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Executive Summary

As a way of encouraging enhanced climate action from developing countries while facilitating access to financing, technology and capacity building support, the Bali Action Plan introduced the concept of nationally appropriate mitigation actions (NAMAs). Importantly, NAMAs are intended to not only achieve reductions in greenhouse gas emissions, but also promote sustainable development. Both the mitigation actions and support are subject to measurement, reporting and verification (MRV).

While most discussions around MRV of NAMAs have centered on greenhouse gas emissions reductions, many developing countries view the sustainable development outcomes as the primary policy driver and main selling point to national stakeholders. Metrics such as job creation, access to services, and improved air quality help local political leaders sell their NAMAs to their voting public. This greatly increases the likelihood that such projects and policies will be continued and expanded when donor financing is no longer there. Therefore, an emphasis on sustainable development metrics and progress – although not mandated by the United Nations Framework Convention on Climate Change (UNFCCC) - can help build and sustain domestic political support for implementing climate mitigation policies while at the same time engaging international financing for NAMA implementation, including from development agencies. Further, monitoring these indicators can lead to improved sustainable development outcomes and stimulate replication of successful policies.

Building from our earlier paper, “MRV for NAMAs: Tracking Progress while Promoting Sustainable Development” where we advocated for a broader approach to MRV for NAMAs that includes metrics for: 1) Actions and Progress, 2) GHGs and 3) Sustainable Development (economy, health, equity, etc.), and drawing from experience with MRV in the development community, within the Clean Development Mechanism (CDM), and the Climate Investment Funds (CIF), this paper describes processes used in the Philippines and under the CIF to spur use and monitoring of sustainable development metrics, and elaborates on specific sustainable development metrics that can be used in five key sectors: Transportation; Renewable Power Generation; Residential, Commercial and Public Building Energy Efficiency; Industrial Energy Efficiency; and Waste Management. These metrics would allow policy makers to track and highlight the effects of NAMAs on catalyzing economic growth, poverty reduction and environmental conservation. We also showcase two examples—the TransMilenio BRT of Bogotá, Colombia and the North Wind Bangui Bay wind project of Bangui, Philippines --where sustainable...
development metrics were chosen and used to build political and community support for actions achieving greenhouse gas emissions reductions.

In determining which metrics to include, the Center for Clean Air Policy (CCAP) selected indicators that are specific, measurable, cost-effective to harvest, relevant, understandable and meaningful to domestic policy-makers and contributing countries. Using the menu of sustainable development indicators provided in this paper, developing countries can begin to assess which metrics best support their national development priorities, and can be readily collected given existing data, human resources and funding. Since the technical assistance, staff support, and financial resources required to effectively measure and evaluate metrics can be significant, it is important to include these costs when securing financing for NAMA development.
**Introduction**

Under the United Nations Framework Convention on Climate Change (UNFCCC), the Bali Action Plan of 2007 conceived of a new policy instrument for developing countries known as Nationally Appropriate Mitigation Actions (NAMAs) to drive climate mitigation policies within the context of sustainable development. NAMAs implemented by developing countries are intended to be supported by technology, capacity-building and financing from developed countries that is “new and additional, predictable and adequate”, as agreed in the Copenhagen Accord. A critical component of NAMAs is that actions be implemented in a measurable, reportable and verifiable manner. MRV, as it is known, applies both to financial support given by developed countries and actions by developing countries. Accurate MRV is therefore paramount for ensuring international support is effectively provided and utilized, and implemented mitigation actions achieve progress towards emissions targets. Internationally supported NAMAs are subject to international measurement, reporting and verification in accordance with guidelines to be developed under the Convention, whereas unilaterally supported NAMAs are subject to more general guidelines.

**Measuring**

Under the Convention, measuring has historically referred specifically to the conduct of national greenhouse gas (GHG) inventories, which are reported in National Communications and Biennial Update Reports submitted to the UNFCCC. During the Cancun and Durban negotiations, the Conference of Parties (COP) decided that “enhanced” GHG inventories must be conducted every four years for developing countries. Effects and progress of specific NAMAs will also undergo measurement.

**Reporting**

There are two types of reporting specified under the Convention: National Communications and Biennial Update Reports (BURs). Reporting expectations were elaborated in the Cancun Agreements and finalized in Durban. Non-Annex I countries, or developing countries, are required to report their climate change mitigation actions in National Communications, which should be submitted every four years. In addition to national GHG inventories, this report includes mitigation actions and their effects, and support received. BURs provide an update to the information presented in National Communications and include information on mitigation actions, needs and support received. NAMAs can be voluntarily reported, but are not mandated, in both of these mechanisms. The COP-17 in Durban decided that non-Annex I countries should submit BURs every two years, beginning in December 2014, and include GHG inventories conducted within four years of submission.

**Verification**

International Consultation and Analysis (ICA) of BURs is the mechanism used to verify mitigation actions, outcomes and support. It is emphasized that the ICA process “should be non-intrusive, non-punitive and respectful of national sovereignty”. It is intended to increase transparency of mitigation actions and their effects. The first round of the ICA is set to begin within six months of the submission of the first round of BURs. Although the modalities and guidelines of the ICA have been adopted, the composition and procedures for the team of technical experts for the ICA has yet to be decided.
In addition to elaborating expectations for MRV of NAMAs, the Durban decision operationalizes the NAMA registry to facilitate matching financing, capacity building and technological support for NAMAs seeking international funding. Although not required, the Parties are invited to voluntarily submit to the registry “other indicators of implementation” for NAMAs receiving international financial support, including the co-benefits for sustainable development. Loosely defined, the language of the Durban decision gives room for countries to monitor non-GHG indicators using nationally relevant metrics, presenting an opportunity for nations to demonstrate how mitigation actions can further national sustainable development priorities.

Since the term “sustainable development” was conceptualized in 1987, developing countries have sought to pursue economic growth with social and environmental gains. In the context of climate change mitigation, many of the strategies that reduce GHG emissions produce co-benefits that overlap with national sustainable development priorities. For example, reducing emissions through renewable power generation also expands access to energy, increases employment, and reduces air pollution. Thus NAMAs can be part of national sustainable development strategies and used to secure climate financing that ultimately supports a nation’s development agenda. Furthermore, they provide a means for building domestic political support for funding and implementing GHG mitigation actions. Quantifying sustainable development outcomes resulting from the TransMilenio bus rapid transit (BRT) system in Bogotá, Colombia (described in Box 1, below) shows one example where such benefits helped build domestic support. Measuring, reporting and verifying sustainable development impacts can also ensure policies and financing are effective, and financial commitments accountable.
Box 1: TransMilenio BRT of Bogotá, Colombia

In the 1990’s, the city of Bogotá, Colombia, implemented a multi-modal transport strategy to address the severe traffic congestion caused by the city’s burgeoning population of 8.5 million. Bogotá built a city-wide network of bicycle routes, pedestrian walkways, and a bus rapid transit system (BRT) called the TransMilenio that integrated all three modes of transportation. While in this case measurement of sustainable development impacts were planned after implementation had already begun with municipal and national support, the impacts achieved facilitated continued access to national project funding and now is being used to justify national financial and capacity support to similar municipal projects.

