have been made in compliance with applicable national and local requirements in terms of occupational health and safety. Appropriate training is provided to ensure that employees have the essential knowledge and skills required for their respective jobs. Interestingly, the employees consider their remuneration packages to be competitive as compared to the local job market of Zhangye city.



Jianming Zhang and his solar cooker. Photo credit: Beijing Harmonious Energy Development.

## Improving Kiln Efficiency in the Brick Making Industry, Bangladesh

### Development through Eco-Friendly Brick Kilns

In rural Bangladesh, it is uncommon for women to participate in village governance, much less take an active role in decision making within the household. But in the village of Marumdali, some 40 km away from the capital city of Dhaka, the situation has changed.

“Since the operation of the modern brick kilns started, women in the village have been able to earn for their family,” explains Rekha Akhter, who herself served in the Marumdali local council until 2015. “Women now have an equal voice in the decision making on family matters such as their children’s education and marriage.”

The introduction of eco-friendly brick kilns that employ many women is creating an enabling environment for them to make informed decisions for their own benefit as well as for their families and community. This reflects a positive move toward changing the social structure and overall development of the society.

The brick-making industry is one of the major sources of rapidly increasing GHG emissions in Bangladesh. It is responsible for approximately 14% of the total CO<sub>2</sub> emissions in the country. Construction and operation of 7 energy efficient hybrid Hoffman kilns (HHKs) plants are part of two registered CDM projects<sup>39</sup> developed by the Industrial and Infrastructure Development Finance Company Limited, a nonbank financial institution in the country. The bricks produced under the project are supplied to the Dhaka metropolitan area for government and private infrastructure projects.

The energy efficient HHK were introduced to replace the traditional kilns, known as fixed chimney kilns (FCKs). FCKs have low heating efficiency during the brick burning process and vent exhaust gases into the atmosphere through a chimney, resulting in higher consumption of coal. In contrast, the HHK’s unique technique of forming green bricks reuses the exhaust gas instead of releasing it into the atmosphere, reducing fly ash emissions. This technology results in higher quality bricks, higher production, and reduced coal consumption which results in lower pollution as well as GHG emissions. In the absence of these projects, FCK-made bricks would have resulted in higher consumptions of coal as well as GHG emissions. The projects, thus, result in energy savings and avoidance of GHG emissions of around 33,110 tCO<sub>2</sub>e per annum.

Introduced in 2006, these HHKs were the first of its kind in the country, first designed in Germany and then manufactured and imported from the PRC. In over a decade, these HHKs have been instrumental in transforming the most energy-intensive industry in the country into an energy efficient one. The technology was adapted to suit local circumstances. Changes included raising the base of the HHK plant to avoid flooding and

<sup>39</sup> Improving Kiln Efficiency in the Brick Making Industry in Bangladesh and Improving Kiln Efficiency in the Brick Making Industry in Bangladesh (Bundle-2)

prolonging the duration of the drying process. External experts from the PRC were hired to conduct specific training for fire masters who play a vital role in operating HHK plants. The success of these projects have motivated other private companies to invest in HHK technology as well. As such, these projects are supporting diffusion of clean technology in the country while contributing to a shift toward energy efficiency in the brick industry. On an average, 100 jobs are created by an HHK plant with a daily production capacity of 50,000 bricks. At least 200 permanent jobs have been created for women, representing approximately 30% of the total staff employed in the seven HHK plants under these projects. The women employed in these plants would otherwise remain unemployed or continue to work in the FCK under poor working conditions. Their employment in HHK plants provides additional income to support their families. This enables them to help raise their standard of living by having access to good sanitation facilities, better nutritional intake, and better education for their children.



Mainly women are employed to work the line in the hybrid Hoffman kiln plants. Photo credit: Industrial and Infrastructure Development Finance Company.

Traditional FCK plants are seasonal in nature and normally operate for 5 to 6 months a year. During the monsoon season, sites are submerged, forcing operations to cease. In contrast, HHK plants are designed to remain operational throughout the year, as they are equipped with a dryer and are designed and built in such a way that operations are not affected by monsoon floods. This means that workers from the villages have secure year-round jobs and a permanent source of income. Ambia, a worker of Bricks 2010 Ltd. who used to work in an FCK plant, remembers her days at her former place of work. “At that time, our wages were much less compared to the amount I am earning now,” she says. “Employment was seasonal. So I was unable to meet the basic family needs. Here in Bricks 2010, our year-round income has resulted savings in our children’s education and nutritious food on the table.”

The projects also have a Community Benefits Plan to implement certain safeguard policies and social measures in each HHK to ensure better environmental and social practices at the plant level. Sanitation and washing facilities are built into the brick manufacturing facilities under the projects. There are separate toilets and washing facilities for female workers. Hasna Hena, a production worker at Eeta & Tiles Ltd., shares, “I don’t even have such quality toilets and washrooms at my house.” She is now saving money so that she can install similar facilities in her own home. Workers at the project plants no longer have to work under the sun, which is a standard practice for the brick industry. HHK plants under the projects are outfitted with proper facilities including adequate lighting, ventilation, and electric fans to ensure the comfort of the workers. Plants also provide male and female workers with separate sheltered areas for use during breaks, lunch, and prayer time.