Colombian National Approval Process for Project Funding

To secure support for the project, the mayor emphasized those indicators that addressed the city’s primary concerns, namely congestion, air pollution, road fatalities and access. The argument in favor of the project thus highlighted how the system would improve the quality of life of Bogotá’s residents by reducing air pollution, improving road safety, decreasing commute times, and improving equity through expanded access to affordable, high quality transportation services.

The TransMilenio benefitted from a Colombian national government law that allows the government to partially fund municipal transportation projects. Bogotá developed plans for a BRT system to replace a metro project previously approved but not advanced. The key to receiving approval for the BRT system would thus be the emphasis on short-term project delivery to resolve transportation concerns quickly, as well as considerations for cost effectiveness and impact. Although Bogotá conducted its own feasibility study, the National Planning Department, in cooperation with the Ministries of Transport, Environment and Finance, commissions and supervises studies of proposed transportation projects for those projects developed after the TransMilenio to determine the best option for meeting a city’s needs. The TransMilenio project proposal was then registered with the National Bank of Investment Projects (BPIN). Although ultimately implemented at the municipal level, Law 310 of 1996 stipulates that the national government can provide technical support and fund up to 70% of the infrastructure costs of the project under the following conditions:

1. The project must be in accordance with city development plans;
2. A special purpose vehicle must be established to manage the transit project;
3. The local government must commit enough funds to cover the difference in cost and national government funding; and
4. The project must undergo a socio-economic evaluation to determine the sustainable development impacts on society and the environment.

Ordinarily, BPIN will thus commission a mandatory cost-benefit analysis of the socio-economic impacts of the project, namely travel time and travel cost savings. Other sustainable development indicators such as employment and air quality may also be quantified but are not mandatory. After it is determined that the project is in compliance with the above four conditions, BPIN will submit the project to the National Council on Social and Economic Policy (CONPES) under the National Planning Department for presentation to the President and key ministries for the purpose of receiving approval for national funding. Construction contracts are then awarded through an open bidding process and funding is disbursed in tranches based on progress in reforming municipal transportation policies and infrastructure construction.

In the case of Bogotá, a special purpose vehicle called the TransMilenio, S.A. was established to manage the BRT system and report on implementation actions and progress. It was not however until after the project was implemented that the National Planning Department determined it would conduct an ex-post evaluation to determine the impact of the nationally funded TransMilenio. The ex-post evaluation, conducted by consultants at the behest of the Department, was important for justifying the continuation of the program under which national funding for public transit services was made available. It also helped identify areas for improvement, and was used for benchmarking for future projects. Many of the sustainable development impacts of the project were

MRV of NAMAs: Guidance for Selecting Sustainable Development Indicators
monetized to demonstrate the financial value of such indicators. Finally, although the indicators did not necessarily drive transportation policy, the Department recognized the benefits of tracking project impacts following the positive results of the TransMilenio, and has since commissioned studies on the BRT systems of at least two additional Colombian cities.

**Sustainable Development Outcomes**

The TransMilenio’s raised platforms, pre-boarding automated fare collection, and segregated lanes helped increase average bus speeds from 5-17 km/h up to 29 km/h, reducing average commute time by 20 minutes per passenger-trip, or 32%. The BRT was an important catalyst to improving public safety, reducing collisions by 79%, injuries by 75% and fatalities by 92% along its corridors.

As of 2009, the TransMilenio created 1,900-2,900 net permanent jobs in the system’s operation, and an additional 1,400-1,800 jobs per month in construction. Regarding quality of work, bus drivers on average now work 6 hours less per day - from 14 to 8 hours – and receive social benefits, such as health insurance. Accessibility from the city’s periphery to new neighborhoods also increased real-estate property values along trunk lines by 15-20%.

TransMilenio’s modern bus fleet is fuel efficient, resulting in a reduction of bus fuel use by 59%. By decommissioning obsolete buses and shifting users to the BRT’s low-carbon, high-capacity articulated buses, the BRT system improved city-wide air quality by 40% and abated roughly 2 million tons of CO₂-eq in its first decade.

Bogotá’s multi-modal transportation system was important in demonstrating the potential of low-carbon transit to address mobility concerns and improve the quality of life of its citizens. The TransMilenio system thus generated support for a national plan that expects to replicate Bogota’s program in cities across Colombia.

There are numerous indicators and databases that measure the myriad aspects of sustainable development. CCAP proposes selecting indicators that will reflect how NAMAs support sustainable development and can best shore up domestic political support and international funding for their implementation. In order to limit the burden on human and financial resources to measure and report data, policy-makers should select a small, core list of indicators that are specific, meaningful, measurable, and cost-effective to harvest (if not already being collected). They should also be pertinent and easy to understand. A secondary consideration is whether policy-makers want to compare sub-national or project specific data, or highlight sector-wide changes. Developing universal indicators and methodologies will facilitate sub-national comparisons and data aggregation for national or sector specific monitoring. Finally, identifying and disaggregating metrics that show the impact on women and the poor can help promote programs that impact both growth and equity, and do not inadvertently disenfranchise these vulnerable groups.

As part of the Mitigation Action Implementation Network (MAIN) initiative, a regional and global dialogue forum that supports development and finance of NAMAs, CCAP is working closely with developing country counterparts, donor governments and partner organizations to promote an expanded set of MRV metrics. CCAP’s policy paper “MRV for NAMAs: Tracking Progress while Promoting Sustainable Development” proposed a broad approach to MRV that addresses 1) GHG emissions 2) actions and progress and 3) sustainable development.
• **GHG reductions** are measured relative to a business-as-usual baseline that reflects assumptions, such as GDP and population growth, that could alter the trajectory of emission generation. As these assumptions change, the baseline should be adjusted accordingly to facilitate more accurate measurements. Although MRV of emissions reductions is mandatory, it is important to minimize reporting burdens on developing countries so that MRV does not deter NAMA development.

• **Action** metrics indicate that NAMAs are being implemented, such as establishing renewable energy portfolio standards or building waste treatment facilities. **Progress** metrics indicate the results of implemented actions, such as an increase in the renewable share of a nation’s power sales or tons of waste treated. Many of these metrics may already be necessary to measure GHG emissions, and if compared to historic data, can help assess the effectiveness of actions.  

• **Sustainable development** metrics highlight the impact of actions on economic development, the environment, and public welfare. Examples include increased energy security, reduction of ground and surface water pollution, and reduced cost of power and transportation. By addressing citizens’ concern, they are critical to harnessing domestic political support and securing funding from contributing countries that are interested in both stabilizing atmospheric concentrations of GHGs and promoting sustainable development.

This broader approach to MRV permeates the work products developed through the MAIN, including a suggested NAMA design template and proposed criteria for supported NAMAs. Further, these issues come to play as we work one-on-one with individual developing countries.

Recognizing the important role MRV will play in measuring outcomes and securing financing, many organizations are working with developing countries to build MRV capacity and develop relevant metrics. For example, the World Resources Institute is building national capacities and developing methodologies to measure GHG emissions. There is also an extensive development literature on metrics and methodologies to assess non-GHG outcomes. Some of these include the International Energy Agency, United Nations (UN) Department of Economic and Social Affairs, UN Industrial Development Organization, International Atomic Energy Agency, the World Bank, the International Monetary Fund, and the World Health Organization, among others. CCAP has built upon this work by identifying and elaborating metrics that are relevant to climate mitigation actions, and that demonstrate potential for monitoring sustainable development progress and catalyzing broad domestic support for implementing NAMAs.

This paper enlists examples from the CDM and Climate Investment Funds to demonstrate how existing institutions and processes identify, measure and report sustainable development metrics. It also identifies a menu of indicators that can be used to highlight the impact of mitigation actions on furthering national development priorities to make a compelling case for domestic and international support for NAMA development. NAMAs in five sectors are considered: Transportation; Renewable
Power Generation; Residential, Commercial and Public Building Energy Efficiency; Industrial Energy Efficiency; and Waste Management. Information is further broken down into economic, social or environmental categories within each sector. In selecting the indicators, CCAP considered the importance each contributes towards reaching domestic sustainable development goals as well as the availability and ease of measuring data.

Institutions and Processes for Monitoring Sustainable Development Metrics

Through examples in the Philippines (through their domestic implementation of the CDM) and under the Climate Investment Funds program Scaling Up Renewable Energy in Low Income Countries (SREP), we highlight recent experiences with identifying, measuring and reporting sustainable development metrics at the project and programmatic levels. Both the CDM and the CIF have been valuable in helping developing countries leverage financing for climate change mitigation actions, and both emphasize to different degrees the important contributions such actions can make to sustainable development. The specific examples highlighted here illustrate approaches that can be used by developing countries wanting to voluntarily MRV the sustainable development benefits of NAMAs. Common elements are as follows:

• **Use of national or programmatic criteria:** A common theme in these programs is the establishment of national or programmatic sustainable development criteria that provide general guidance on the categories of metrics that reflect a nation’s sustainable development priorities.

• **Development and approval of a small number of indicators specific to the project or program that align with the established criteria and are measured over time:** Importantly, while there may be guidance on which specific indicators to use to facilitate comparisons across programs and national aggregation, there is also flexibility to select indicators that are appropriate to the specific circumstances, including the financial resources, capacity and data that are available or can realistically be made available with international support.

• **Establishment of reporting requirements and deadlines:** Providing guidance on reporting requirements for project implementers and setting deadlines for the submission of monitoring reports will help enforce MRV of sustainable development metrics.

• **Stakeholder Consultation:** Consultations with affected communities is important for identifying community priorities and addressing concerns. Robust, in-person consultations with a broad range of stakeholders often helps build community support for projects, and bring sustainable development metrics more closely in line with community needs.

**Example 1: CDM in the Philippines**

The Philippines’ CDM policy is centered on achieving the country’s poverty reduction and sustainable development goals as set forth in the Philippines Agenda 21. With sustainable development as the primary driver behind the Philippines’ involvement in the CDM, the nation has a careful process for
monitoring and evaluating the sustainable development impacts of CDM projects. The structure and process of the Filipino framework is a useful model for countries to consider in selecting and measuring sustainable development metrics for NAMAs.

The Kyoto Protocol stipulates three internationally agreed criteria for CDM approval: measurable climate change mitigation benefits, emissions reductions that are additional to those that would occur without the project, and contribution to national sustainable development goals. Non-Annex I countries are asked to develop national criteria for the evaluation of CDM projects.12 In its capacity as Designated National Authority (DNA), the Department of Environment and Natural Resources (DENR) is responsible for promoting CDM project activities in accordance with national laws that reduce GHG emissions, lead to the transfer of climate mitigation technology and capacity, contribute to the sustainable use of natural resources and conservation of biodiversity, and promote poverty reduction. In accordance with the Kyoto Protocol, DNA approval is one of several steps needed before a CDM project proposal can be presented to the CDM Executive Board. In the Philippines, this approval is contingent on compliance with two National Approval Criteria, as determined by the DENR: the legal capacity of proponents to implement the project, and contribution to sustainable development.

**National Institutional Structure for CDM Project Review**

The Philippines has established several institutional bodies to facilitate the national approval process:

The **CDM Secretariat** facilitates the implementation of the national approval process and is the point of contact for information regarding the status of projects in the approval pipeline. The CDM Helpdesk answers inquiries related to CDM implementation for all participants and stakeholders, provides guidance throughout the project cycle for proponents, brings together relevant government agencies and stakeholders, and is generally responsible for information dissemination on CDM activities. Relevant information on CDM in the Philippines, including important project documents and guidelines for CDM application, is hosted online through the CDM Information Clearinghouse.

The **CDM Technical Evaluation Committee** (TEC) is an expert committee that evaluates CDM proposals using National Evaluation Protocols to determine whether they meet the National Approval Criteria, as laid out in the Departmental Administrative Order 2005-2017. There are three technical committees each responsible for the evaluation of projects in a specific sector (focused on waste, forestry and energy). The lead government agencies for the technical evaluation committees may also invite representatives from civil society, academia or sector experts to participate in the activities of the TECs. The DENR Secretary may create additional committees to address projects in other sectors.

The **CDM Steering Committee** is an inter-agency, cross-sectoral committee that reviews the project specific evaluations of the TECs. It also advises the Secretary of the DENR on the successful implementation and advancement of the CDM policy framework. The Secretary designates a DENR Undersecretary to chair the Steering Committee, as well as an alternate. Other members of the committee include Undersecretaries and alternates from the Department of Energy and the Department of Science and Technology, a representative from the Philippine Chamber of Commerce for the private sector, and a representative from the Philippine Network on Climate Change for civil society.
National Approval Process and Sustainable Development

The DENR requires that proponents submit to the Philippines CDM Secretariat a Project Application Document, or the UNFCCC CDM Project Design Document, that includes general project information, documentation of stakeholders’ consultation, proof of legal capacity and a Sustainable Development Benefits Description (SDBD).

The SDBD requirements differ for small-scale projects and projects not considered small-scale. Both categories must elaborate on the additionality of the sustainable development impact of the project - namely, the benefits that can be attributed to the project that would not have occurred otherwise – as well as address the following three sustainable development dimensions:

Economic dimension
- Provides livelihood and economic opportunities
- Provides proper safety nets and compensatory measures for affected stakeholders
- Promotes the use of cleaner, more efficient, environmentally-sound technology
- Provides new financial resources

Environmental dimension
- Complies with the environmental policies and standards set by the Philippines
- Improves the quality of the environment
- Promotes sustainable use of natural resources

Social dimension
- Builds local stakeholder capacity through education and training
- Provides local resources and services to vulnerable groups
- Encourages local participation in the CDM project activity

Within the above guidelines, the project proponent is responsible for identifying project level indicators to measure the sustainable development impact of CDM activities and report these in the project application document. In addition to the above guidelines, projects that are not considered small-scale are required to justify their determination that identified impacts are significant and create a plan for monitoring indicators. They must also elaborate on the measures that will be taken to mitigate any negative impacts of the project. It is worth noting the importance of stakeholder consultations in the process. Consultations must be done in person with local stakeholders, and include detailed notes of stakeholder comments and concerns, and how project proponents expect to address these concerns. This ensures that local concerns are taken into account in the project design.