Training on occupational health and safety is a routine program in the project facilities. They also provide the workers with personal safety equipment. This training in the use of safety equipment keeps the number of accidents to a minimum at the plants. Didar Alam, the manager of Kapita Auto Bricks Ltd. proudly mentions, “In my plant no major accident has occurred in the last 8 years of operations.” To ensure the workers’ health, the plants provide free bi-monthly health check-up by qualified medical practitioners for all workers that take place in the plants’ premises.



Workers are required to use safety gear at the hybrid Hoffman kiln plants, according to industry standards. Photo credit: Future Carbon Fund.

The reduction in coal use achieved through the high efficiency of the HHKs leads to GHG emissions reductions, as well as a reduction in particulate matter content in the atmosphere. HHK emits 75% less particulate matter compared with FCKs, significantly contributing to improvement of local air quality. This is not only beneficial to people’s health, it is also good for crop production in the surrounding farmlands.

“We have been suffering from high amount of coal dust and other pollution from traditional kiln,” Marumdali village farmer Abdus Samad reveals. “It caused damage to our crops and fruit-bearing trees. We can now breathe easy, so can our crops and trees.”



The Kapita Auto-Bricks plant. Photo credit: Industrial and Infrastructure Development Finance Company.

The establishment of the green brick plants have resulted in the development of ancillary business opportunities in Bangladesh. These include manufacturing of carts for clay collection; truck sales and rental for raw material collection and brick delivery; setting up of workshops and foundries; and opening of grocery stores, vegetable shops, tea stalls, and mobile cash facilities. Clay, the raw material used for brick production is procured from nearby river beds and ponds and transported to the plant stacking yard by trucks.<sup>40</sup>

“The entire soil collection for the plant is carried out through local vendors and/or suppliers,” Akther shares. “It’s a huge business opportunity for the local people.” The projects also have a welfare fund which makes donations to the local mosques, *madrassahs* (Islamic schools), clubs, and for socio-cultural activities that promote community gathering and enhances social relationships.

<sup>40</sup> Soil that has eroded through natural processes and deposited on the river beds (sediment load) is collected as raw material, which also helps keep water levels stable and avoid flooding.

## Promotion of the Improved Cooking Stove, Nepal

### Supporting Rural Households with Healthy Solutions

Women are in the frontlines in fighting climate change when it comes to cook stove technologies. The government-run program of activities for the installation and promotion of improved cooking stove (ICS) in Nepal commenced in 2012.

Pavitra Ray, a 45-year old woman in Saruattha village of Rahtahad district, has been using a traditional cook stove to feed her family for the past 20 years. She said “I used to spend about 2 hours every morning collecting fuel wood from a forest nearby.” She explains that she would constantly keep coughing and be teary-eyed due to the smoke from her old cook stove. It was common for women in her village to have respiratory ailments and eye infections. Ray trained to be a stove master in 2012. Using the mud ICS, she has been cooking food efficiently for her large family ever since. The ICS has been an important asset for her and her children, allowing them more family time, especially when her husband visits once a year from India where he works to earn a decent livelihood for the family.



Pavitra Ray with her ICS. Photo credit: Future Carbon Fund.

The Promotion of Improved Cooking Stoves – Nepal, is a POA coordinated and implemented by the Alternative Energy Promotion Center (AEPC)<sup>41</sup> under the then Ministry of Science, Technology, and Environment of Nepal.<sup>42</sup> Starting with a pilot implementation of POA in 2012, it has distributed ICS to more than 300,000 households in the rural hilly and plain regions of Nepal. Under the POA, mud ICS are distributed across the plains while metallic ICS are provided to households in the hilly region. Mud ICS is one of the most simple, inexpensive technologies used to improve the combustion efficiency of fuel wood and reduce indoor air pollution. The ICS are made of clay, rice husk, dung, and a few metal rods. Stove masters, who are trained and certified by the AEPC, craft the mud ICS on-site and educate the users on their maintenance. Metallic ICS fabricated and distributed by pre-qualified manufacturers serves a dual purpose of cooking and space heating and are suited to meet the needs of people living above 1,500-meter altitude in the remote hills of Nepal.

A traditional cook stove using firewood releases a high amount of black carbon pollution due to inefficient combustion. An ICS also utilizes firewood but is designed to maximize thermal and fuel efficiency. It achieves thermal efficiency of 27%, which is more than double as compared to traditional cook stoves. In the absence of the POA, 300,000 households would have continued to use the traditional cook stoves and consume a higher volume of firewood, resulting in approximately 1.5 tCO<sub>2</sub>e of emissions per stove per annum.

<sup>41</sup> The ICS program is being implemented under the National Rural and Renewable Energy Program with financial assistance from Government of Nepal, Government of Norway, and Government of Denmark.

<sup>42</sup> Now the Ministry of Population and Environment.



Accordingly, the 300,000 ICS installed under the POA have a potential to avoid 450,000 tCO<sub>2</sub>e per annum.

Every year, over 4 million people die prematurely worldwide from illnesses attributable to household air pollution caused by the inefficient use of solid fuels for cooking (World Health Organization, 2012 data). More than 50% of premature deaths due to pneumonia among children under 5 years are caused by the particulate matter (soot) inhaled from household air pollution (World Health Organization, 2014 data).<sup>43</sup> The mud and metallic ICS being installed under the POA generate 50%–80% less smoke than traditional cook stoves and therefore significantly reduce indoor air pollution, which is one of the main sources of respiratory diseases. The use of a proper chimney, as installed in most ICS, leads to better ventilation which further reduces air pollution.