Once completed, the project proponent submits the application to the CDM Secretariat, who distributes the application to the TEC for review. The TEC will determine whether the project meets the National Approval Criteria, and sends its project evaluation report to the CDM Secretariat for submission to the Steering Committee. The Steering Committee will review the documentation and provide a recommendation to the DENR Secretary to issue a Letter of Approval or Non-Approval. Projects
receiving Letters of Approval from the Secretary can then be submitted to the UNFCCC CDM for consideration. Those projects that are ultimately approved by the UNFCCC CDM Executive Board and implemented will be monitored by the CDM Secretariat. Sustainable development indicators are measured by the project proponent and monitoring activities for all project activities are reported in the government’s annual work plan. The results of the sustainable development monitoring are included in annual GHG monitoring reports submitted to the UNFCCC for many projects.

**Box 2: Stakeholder Consultations and Sustainable Development at the North Wind Bangui Bay Project, Philippines**

The North Wind Bangui Bay Project is a 33 MW wind power plant in Ilocos Norte, Philippines, a province on the periphery of the country without access to reliable power. Built along the shoreline of Bangui Bay, the project became the first Filipino CDM project, as well as the first commercial wind power project in Southeast Asia.

In order to receive carbon credits through the CDM, the project sought DNA approval by highlighting the sustainable development co-benefits of building a wind farm. Proponents maintained employment would be created through the construction and operation of the facility. As the first of its kind in the region, the project was also expected to create significant opportunities for the transfer of wind power technology and to serve as a tourist destination, thereby creating economic opportunities for local businesses.

**Stakeholder Consultations**

In accordance with Philippines national CDM requirements, the project held in-person stakeholder consultations through visits to adjacent landowners, meetings with provincial, municipal, and village officials, and consultations with the community most impacted by the coastal wind turbines – the fishermen association in the town of Bangui.

The Project Design Document reported that stakeholders expressed their support for the project, in particular the anticipated economic benefits of increased tax revenue, employment, tourism and improved power supply. The fishermen would also benefit from the construction of an all-weather access road to the shore area to provide improved access to livelihood activities. In response to concerns, project developers announced it would also prioritize local residents in the hiring process - as required by law – and limit land acquisition for the plant or encroachment on indigenous people territories.

**National Criteria and Sustainable Development Monitoring Plan (SDMP)**

The project created a SDMP in line with national criteria and addressing issues raised through the stakeholder consultation that included the following concerns, indicators and timelines:

**Economic**

- **Local employment**: A local hiring policy will be put in place by March 2005, and share of hires from the local community monitored.
- **Damage to private property**: Damage complaints will be addressed and property owners eligible for compensation for those reported by March 2005.

**Environmental**

- **Siling of coral reefs during construction**: The project will include clauses in contracts with developers to ensure compliance with Philippines environmental regulations, and build infrastructure to mitigate silting by March 2005 for Phase 1, and May 2008 for Phase 2.
- **Oil and grease contamination of the beach**: Oil and grease analysis reports will be submitted every 6 months.
- **Observation of turtles**: Sightings will be monitored generally, and reported every 6 months.
- **Observation of bird collisions**: Surveillance reports will be submitted every 6 months.
Example 2: Clean Investment Funds

The Climate Investment Funds (CIFs), managed by the World Bank, provide concessional financing and technical expertise to developing countries for the implementation of pilot projects for low-carbon growth and climate-resilient development. The Strategic Climate Fund, one of two funds within the CIF, supports scaling-up pilot projects that respond to a specific climate change issue or sector. Programs under this fund address deforestation and forest degradation, climate resilience integration in development planning, and scaling-up renewable energy. This latter program, known as Scaling Up Renewable Energy in Low Income Countries (SREP), is the only one of the four funding windows that has finalized its monitoring and evaluation plan, or SREP results framework, providing another model for developing countries seeking to MRV sustainable development outcomes of NAMAs.

To access funding through the SREP, developing countries will designate an SREP focal point to request a joint mission by the World Bank Group and the relevant regional development bank to meet with stakeholders and produce a country-specific Investment Plan. Plans are intended to be country-led and build on existing national policies to integrate renewable energy in national energy plans. They include both renewable energy investment and support through technical assistance, and are expected to achieve economic, social and environmental co-benefits.

Investment Plans include a country-developed results framework that indicates which metrics will be measured. In order to facilitate the development of national monitoring and evaluation (M&E) systems, each program under the CIF umbrella has created a recommended results framework that serves as a starting point for developing countries to build on. The framework is designed to function within national M&E systems, and in consideration of national capacities. The SREP has identified a set of core indicators that directly measure the impact on SREP objectives. SREP recommends developing countries collect the identified core indicators in order to monitor project progress and facilitate aggregating country-level outcomes, and also allows for use of additional indicators. Of particular importance are

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\(^a\) The CIF are administered by the World Bank Group, in cooperation with the African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, and Inter-American Development Bank.
Mrs. energy poverty and increased energy security, which are the core objectives of the program. Indicators are divided into two categories: transformative impact and program outcomes:

- **Transformative Impacts** go beyond SREP intervention and look at the impacts of nation-wide programs and policies (SREP or other) to affect a structural shift towards low-carbon development. Indicators include: energy poverty (Energy Poverty Index or other measure), annual electricity output from renewable energy (GWh), and increased annual public and private investment in the targeted sector ($).

- **Program Outcomes** examine the direct outcomes resulting from SREP intervention, namely annual electricity output from renewable energy from SREP projects (GWh), and the number of women, men, businesses and community services benefitting from improved access to electricity as a result of SREP projects.

Project-specific M&E plans can comprise many indicators in addition to (or in place of) the above, as determined by countries at the project or program level. Although measuring sustainable development co-benefits are encouraged, they are voluntarily identified, measured and reported by developing countries.

As the CIF is relatively new, a trial-and-error learning approach is encouraged. Thus the results framework is pragmatic and will evolve based on country experiences. It is expected that any reported co-benefits will be detailed in both the transformative and outcome level of the results framework. Countries are required to submit an annual report to the CIF on project results. The CIF will then aggregate country-level data to provide an overview of programmatic impacts. Voluntarily measured sustainable development indicators can be included in the annual report. Since many of these programs are relatively new, countries have been reporting qualitative updates on project status, lessons learned, etc., but will not begin reporting metrics until the fourth quarter of 2012.

According to stakeholder feedback, under the early rounds of CIF funding, developing countries found it difficult to measure project indicators under the initial results frameworks of the SREP and sister funding windows. The results frameworks were too complex, with 22 indicators across multiple levels for SREP alone, causing confusion and creating a burden on developing countries to measure impacts. Indicators also did not correspond to nationally available statistics or readily collected data, increasing the transaction costs for countries to create baselines and measure new indicators. Countries experienced the additional burden of multiple reporting requirements – national program results are reported to the CIF and project-specific results reported to the multi-lateral development banks. Finally, many Investment Plans cut across sectors, thereby relying on several government bodies to measure and report metrics to the CIF focal point for aggregation at the national level. This has proved to be particularly difficult given the capacities of each body and the administrative challenge of collecting and harmonizing data from different sources. To address these issues, the CIF programs are in the process of finalizing new results frameworks that will simplify M&E of programs and projects, as does the SREP program. The CIF experience provides valuable lessons for countries developing their own MRV systems for voluntarily measured metrics such as the impacts of sustainable development.
Menu of Sustainable Development Indicators

Using the menu of sustainable development indicators listed below and elaborated in Annex 1, developing countries can begin to assess which metrics best fit their national circumstances. Key questions to consider when selecting sustainable development indicators include:

- Does the metric align with national sustainable development priorities?
- Will tracking the metric help build domestic political and/or financial support?
- Are the data already collected, or can it be collected at a reasonable cost?
- Can the data be collected with reasonable assurance of accuracy?
- Will the metric facilitate aggregation across policies and/or comparisons within or across sectors?
- Does the metric align with development interests of prospective contributing countries or institutions?

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<th>RE Power</th>
<th>Building EE</th>
<th>Industrial EE</th>
<th>Waste Mgmt.</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>Balance of payments</td>
<td>value of imported fossil fuels displaced by incremental renewable power generation ($)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitiveness and productivity</td>
<td>manufacturing value added (MVA) per unit of energy consumed ($/MWh)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MVA per value of energy consumed ($)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deferred capacity additions</td>
<td>MW</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy cost savings</td>
<td>avoided cost of energy ($)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy intensity of GDP</td>
<td>M/J/$</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy production</td>
<td>energy production (kWh)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy security</td>
<td>imported fuels (tons of oil equivalent)</td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>share (%) of imported oil (attributed to sector)</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>share (%) of total energy supply from renewables</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel intensity</td>
<td>average fuel consumption per passenger-kilometer</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel savings per capita</td>
<td>tons of oil equivalent per capita</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Job Creation</td>
<td>net number of jobs created</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>Leveraging of private financing</td>
<td>ratio of private funding to public funding</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ratio of public climate finance to broader public and private finance</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ratio of total funding to public funding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modernization</td>
<td>average age of technology (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>investment in new capacity ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>Public expenditure</td>
<td>$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>deferred or avoided infrastructure costs ($)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
### Tax revenue

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Unit</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of intellectual property contracts</td>
<td>$</td>
<td>✓</td>
</tr>
<tr>
<td>number of participants</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>number of training programs, workshops, site visits</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>total annual investment and financial flows in climate change technologies</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>volume or value of joint research, development and demonstration (RD&amp;D) activities</td>
<td></td>
<td>✓</td>
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</table>

### Technology transfer

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Unit</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>number of intellectual property contracts</td>
<td>$</td>
<td>✓</td>
</tr>
<tr>
<td>number of participants</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>number of training programs, workshops, site visits</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>total annual investment and financial flows in climate change technologies</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>volume or value of joint research, development and demonstration (RD&amp;D) activities</td>
<td></td>
<td>✓</td>
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</table>

### Value of waste related by-products

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Unit</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>economic value ($)</td>
<td></td>
<td>✓</td>
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### Social Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to modern electricity</td>
<td>share (%) of households/population with access to modern energy</td>
<td>✓</td>
</tr>
<tr>
<td>Access to public transit</td>
<td>share (%) of population with access to low-carbon transport</td>
<td>✓</td>
</tr>
<tr>
<td>Access to waste management services</td>
<td>share (%) of population or households with access to waste management services</td>
<td>✓</td>
</tr>
<tr>
<td>Affordability of electricity</td>
<td>cost per unit of energy</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>share (%) of household income spent on fuel and electricity</td>
<td>✓</td>
</tr>
<tr>
<td>Capacity building</td>
<td>number and type of knowledge assets produced</td>
<td>✓</td>
</tr>
<tr>
<td>Cost of transportation</td>
<td>average cost per passenger-trip</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>share of household income spent on transportation</td>
<td>✓</td>
</tr>
<tr>
<td>Health</td>
<td>disease prevalence (various)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>respiratory infections</td>
<td>✓</td>
</tr>
<tr>
<td>Quality of employment</td>
<td>number of employees with access to benefits</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>per capita or household income</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>safe worker environment (proportion of laborers with access to safety equipment)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>skill level (number of training sessions)</td>
<td>✓</td>
</tr>
<tr>
<td>Reduced household expenditure</td>
<td>avoided cost of energy ($)</td>
<td>✓</td>
</tr>
<tr>
<td>Safety</td>
<td>number of accidents</td>
<td>✓</td>
</tr>
<tr>
<td>Travel distance and time</td>
<td>distance (km) travelled per passenger-trip</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>hours per passenger-trip</td>
<td>✓</td>
</tr>
</tbody>
</table>

### Environmental

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air pollution</td>
<td>annual air pollutant emissions (tons or concentration)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>concentration of pollutants emitted</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>number or share (%) of households burning waste</td>
<td>✓</td>
</tr>
<tr>
<td>Natural resource exploitation</td>
<td>natural resource consumption (e.g. tons, acres)</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>resources consumed per unit of value added (e.g. tons/$)</td>
<td>✓</td>
</tr>
<tr>
<td>Water quality</td>
<td>level of pollutants in ground/surface water (mg/l)</td>
<td>✓</td>
</tr>
</tbody>
</table>
Conclusion

MRV of NAMAs presents an opportunity for developing countries to leverage climate financing to abate emissions while promoting sustainable economic development. GHGs outcomes are required to be tracked within the UNFCCC reporting frameworks. However, to better track the broader impact of NAMAs, CCAP has proposed voluntary reporting on an expanded set of metrics that go beyond GHGs and include indicators of actions taken by NAMA implementers, progress achieved by mitigations actions, and the impact of actions in promoting sustainable development.

These metrics can demonstrate that climate financing is being utilized effectively and that implemented policies are achieving intended results both in terms of reducing atmospheric GHG concentrations and fostering sustainable growth. Indicators of sustainable development are particularly important for securing domestic political support and international financing for NAMAs. Monitoring development outcomes as a result of mitigation actions can also improve policy effectiveness and ultimately make the case for wider replication.

There are a number of metrics that can be used to measure how NAMAs support sustainable development. Each country must ultimately determine its national priorities and select the metrics that most compellingly measure the effect of implemented policies on economic growth, poverty reduction and protection of the environment. Indicators should be specific, measurable, cost-effective to harvest, relevant, understandable and most importantly meaningful to policy-makers and contributing countries. The MRV of sustainable development metrics, although voluntary, can be potentially costly, requiring capacity building, technology, and significant human and financial resources for harvesting and analyzing data. Therefore it is critical that contributing countries include these costs in NAMA financing packages to ensure there are sufficient funds to monitor activities.