A newly installed mud ICS by Sajra Khatoon (right) for her customers. Photo credit: Future Carbon Fund.

For Sajra Khatoon, the installation of an ICS in her small dwelling in Saruattha village in Nepal was a life-changing experience. A full-time homemaker, she spent most of her time inside her house, the walls of which have soot deposits from a traditional stove. Realizing the detrimental impact the polluted air was having on her children, she would only begin cooking when her children were out playing or would tell them to go outside when she had to cook. Khatoon decided to enroll as a stove master so she could be trained to make mud ICS. Once fully trained, she immediately installed a mud ICS in her own house.

Immensely satisfied with her mud ICS as well as its positive health outcomes for her family, Khatoon became determined to spread the message and revolutionize the life of women in her village. In 2013, Khatoon was instrumental in installing new ICS in 100 households, with the support of the district level committee. This earned her NRs150,000 (\$1,444) which helped augment her family's income as her husband is a daily wage worker. Khatoon became an entrepreneur and a role model for many in her

village. "My family members now respect my views," she says confidently. "This gives me the strength to fight against misconceptions regarding women employment." Khatoon is now actively engaged in educating people in the neighboring villages. "If we are determined," she says, "society definitely follows the good work, though initiation is not easy and poses many challenges."

In the rural areas of Nepal, communities rely on fuel wood from native forests and agroforestry for cooking. The women and children (mostly girls) collect the firewood and spend a significant amount of their daily life in the process. Heavy consumption of fuel

<sup>43</sup> World Health Organization. Household Air Pollution and Health. <http://www.who.int/mediacentre/factsheets/fs292/en/>.



wood has put immense pressure on the forest resources in Nepal, negatively impacting the environment. With the adoption of the ICS, there is a 30%–50% reduction in fuel wood consumption. This helps to reduce deforestation and its environmental impacts, saves time spent gathering fuel wood, and ensures the safety of women who are no longer required to cover long distances to collect the required quantity of wood. It also reduces the need for families to purchase fuel wood from the market using their limited income.

For Rinki Yadav, a resident of Jhunkhunwa village and a beneficiary of the ICS since 2014, the money savings associated with reduced consumption of fuel wood is helping her to pay for her children's education. "I buy fuel wood from the local market. Since there is low consumption of fuel wood in ICS, I save about NRs1,000 (\$9.60) on a monthly basis," she says. "It helps me buy school materials for my children and pay for their school fees."

The POA is also generating various job opportunities in the area. AEPC is working with service providers at the regional and district levels for the effective and timely roll out of ICSs under the POA. This has created 250 jobs within the service providers. In addition to this more than 1,500 stove masters trained under the POA have pursued mud ICS business opportunities and a total of 100 jobs have been created through 33 metallic ICS manufacturing companies.

According to Mannath Nepal, who is in charge of the metallic ICS manufacturing unit of Suryachandra Investment in Kathmandu, they have employed about 20 people in the past 6 years since they have been in operation. The unit, which has a capacity to manufacture about 3,000 metallic ICSs per year, has produced about 10,000 metallic ICS since 2011.

To maximize the benefits of the improved cook stoves, AEPC is conducting ICS awareness programs at the country level and training (through local nongovernment organizations and private entities) for the stove masters. This is creating new business opportunities for installing mud ICS. Rajkali Devi, a 55-year old stove master in Jhunkhunwa village, received training on mud ICS technology (manufacturing and installation) in 2014. Since then Rajkali has crafted and sold more than 300 mud ICSs to her co-villagers. More than 3,500 stove masters, 50% of whom are women, have been trained under the POA. The ICS POA illustrates how empowering women in rural areas through meaningful occupation can raise the quality of life for the beneficiary communities.



ICSs were also installed in small shops, such as this tea stall in the town of Chapur, Rautahat district. Photo credit: Future Carbon Fund.



Sherwa Thami with her metallic ICS. Photo credit: Future Carbon Fund.

## Promotion of the Improved Water Mills, Nepal

### Yielding Developmental Benefits for People in the Hilly Areas

In 2013, Hariprasad Chamlagin of Jhangjholi Village in Nepal installed an improved water mill (IWM) to provide flour milling services to his community. The IWM has not only improved the flour milling capacity in his village but has also helped him generate electricity and diversify his business into the storage and distribution of dairy products. In an area with no access to electricity, it had been difficult to refrigerate and distribute such perishable products among local communities. With the installation of IWM, things are pleasantly different today.



Hariprasad Chamlagin with his refrigerator. Photo credit: Future Carbon Fund.

The POA for the promotion of the improved water mills in Nepal, is a nationwide program coordinated and implemented by the AEPC<sup>44</sup> under the then Ministry of Science, Technology, and Environment of Nepal (footnote 41). People in rural hilly areas in Nepal have been relying on inefficient traditional water mills (TWMs) commonly known as *ghatta* for flour milling which unfortunately do not meet the increasing demand.<sup>45</sup> As a result, in the absence of the POA, TWMs would have been replaced with the diesel-based mills. Usage of imported diesel and machinery would have diminished Nepal's self-reliance and polluted the local environment with diesel fumes. By replacing existing TWMs with IWMs, the POA therefore limits the installation

of diesel mills, thus avoiding GHG emissions. It is estimated that there are about 25,000 TWMs existing in the country.<sup>46</sup> The POA has potential to reduce about 22,300 tCO<sub>2</sub>e emissions per annum.