Developing countries can draw from existing frameworks as a starting point to develop their own institutions and processes for the voluntary identification, measurement and reporting of sustainable development metrics. Development of national or programmatic criteria can provide guidance for the development of metrics for specific actions that support national development priorities, and stakeholder consultations can help ensure the concerns of stakeholders are addressed and that activities positively impact development priorities in the community. In addition, establishment of guidelines and deadlines for monitoring reports can help governments enforce monitoring of sustainable development metrics and enable beneficial uses of those data.

Going forward, CCAP will continue to support NAMA development in Asia and Latin America through the MAIN. A key focus will involve crafting the MRV components of the NAMAs, including consideration of action, progress, GHG and sustainable development metrics most consistent with national priorities and tailored to the NAMA in question. It is important that voluntary MRV of non-GHG metrics be designed by developing countries rather than mandated by and negotiated through the UNFCCC process. We expect that future papers will describe these case studies and begin to develop best practices to identify, define, measure and advance sustainable development outcomes.
Annex 1: Menu of Sustainable Development Metrics, by Sector

Drawing from the broad literature on sustainable development metrics as applied to activities that reduce GHG emissions, a menu of sustainable development indicators is presented for the following five sectors: Transportation; Renewable Power Generation; Residential, Commercial and Public Building Energy Efficiency; Industrial Energy Efficiency; and Waste Management. As described previously, developing countries can use this menu to select a small set of core indicators that best fit their national circumstances.

Transportation

Transit-oriented development (TOD) is an urban planning model that promotes the construction of strategic, mixed-use real-estate within walking distance of high-capacity public transport. In addition to reducing emissions, sustainable urban development minimizes public infrastructure expenditures, reduces transportation and energy costs for users, increases neighborhood property values, and stimulates growth in the retail sector.

A key component of TOD is creating a multi-modal transport system, including pedestrian and bike accessways, centered around a bus rapid transit (BRT) system or other high-capacity public vehicle system (e.g., light rail, subway, or high efficiency bus). Efficient public transportation systems are a pillar of sustainable development, connecting people to employment, schools, clinics, and commerce. Services elevate the poor in particular, who spend a significant portion of their income and time on commuting. Further, by relieving traffic congestion, cities are able to liberate hours of economic productivity and energy otherwise spent on roadways while reducing harmful emissions. Thus developing a comprehensive transit infrastructure surrounded by well planned, mixed-use real estate has become a priority for many developing countries.

Economic Indicators

**Public expenditure** – TOD can induce a shift to more efficient land uses by creating high density communities that efficiently serve a greater number of residents while minimizing infrastructure investment needs, such as water, sewer and electricity. Additionally, policies that lower use of low occupancy vehicles can reduce expenditures for road infrastructure construction and maintenance. Thus, TOD *defers or avoids costs* associated with public infrastructure, creating significant *public expenditure* savings ($).19

**Tax Revenue** – High density populations in accessible urban areas can increase foot traffic at local businesses, thereby increasing retail sales. Additionally, demand for property in well-planned neighborhoods is often high, increasing property values. TOD thus generates additional *tax revenues* from these sources ($).20

**Job creation** – Building public transit infrastructure creates temporary jobs in construction. The operation and maintenance of these systems also create significant numbers of permanent jobs. However, many people are employed by the informal transportation sector, especially the poor. As low-
carbon transport modes displace the informal sector, jobs in that sector will be lost. Thus, job creation in the transport sector should consider net number of jobs created.

**Leveraging of private financing** – Creating accessibility to neighborhoods through public transit can stimulate economic growth along public transit corridors. Public urban planning and investment in transport infrastructure can significantly leverage private sector investment in real-estate. Several leverage ratios can be used to represent this indicator, including ratio of total funding to public funding; the ratio of private funding to public funding; or the ratio of public climate finance to broader public and private finance. 21

**Energy Security** - A shift to efficient public transport and non-motorized transit reduce overall transport-related energy demand. The impact of these policies on energy security can be measured as the reduction in share (%) of imported oil. 22

**Fuel intensity** – High-occupancy vehicles and non-motorized transport reduce average fuel consumption per passenger-kilometer, or one kilometer traveled by one passenger. Declining fuel intensity trends can be an indicator of a long-term structural shift to low-carbon transport modes, such as the permanent decommissioning of obsolete buses and growing share of passenger trips via fuel-efficient buses.

**Fuel savings per capita** – Reducing private vehicle use decreases fuel consumption, in tons of oil equivalent saved. By measuring fuel savings per capita, the indicator accounts for population growth. Fuel savings are especially important for fuel importing countries that may be less energy secure.

**Social Indicators**

**Travel distance and time** - Traffic congestion on roadways increases the duration of passenger-trips and leads drivers to use circuitous routes to avert traffic, thereby increasing the distance traveled. Additionally, poor public transit design causes multiple transfers in often inefficient segments to reach a destination, increasing both the distance and time traveled. Multi-modal and public transit projects reduce the time (hours) and distance (km) travelled per passenger-trip.

**Access to public transit** – To make serious gains in poverty alleviation, increasing access of disadvantaged groups to public transportation, and thus employment, is critical. This can be measured by the share (%) of population with access to low-carbon transport within a pre-determined distance of high-frequency transit, and can be disaggregated by socio-economic class, gender and geography to ensure equitable access.

**Cost of transportation** – For many urban poor, the cost of public transportation can present a significant barrier to access. Thus measuring the cost of public transit in comparison to other transportation modes in terms of average cost per passenger-trip or share of household income spent on transportation can give insight into the affordability of transport options.
Health – Vehicle emissions are one of the primary causes of urban air pollution. Measuring the change in respiratory infections per population is an indicator of the health impact of air pollutants as actions help reduce air pollution to levels that are protective of health.

Safety – Traffic congestion, outdated vehicles, aggressive driving practices and lack of pedestrian or bike pathways leads to dangerous conditions for users of all transportation modes. High-quality transit projects have been shown to decrease the number of accidents along BRT corridors (injuries, fatalities, and collisions).

Environmental Indicators
Air pollution - In addition to GHGs, fuel combustion from vehicles emits suspended particulate matter, nitrogen oxides, carbon monoxide, and ozone creating molecules that cause smog. Dense urban developments centered around efficient public transit reduce the number of passenger vehicle trips and lengths. Together, they significantly reduce air pollutants (in tons). Components of this metric include the amount of transport fuel avoided (in tons of oil equivalent) and the pollution intensity of transport fuels (tons of pollutants/unit of fuel). Since calculating non-point source pollutants can be challenging, pollutants can also be estimated by measuring the average level (concentration) of pollution in a given zone.23

Renewable Power Generation
Under the existing policy framework, global power demand is projected to double from 2009 to 2035, led by developing countries, which are expected to exhibit a 172% increase in demand for power.24 Recognizing that access to a modern, affordable and reliable power supply is paramount for economic development, poverty reduction and improved air quality, many countries have created a framework of policies, targets and financial mechanisms to stimulate renewable energy development. As a result, 37% of the electrical capacity added in 2011 was from renewable resources, worth $257 billion – 35% of which was invested in developing countries. b,25

These significant investments have allowed nations to reduce fuel imports and diversify their energy matrix, thereby improving energy security and the balance of payments. Expanded access to energy for the poor and generation of skilled employment have also fostered economic opportunities and reduced poverty in local communities. In addition, clean energy financing has facilitated technology transfer, allowing developing countries to build competitive domestic markets with products higher up the value chain. Altogether, this has improved economic stability and liberated financial resources that can be reinvested in social programs or used to leverage private sector investment.

Economic Indicators
Energy Security – Sufficient and predictable access to energy supplies at a given price is vital to economic growth. Energy security is thus one of the primary drivers behind renewable energy

b Figures exclude large hydropower. Large hydropower (>50 MW) capacity additions in 2011 are estimated to be 15-25.5 GW, worth up to $25.5 billion. Including large hydropower, renewables accounted for almost half of capacity additions in 2011.
Countries that depend heavily on imported fuel are more vulnerable to the energy price shocks and supply disruptions that reduce energy security. Exposure to these disruptions can be limited by minimizing import dependency via increased production of energy from indigenous sources. The change in share (%) of imported fuels for power generation or change in share (%) of total energy supply from renewable sources measure dependency on fuel imports and fossil fuels in general. Disaggregating by technology will more accurately reflect fuel diversity.

**Job creation** – As of 2011, renewable energy industries have employed roughly 5 million people, directly and indirectly. Nearly half of these are in the bioenergy sector, where growing, harvesting and distributing the feedstock is highly labor intensive. For other technologies, equipment manufacturing, installation, operation and maintenance are the key drivers of employment. A shift to renewable energy may also reduce employment at displaced power plants, thus direct job creation should consider the number of net jobs created. This can be derived from employment, training and social security records.

**Balance of Payments** – By reducing a nation’s foreign currency expenditures on fuel imports, indigenous renewable energy production has a positive effect on the balance of payments. Using national energy statistics on the volume of imported fuels and price, one can determine the value of imported fossil fuels displaced by incremental renewable power generation ($).

**Technology Transfer** - With respect to technological development, estimating the total annual investment and financial flows in climate change technologies from the domestic and international, private and public sectors, and bilateral and multilateral sources is important to highlight the flow of investment in new technologies into developing countries. Another common indicator is the volume or value of joint research, development and demonstration (RD&D) activities. This indicator includes gross domestic expenditure on RD&D by all parties and covers capital expenditures and current costs related to technological innovation only. Knowledge exchange can be measured by estimating the number of training programs, workshops and site visits for building capacity in technology information, or the number of participants in these activities. It may also be possible to quantify transfers based on the number of intellectual property contracts signed in countries where such documentation and engagement exists.

**Social Indicators**

**Access to Modern Electricity** – Currently 1.4 billion people globally do not have access to modern energy, limiting their potential to escape poverty and restricting economic growth. As demographic growth outpaces electrification, adding power production from renewable sources can expand access to underserved populations. Using household surveys, data regarding the share (%) of households or population with access to modern energy can be collected. Disaggregating data into rural and urban populations will also provide insights into the impact of electrification efforts on poor, rural communities.
Affordability of Electricity – For millions of poor, availability of power services is insufficient to create access. The affordability of electricity is equally important. Thus, comparing local prices of electricity to the pre-project baseline will determine whether increasing renewable power generation has increased availability through lower cost of power for end users. This can be represented as the change in cost per unit of energy over time. Another parameter for measuring power affordability is evaluating the share of household income spent on fuel and electricity. This parameter could be expressed as household income spent on fuel and electricity, and household income for the total population and by quintile.

Health - Disease from energy-related air pollution is common to developing countries, induced by outdoor air pollution from fossil fuel power plants and indoor air pollution caused by the burning of traditional biomass for cooking or heating. The most commonly used indicator is respiratory infections but air pollution is also responsible for chronic obstructive pulmonary disease, ischaemic heart disease, chronic bronchitis, and damage to the eyes. As women and children are disproportionately affected by indoor air pollution from cooking stoves, access to renewable power in rural areas is particularly important for improving gender equality.

Environmental Indicators
Air Pollution – Fossil fuel based power generation, especially from coal fired power plants produce high levels of sulfur oxides (SO\textsubscript{x}), nitrogen oxides (NO\textsubscript{x}), non-methane volatile organic compounds (NMVOC), particulate matter (PM), and heavy metals. Air pollution reductions can be measured by emissions intensities (quantity of pollutant emitted per unit of gross energy used), or changes to annual air pollutant emissions (tons) that consider total energy consumption and grid energy intensity. Air pollutant concentration is also useful metric, and can be measured through pollution censors on smoke stacks or by modeling emissions. When multiple policies that reduce air pollution interact, it may be difficult to accurately measure air quality improvements and attribute these to the implementation of a single renewable power NAMA or policy. One option is to measure improvements resulting from a suite of policies instead of attempting to attribute results to a specific action. Finally, establishing an accurate baseline is critical to measuring progress in comparison to historical data. As assumptions are corrected, the baseline should be adjusted accordingly.

Residential, Commercial and Public Building Energy Efficiency
Global building energy consumption in 2009 rose to 2.8 billion tons of oil equivalent, and is projected to increase by 31% by 2030. Implementing energy efficiency measures in this sector thus has significant potential to reduce primary energy demand, increase energy security, defer the cost of expensive energy infrastructure, and produce energy cost savings for households, businesses and the government. Important to note is that energy efficiency measures are often not only cost-effective, but have negative abatement costs and are therefore affordable for all classes given the right financing mechanism. Energy efficiency can be encouraged through myriad policies, some of the most common of which include minimum energy performance standards, energy labeling, energy auditing, efficient building materials and lighting, and creating incentives and financing to facilitate efficient technology uptake.
Economic Indicators

**Energy Security** – Many developing countries struggle to meet the energy demand of their citizens, often relying on increased energy imports to fill this gap. Energy security is influenced by the availability and price of energy, thus dependence on other states to supply fuel can make fuel-importing nations vulnerable to supply constraints or price shocks. In addition to increasing a nation’s installed capacity, policies that reduce energy demand can lower the need for imported fuels to meet growing energy needs. Energy security can be monitored by measuring the reduction in imported fuels (in tons of oil equivalent) through energy efficiency measures and accordingly, the resulting reduction in share (%) of imported fuels in total power supply or energy demand.

**Deferred capacity additions** – By reducing power demand, energy efficiency reduces capital expenditures that would otherwise be used for power capacity additions. Using national estimates of reduced consumption as a result of energy efficiency measures, avoided or deferred capacity additions can be estimate (MW). It is important to note that this simple estimate does not account for capacity additions to support energy needs in other locations.

**Energy intensity of GDP** – This indicator highlights energy use per output. It is an indicator of economic efficiency and provides insights into the health of the overall economy. Economic efficiency is affected by the type of industries that are prevalent, thus trends that demonstrate a reduction in energy intensity can be indicative of nations that are transitioning into a post-industrial economy. Energy intensity of GDP can be presented in MJ/$.

**Job creation** – Manufacturing of high-tech appliances, equipment and materials, and energy management and auditing create a range of skilled employment opportunities. Data on the net number of jobs created can be derived from employment, training and social security records.