An IWM is a modified and far more efficient version of a TWM. It consists of a metallic runner with cup-shaped blades that is hydraulically more efficient than a TWM which increases operational efficiency and therefore output of the IWM. There are two types of IWM: short shaft and long shaft. The short shaft IWM is installed solely for grinding cereal grains, while the long shaft IWM is installed for grinding as well as for other uses such as paddy husking, saw milling, oil expelling, and electricity generation. With the IWM it has

<sup>44</sup> The IWM program is being implemented under the National Rural and Renewable Energy Program with financial assistance from Government of Nepal, Government of Norway, and Government of Denmark.

<sup>45</sup> A *ghatta* or water mill is a traditional hydropower technology that converts the kinetic energy of the flowing water into mechanical energy to propel an electricity generator, a grinding mill, or other useful devices for rice hulling, oil expelling, or saw milling, etc.

<sup>46</sup> As per case study report presented by Centre for Rural Technology, Nepal. [http://www.inforse.org/asia/pdf/Pub\\_Nepal%20water%20mill\\_2014.pdf](http://www.inforse.org/asia/pdf/Pub_Nepal%20water%20mill_2014.pdf).

also been possible to operate the water mills even in the winter periods despite the low flow rates.

Commencing in 2011 the POA targets to install around 4,500 IWMs in the hilly rural areas of Nepal by end of 2017. By August 2017, a total of 3,500 IWMs, including 3,300 short shaft and 200 long shaft IWMs have been installed under the POA.

On an average day, an IWM serves 30 local households. This means 105,000 households in remote areas of the country avail milling services operated by the IWM installed under the POA. Additionally, electrification is also an important end use of the IWM which provide lighting to around 400 households from long shaft IWMs with an installed capacity of 31.8 kilowatts.

Women who have been trained in the use of the IWM have become successful entrepreneurs and operate their own IWM. Bed Bdr. Syangtan is an entrepreneur belonging to an ethnic Janajati group in the remote village of Bhimpede. She runs a flour grinding facility that serves more than 40 households in her area. As the IWM has low water flow requirement, she can operate her IWM even during the dry season and provide an important service to the village throughout the year. As her customer base increased, so did her income, which has grown incrementally by 50% since she installed the IWM. Neelam Sharma Rijal, AEPC Carbon Financing program officer cites, “IWM owners have reported an average increase of 25% in the family income in the case of short shaft IWM and 75% in the case of long shaft IWM.”



Bed Syangtan with her customers at her flour mill. Photo credit: Future Carbon Fund.

Another direct beneficiary, Tilak Tamang of Bhimkori village in Kavre district, owns both a long shaft and a short shaft IWM. He and his wife run their traditional business of providing milling services during the day and operate their IWM to provide electricity to their house at night. They were previously using kerosene oil lamps to light up their place. “My wife and I serve around 35 to 40 customers each day and it has improved our lives,” he shares. His wife is happy to have been trained to use the IWM which enables her to make a contribution to their business and their family income.

IWMs provide communities with efficient milling systems. IWMs reduce the cereal grinding time by half and thus increase the output of the agro-processing facilities. With TWM, farmers were often refused service due to capacity limitations. In such cases women and children had to use stones or traditional tools like *dhiki* or *janto* for beating and grinding grains, resulting in long hours of laborious work.



Tilak Tamang and his wife at their improved water mill.  
Photo credit: Future Carbon Fund.

The time saved by the farmers in using the IWM is utilized on other income-generating opportunities such as farming and cattle raising. For some women, this allows more family time particularly for children, weaving, and participating in community affairs and social gatherings. Beneficiaries are happy to share that some of the major benefits of using the IWM include reduced agro-processing time and cost.

The presence of agro-processing units with IWM also provides a venue where people from different castes and ethnicities interact, develop social ties based on cooperation and solidarity, and interact on various social and political affairs.

AEPC is working with 27 local partner organizations (LPOs) at the regional and district levels for the effective and timely implementation of the POA. Since the IWMs are manufactured locally, the program has created more than 90 direct jobs in the IWM distribution supply chain, including 80 jobs through local service providers and 10 jobs at the central and regional level. Additionally, the POA also created more than 20 jobs at the 11 IWM manufacturing units.

LPOs are usually the local watermill owners' associations and are responsible for conducting the feasibility studies and consequently undertake the installation of IWMs. As the local watermill associations, LPOs remain engaged with the IWM owners throughout the lifetime of the IWM, assisting and training them on how to operate, repair, and maintain their IWM. AEPC has provided manufacturing specifications to IWM fabricators and operating guidelines to LPOs. Since the start of the POA, AEPC has organized trainings and workshops for potential IWM fabricators on the manufacturing of IWM and for LPOs on the installation and maintenance of short shaft IWM (40 LPO representatives) and long shaft IWM (37 LPO representatives). Shivasharan Shrestha, president of an LPO responsible for the installation and maintenance of IWM in the Kavre District of Nepal, says "there are about 1,000 IWM installed so far in Kavre district and potentially avoided installation of equal number of diesel-based mills in the area." The program also helped establish a quality management system and a systematic monitoring system on the installation of IWM. All of these, by way of improved institutional and local capability, have significantly increased the sustainability of the IWM sector in the last few years.



## Kinoya Sewerage Treatment Plant Greenhouse Gas Emission Reduction Project, Fiji

### Improving People's Lives through Effective Wastewater Treatment

Atalaite Cegudrau, a stay-at-home mother, and her children used to be woken up by the foul smell of the nearby Kinoya Sewage Treatment Plant less than 1 km away. It was their “breakfast, lunch, and dinner,” she says. She has lived near the plant for more than 40 years but, things have now changed. Atalaite shares, “My youngest children will no longer grow up smelling that heavy, obnoxious odor.”

The plant is being managed by the Water Authority Fiji (WAF), the commercial statutory authority responsible for the overall operation and management of water and wastewater services in the Suva–Nausori area. Commissioned in 1974, the plant had a design capacity of 60,000 population equivalent after some upgrade efforts in 1984. Through the years, several upgrade efforts were implemented in the plant. With the increasing population, the plant was operating significantly above capacity and was treating wastewater for around 150,000 population equivalent by 2011.

The existing wastewater treatment system was further upgraded with the installation of new inlet works, additional primary and secondary clarifiers, an additional high rate trickling filter and new filter media for the existing filters, and the upgradation of the sludge treatment system in 2014. As part of the upgrade, WAF constructed a new anaerobic digester with twice the volume of the old digester, and installed a methane gas recovery and combustion system via an enclosed flaring system. This has vastly helped in effectively managing the increased volume of wastewater and in improving the sludge digestion process, resulting to further reducing the odor coming out of the plant. With the recent upgrade works, the biological oxygen demand of the final effluent was reduced by 40%. The management of the plant is continuously trying to improve operations to be able to lower the biological oxygen demand levels even further with plans in place for the addition of other treatment stages at the plant.

If the recent upgrade works had not been implemented, the plant would have continued to rely on the old digester and methane generated by the sludge would have been directly released to the atmosphere. With the capture and flaring of the methane from the digester, the project has a potential of 22,471 tCO<sub>2</sub>e emission reductions per annum by avoiding methane emissions.



Atalaite Cegudrau, a neighbor of the Kinoya Sewage Treatment Plant.  
Photo credit: Future Carbon Fund.



The Kinoya Sewage Treatment Plant with the new anaerobic digester and the biogas capture and flare system. Photo credit: Future Carbon Fund.



Anare Vocea with his grandchildren says there is almost no more smell from the Kinoya Sewage Treatment Plant. Photo credit: Future Carbon Fund.

Anare Vocea, a 65-year old retired civil servant who lives in a nearby community, is happy his grandkids do not have to endure what his children did. “There is almost no more smell,” he shares. Years ago, his family was not very proud of where they lived. “Before, when our relatives would come for a visit, they just come and go, but now, they can stay here for hours and we rarely even notice.” The neighbours of the plant are truly appreciative of the efforts that WAF has put in place for the plant.

As the recent upgrade works allow the plant to operate at a higher capacity, this has encouraged WAF to make the expansion of the wastewater line connections one of its strategic priorities. WAF is now able to actively campaign for customers to connect to sewerage lines instead of using septic tanks. Septic tanks commonly leak, allowing septic waste to be discharged without proper treatment or seep into the groundwater causing health and environmental risks.

Jovesa Tora, the 54-year old caretaker of the church in Ratu Sukuna, appreciates that he no longer uses the septic tank. Connected to the sewers since 2016, Jovesa does not have to worry whenever he hosts the church’s annual congregation at his home that was built in the 1960s. “It’s a big party of 50 to 60 guests every year and what I want to focus on is making sure my guests are comfortable. All the more because, as is customary in Fiji, a lot of my family members from the islands also come and stay here for a week or so whenever they come to the big city.

Previously, I used to have our septic tank cleaned every year.” More importantly, he also understands the health hazards from leaking septic tanks.

Upgrading the plant also means jobs for the wastewater connections team. Faizal Ali, a young engineer who graduated from university in 2013, was employed by WAF as a project manager and has since worked on new wastewater line connections. He says this is a very complicated job, much more than putting water supply connections in place. It requires a lot of oversight and strategic thinking and Faizal recognizes that this job provides him not only with technical skills but also with valuable management experience. He works with 7 other professionals and trainees and at least 22 project workers in WAF’s wastewater line connections team.

The project requires 24-hour supervision of six operators and flare technicians. A manager oversees the project operations, while a lab technician analyzes the effluent and sludge parameters of the project, among other tasks.



WAF provides employees with fairly competitive salaries compared with those of the local market and recognizes that employee training is crucial to upgrade the skills of their staff. At an average, every staff is provided training for more than 14 days per annum.

Malkit Singh is a flare technician, SCADA<sup>47</sup> operator, and CDM monitoring technician. He started working with WAF in 2013 after the project was commissioned. He was previously engaged in 2011 by the project contractor, TechnoFab Engineering, as an electrician on a contract basis and therefore brought institutional knowledge of the project to his operational role. Malkit remembers each of the 67 staff who worked during the construction of the project, including several engineers and skilled workers from India. Malkit appreciates that he now has secured and continuous employment.

The project has facilitated diffusion of an imported technology and know-how which was not available in Fiji. During construction, the technology provider from India engaged with local companies to provide support on general engineering services, hydraulics, and systems design and management. These companies continued to provide services for the project's operation and maintenance, allowing them to continue to provide jobs to the same engineers, skilled technicians, and laborers who were working on the project during construction.<sup>48</sup>

Tevita Kaumaitoyu first became involved in the project when he was engaged by the technology provider as the local SCADA engineer to maintain the project's SCADA system. This opened new doors for him within WAF and he is now in charge of the maintenance and calibration of the meters at the project, as well as the other meters in the sewage treatment plant and at other WAF projects. Tevita feels lucky to have been given these opportunities, he says, "I have since expanded my business to include calibration and testing, SCADA systems development, programming and instrumentation."



Vilmaina Naga, laboratory database technician, testing the various parameters of the wastewater and sludge. Photo credit: Water Authority of Fiji.



Tevita Kaumaitoyu is a local SCADA engineer who also provides calibration and testing services for various meters at the plant. Photo credit: Future Carbon Fund.

<sup>47</sup> Supervisory Control and Data Acquisition

<sup>48</sup> Vatuwaga Engineering provides general engineering services and engages an engineer, a skilled worker, and two laborers for the project. Seamach provides maintenance support on hydraulics (pumps) and engages one engineer and two unskilled workers for the project. Optima Automation, which Kaumaitoyu owns, provides SCADA systems management and meter calibration and testing services and has two unskilled laborers specifically for the project.

## Ajbapur Sugar Complex Cogeneration and DCM Shriram Consolidated Limited Sugar Ajbapur Cogeneration Projects, India

### Empowering Farmers, Improving Livelihood

Brijbhan Singh, a sugarcane farmer in Mastipur village of Lakhimpur Kheri district, saw his crop yield rise by 50% in a year after making small improvements in his farming methods in 2015. Singh is one of the many farmers in the area who participated in a series of farmer empowerment initiatives organized by DCM Shriram Limited (DCM). One of these initiatives facilitated free soil testing for his farm and provided him with a soil health card. The soil health card provided information about nutrients already present in the soil as well as the kind and amount of fertilizer it needs, allowing him to achieve optimal soil condition with less amount of fertilizer.



Brijbhan Singh checking sugarcane crop at his farm.  
Photo credit: Future Carbon Fund.

“In addition to achieving the yield increase by 50%, my expenses on fertilizers have reduced by 20% after I came to know about the soil nutrient analysis of my land,” he says. Singh was also encouraged to use organic manure such as decomposed press mud on his farm to increase its production. “Since I started applying press mud, which is available at the sugar plant at a subsidized rate, my expenses on fertilizers have further reduced by 30%,” he shares. “These savings<sup>49</sup> have made my life easier and contributed to improving livelihood of my family.” The money he is able to save encourages him to consider buying new farm machinery and improving his farming practices further.

DCM opened the Ajbapur Sugar Plant in 1997. The plant has a sugar-crushing capacity of 10,500 tons of sugar cane per day and generates 2,800 tons of bagasse per day during the crushing months (mid-October to mid-April). Bagasse is a fibrous by-product of sugarcane stalks milled for juice extraction in sugar plants. It is mostly used as a biofuel. To utilize the bagasse, the plant has installed two sets of bagasse-based cogeneration systems. Phase I was commissioned in April 2005 with a capacity of 7.5 MW and Phase II was commissioned in 2007 with a capacity of 20 MW. The projects generate clean renewable power that is exported to the North, East, West, and North-East Grid of India. The clean electricity generated from the projects can potentially light up 62,336 households.<sup>50</sup> In the absence of the projects, an equivalent amount of electricity would have been generated by fossil

<sup>49</sup> Savings of approximately ₹4,000 (\$62 equivalent) in sugarcane cultivation on one acre land from reduced expenses on fertilizer and from use of press mud.

<sup>50</sup> Estimated using the average household size in India in 2016 (Esri's ArcGIS. <http://www.arcgis.com/home/item.html?id=6cf22970ea8c4b338a196879397a76e4>) and the average electricity consumption per electrified household in India (Enerdata. 2014 Data. <https://wec-indicators.enerdata.net/household-electricity-use.html>).

fuel-fired power plants connected to the grid. The project therefore reduces approximately 64,588 tCO<sub>2</sub>e per annum (13,772 tCO<sub>2</sub>e per annum from Phase I and 50,816 tCO<sub>2</sub>e per annum from Phase II) while addressing power shortages, improving access to clean electricity, and reducing dependency on fossil fuels.

The cogeneration projects have provided employment opportunities to 250 skilled and unskilled workers during the construction phase and continue to provide employment to 50 people involved in day-to-day operations of the projects.

DCM is implementing a Social Development Plan (SDP) using a portion of the proceeds from the CER transaction. The SDP aims to reinforce the contribution of the projects to the social and economic well-being of the local communities.

### ***Empowering farmers***

Under the SDP, local farmers have been empowered in three different ways:

- (i) **Soil health card.** Lack of proper training of farmers has caused the soil on their farms to deteriorate over time. Under the SDP, soil samples from low-yield agricultural fields were collected for nutrient status tests and soil health cards were issued to over 5,500 farmers. The card contains information on soil health that helps farmers know which fertilizer and how much quantity their soil needs in order to become more productive. Farmers report that they have achieved optimal soil nutrition with lesser quantity of fertilizer, which has resulted in savings for many farmers.



Lab technicians conducting soil tests at the Ajbapur Sugar Plant.  
Photo credit: Future Carbon Fund.

- (ii) **Decomposed press mud as organic manure.** Due to their rising cost, chemical fertilizers have become unaffordable for some of the small farmers. To address this, farmers are introduced to an economical alternative—decomposed press mud, which is a sugar processing waste product. Aside from being low cost, other benefits include its ability to release nutrients gradually, its trace element content which is beneficial for soil, a high water holding capacity, and mulching properties. About 48,400 tons of press mud was distributed to more than 3,500 farmers in 2016, at a very subsidized price.
- (iii) **Farmer training.** DCM organizes regular training workshops for the local farmers. Agricultural scientists provide training to farmers on crop-specific farm practices, seed production, rainfall patterns, soil characteristics, cropping patterns, and irrigation facilities in the region. In 2016, a total of 20 such workshops were conducted for 500 farmers.



A farmer applying press mud in farm soil. Photo credit: DCM Shriram.



Rajiv Singh was able to buy his thresh mulcher with DCM Shriram's help. Photo credit: Future Carbon Fund.

Rajiv Kumar Singh, a farmer from Rampur village, who has been using press mud for the last 2 years, says his sugarcane growth has improved by as much as 2 inches and yield by around 30%.

DCM also organizes an annual trade fair to help local farmers and suppliers of farm machinery to connect and introduce the latest technology available in the market. Majhela village farmer Rajiv Singh recently bought a thresh mulcher for his farm. "I attended the trade fair last year and was able to talk to some manufacturers of the latest farm equipment," Singh says. Although he was impressed with the thresh mulcher, the cost was beyond his budget. "I approached the officials of Ajbapur Sugar Plant and explained to them about my plan to procure a thresh mulcher," he shares. "I told them this equipment can benefit me and the other farmers from nearby villages and increase our crop productivity." The project team agreed to cover 30% of the cost, making it easier for him to buy the thresh mulcher. Singh now provides mulching services to farmers in nearby villages, which helps them increase yield rate and reduce labor cost at their farms.

### ***Women Empowerment***

DCM has recently partnered with a local nongovernment organization and set up a sewing training center to provide free training to local women on tailoring and embroidery. The center aims to empower local women by providing them with the skills to run a stitching business from home while still

allowing them to continue their traditional role as homemaker. Over a period of 6 months, 50 women from 9 villages near the projects enrolled to undertake this training. Their new skills will provide them with additional livelihood opportunities, enhancing financial condition of their families.

### ***Medical Support to the Local Communities***

**Health and medical camps.** DCM organizes regular medical camps for providing basic health care facilities to the residents of villages located near the projects, with the help of local nongovernment organizations. More than 23,000 residents from 30 villages in the area have benefited from 376 medical camps organized in 2016 and 2017. Krishna Pandey, a 55-year old resident of Jalal Gopi village, is a regular visitor to these medical camps. "I was not able to even walk 8 months back due to severe pain in my knees," she shares. "I then consulted with the doctors at one of the medical camps organized in my village and



received free consultation and medicines.” The medical care Krishna received helped alleviate her knee pain. Besides free medical consultations and medicine, these camps also focus on enhancing awareness among villagers about general health issues, hygiene, and nutrient directives for pregnant women and vaccination for children.

**Cataract screening and surgery camps.** DCM organized two cataract camps in 2016, which screened about 1,100 villagers in Lakhimpur Khiri and later facilitated cataract surgery for about 350 patients and also provided them postsurgery medical attention. Shiv Narayan, a 66-year old resident of Uttra village of Hardoi district, had been living with partial blindness. “Without vision, I was not able to do my routine work and recognize people,” he recalls. “I often used to fall down while going out of my room.” With his wife also physically unfit for work, Shiv Narayan’s two young daughters were forced to support their family and perform household duties. In February 2017, Shiv Narayan was screened at the cataract screening camp organized by DCM and later underwent cataract removal surgery at a nearby government hospital. With improvement in his vision, he has now started working with his daughters.

### *Local Infrastructure Support*

**Clean toilets.** The government primary schools in the project area lacked proper and well-maintained toilet facilities, affecting the health and hygiene of students. DCM has constructed new toilets in 22 government schools, benefitting more than 2,860 students. With these facilities, the students are being taught about health, hygiene, and sanitation.

**School renovation.** Seven government schools near the projects have been provided with access to drinking water by installing and/or repairing bore wells. DCM refurbished existing school infrastructure by repairing buildings and boundary walls. Nilesh Verma, headmaster of a primary school in Nagla Bhagwan village reports that the enrollment and attendance of students has increased after the renovation work done at the school, which among others included construction of a new toilet.



Krishna Pandey in a medical camp while consulting with a doctor for her knees. Photo credit: Future Carbon Fund.



Shiv Narayan with his postoperative glasses. Photo credit: DCM Shriram.



Students at a primary school in Mahmoodpur Bhagat can now use new toilet facilities. Photo credit: Future Carbon Fund.

## 50.4-Megawatt Tata Wind Farm in Maharashtra, India

### Steering Community Development through Corporate Social Responsibility



Swati Thombe and her daughter at their backyard poultry farm.  
Photo credit: TPC.

Swati Bhausahab Thombe of Ranjani village in Ahmednager district wanted to find a way to enhance her income and support her family. Life was difficult in her remote hometown. Droughts plague the region and the chronic water scarcity meant that they could not depend on farming in the dry season. In 2015, she participated in poultry training organized by the Tata Power Company Limited (TPC) in the Khandke region, under one of the initiatives focused on women's empowerment. She learned a new means of earning, especially during the dry months. She was provided 30 chicks at a subsidized rate which she raised in a small poultry unit in her backyard. Within a couple of months, she was able to earn a profit of ₹2,500 (\$38 equivalent) by selling the chickens in the market. "I am very happy with it and would like to continue doing this," she says

proudly. "I wish every woman were involved in something like this so that their lives could improve too."

TPC developed the 50.4 MW wind farm in the Khandke region of Ahmadnagar district in the state of Maharashtra. The project became operational in 2008 and involves the operation of 63 wind energy generators with a rated capacity of 800 kilowatts each. Approximately 89,570 MWh of renewable electricity is exported to the North, South, West, and North-East Grid of India. Without the project, the electricity would have otherwise been generated through fossil fuel-based power plants connected to the grid and therefore the project reduces GHG emissions and India's dependence on domestic and imported fossil fuels, contributing to energy security in a perennially power-starved country. The electricity being generated by the project can potentially light up 83,011 households (footnote 50). This registered CDM project activity has the capacity to reduce approximately 84,215 tCO<sub>2</sub>e per annum.

The project provided employment opportunities for about 100 skilled and unskilled workers during the construction phase including 60 people from the local communities. It continues to provide long-term employment to about 30 people, including 12 local residents, involved in project operation and maintenance.

The project also benefits local residents through the access road network it created for facilitating project construction. The wind turbines are located on a series of small hills which were not accessible to residents prior to the implementation of this project. The residents can now freely use the network of access roads developed for facilitating project construction and its operations and maintenance. This makes it easier for local



communities to take their cattle for grazing to the hills which were otherwise inaccessible to them.

TPC is implementing a comprehensive community outreach program to improve living standards of the local communities located near the project site. As a part of this, TPC has sponsored 30 solar street lighting systems, 6 watershed systems to preserve rain water, and organized 16 medical camps in a year for 4 villages in the area. TPC's corporate social responsibility program officer Vishwas Sonawale explains how the program has revitalized four state government-owned primary schools, located in Ranjani, Mehekari, Devgaon, and Agadgaon villages, benefitting more than 500 students. The program provides basic infrastructure support to the schools including:

- **Water and sanitation.** Being located in drought-prone areas, these schools lacked sufficient water for students and TPC has built bore wells, installed water storage tanks, and water purification systems to provide clean drinking water to students. The existing toilets have been rehabilitated to provide adequate facilities for boys and girls.
- **Enhanced education with e-learning.** E-learning kits designed in the regional language were made available for school children. This has simplified the teaching process and enhanced the learning experience for these students.
- **Canteen facility.** The students at Ranjani School used to have their meals in an open and unhygienic space within the school premises. TPC has developed a canteen facility where students can enjoy healthy meals, equipped with basic amenities including a kitchen, appropriate seating arrangements, and ample storage space and washbasins.

Pallavi Tarawade, a teacher at Ranjani School says, "With improved facilities such as drinking water, better toilets, and canteen, children now attend school more regularly. Not only do they enjoy being taught with modern e-learning methods but as teachers, we are also learning new innovative ways to impart education."



Students having their lunch in a canteen facility constructed in Ranjani School. Photo credit: Future Carbon Fund.



Students in Devgaon School taking advantage of their e-learning facilities. Photo credit: Future Carbon Fund.



Women in SHGs undergo training for additional livelihood opportunities. Photo credit: TPC.



The awareness programs on sanitation involved educating locals on the importance of constructing an enclosed toilet. Photo credit: TPC.

Sonawale adds that TPC is living by its philosophy of upliftment and welfare of the local community by also addressing social issues. In 2015 and 2016, it undertook several initiatives focused on women's empowerment in the area:

- Training for women's self-help groups.** A total of 23 self-help groups (SHGs) were formed in 6 villages in the vicinity of the project. The SHGs provided training to 295 women for improving their earning potential and offered them an alternative means of livelihood. Around 80% of the women from these SHGs have initiated their own income-generating activities and encouraged other women to get involved in these activities. Swati is one among many local people who have benefited from the SHGs.
- Awareness program on sanitation.** Rural areas in developing countries often lack basic sanitation facilities. Local volunteers conducted an awareness program funded by TPC on the importance of constructing a toilet within their houses. As a result, about 40 women from SHGs have availed of the government's toilet scheme to construct toilets in their homes.<sup>51</sup>

<sup>51</sup> The Government of India's Ministry of Drinking Water and Sanitation launched the Swachh Bharat Mission–Gramin on 2 October 2014, which aims to achieve universal sanitation coverage by 2019. <http://swachhbharatmission.gov.in/sbmcms/index.htm>.

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## **Future Carbon Fund**

### *Delivering Co-Benefits for Sustainable Development*

Asia and the Pacific is home to more than 60% of the world's population and 62% of the global economic output. But the region still faces enormous development challenges and with economic growth, it has become a major source of greenhouse gas (GHG) emissions. This has exposed Asia and the Pacific to the impacts of climate change, threatening to undo the development gains from economic prosperity over the past decades. This report reflects how Clean Development Mechanism projects supported by the Future Carbon Fund not only reduce GHG emissions but deliver social, environmental, and economic co-benefits contributing to sustainable development in the region. This report also presents qualitative and quantitative analysis of these co-benefits.

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**ASIAN DEVELOPMENT BANK**

6 ADB Avenue, Mandaluyong City

1550 Metro Manila, Philippines

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