**Energy cost savings** - Energy efficiency is a cost-effective means for reducing total expenditures on energy use that catalyzes other economic and social benefits. For the public sector, this liberates funding for infrastructure or social projects. Private sector savings can be reinvested in more productive activities. For households, and the poor especially, savings can be used to stimulate the economy and improve quality of life. Energy cost savings are measured by the avoided cost of energy, determined by the amount of power saved (in MWh) and the cost of power per MWh.

**Technology Transfer** – In addition to behavioral changes, technological improvements are necessary for achieving significant energy savings. It is also an opportunity to build domestic capacity for production of high-tech products and to spur local innovation. Measuring total annual investment and financial flows in climate change technologies from a variety of sources – domestic/international, private/ public, bilateral/ multilateral – can provide insights as to the flow of investment in new technologies into developing countries. The value or volume of joint research, development and demonstration (RD&D), is another means of measuring technology transfer. Knowledge exchange can be measured by estimating the number of training programs, workshops and site visits for building capacity in technology information, or the number of participants in these activities.
Social Indicators

Reduced household expenditure – By reducing the amount of energy needed to conduct household activities, households are able to spend less of their limited resources on electricity bills, or maintain expenditures while increasing consumption. This can be estimated through household surveys that examine the amount of energy avoided and the cost associated with those energy savings.

Quality of employment – Due to the technological nature of energy efficiency improvements, and the need for energy auditors and managers, employment produced by this sector requires skilled labor. Formal employment will often provide social benefits and higher wages, improving the quality of employment. This can be measured by skill level (number of training sessions), provision of social benefits (number of employees with access), and increased per capita or household income. Income should be on par with or greater than local or sectoral wages.

Environmental Indicators

Air pollution – Energy conservation and efficiency reduce energy consumption and associated pollutants. By determining the emissions intensity of the electrical grid (tons of emissions per MWh) and the amount of energy reduced through energy conservation and efficiency measures (MWh), it is possible to estimate the reduction of annual air pollutant emissions (tons) attributed to energy efficiency.

Industrial Energy Efficiency

Efficiency improvements have been shown to increase industrial productivity and competitiveness, providing further economic benefits to the sector and nation. Although roughly three-quarters of energy use in industry is utilized to power manufacturing processes, the remaining portion is used as raw material in the form of fossil fuels. Reducing these raw material inputs through improved efficiency and processes has the added environmental benefits of minimizing natural resource depletion. Equipment efficiency is particularly important in improving industrial efficiency. Two sources with significant energy conservation potential are heat-producing boilers and utilizing combined heat and power, or co-generation, to produce power and thermal energy. In 2009, global industrial energy consumption reached 2.3 billion tons of oil equivalent (TOE) and is projected to increase by 54% in the next twenty years. With many developing countries importing fuel to meet their growing energy needs, improving energy efficiency in industry can create much needed energy savings and promote energy security. In developing countries, the petroleum refining and iron and steel industries have the greatest potential for energy savings, with an estimated savings of 4.6 and 5.4 exajoules per year, respectively.

Economic Indicators

Industrial energy intensity - This indicator provides information on the relative use of energy per unit of output, which is reduced through the implementation of energy efficient technologies and processes. Analysis of this indicator can provide insights into trends in technological improvements, energy management, output, product composition and fuel mix of industrial sectors. To aggregate this across industries, the denominator can be converted into output value ($). Although this facilitates
comparison, it is influenced by market price fluctuations. Additionally, translating this metric into the absolute cost of production per unit of energy consumption provides a financial indicator of energy intensity. Firms may hesitate to provide this information due to its sensitive nature thus policy-makers should work with them to ensure information on individual firms will not be published, but instead aggregated by industry to facilitate energy intensity improvements and raise the competitiveness of domestic industries. It may be necessary to have independent monitors confirm data.

Modernization – Energy efficiency improvements are dependent on the replacement of obsolete equipment with modern technology. Modernization of industries in developing countries is critical to remaining competitive in the domestic and global market. Measuring the average age of technology (years) and investment in new capacity ($) through firm surveys will indicate how firms are modernizing their processes.

Job creation – Productivity and competitiveness improvements generate larger profits which can then be transformed into labor or wage increases. Industrial energy efficiency creates employment opportunities through manufacturing, operation and maintenance of energy efficient equipment, and energy management and auditing, for example. Data on number of jobs created can be derived from employment, training and social security records.

Competitiveness and productivity – Energy efficiency improves industrial productivity by reducing the cost of inputs, building a higher-skilled workforce, and improving product quality. This can be measured by determining the manufacturing value added (MVA) per unit of energy consumed ($/MWh) or the MVA per value of energy consumed ($) for specific sectors, and later aggregated for national values. MVA refers to the net output of a sector (sum of all outputs minus intermediate inputs).

Deferred capacity additions – By reducing power demand, energy efficiency reduces capital expenditures that would otherwise be allocated to power capacity additions. Using national estimates for avoided power consumption as a result of energy efficiency measures and the energy intensity of the grid, avoided or deferred capacity additions can be estimated, in MW.

Energy security – With less than 10% of global industrial energy sourced from renewable resources in 2009, fossil fuel importing countries can improve energy security through industrial energy efficiency. Efficiency improvements are also a cost-effective counterpart to renewable capacity addition, which are expensive and can be less reliable due to their intermittent energy production. Energy security can be represented by measuring imported fuel avoided through energy efficiency (tons of oil equivalent) and accordingly, the resulting reduction in share (%) of imported fuels in total power supply.

Technology transfer – Developing country industries seek opportunities to boost competitiveness. Demonstration through technology transfer promotes replication across other firms and industries. In developing countries, the industries with the greatest potential for technical improvement are petroleum refineries, alumina production, copper smelters, and zinc. The volume or value of joint research, development and demonstration (RD&D) is one means of measuring technology transfer.
RD&D includes capital expenditures and current costs related to technological innovation. If available, one can also measure this indicator by the number of intellectual property contracts signed related to renewable energy or energy efficiency.

**Social Indicator**

**Quality of employment** – Energy efficiency gains are often catalyzed by technological improvements, which require skilled labor to manufacture, install, operate and maintain equipment. This creates a range of skilled, formal employment that can be measured by skill level (number of training sessions), provision of social benefits (number of employees with access), and increased per capita or household income. Income should be on par with or greater than local or sector specific wages. Data can be derived from employment, training and social security records.

**Health** – Pollutants from fossil fuel combustion have deleterious health impacts not only on the general population, but especially on factory workers, who suffer from upper respiratory tract infections and asthma attacks as a result of poor work conditions. Furthermore, factories tend to be located in low-wage areas, thus the poor suffer disproportionately from localized industrial pollution. Although many positive health impacts have been documented from energy efficiency improvements, measuring changes in the prevalence of respiratory infections in factory workers and the local population will give insights into the most commonly reported health effects of plant-produced air pollution.

**Environmental Indicator**

**Natural resource exploitation** – As previously mentioned, one-quarter of industrial energy use is utilized as raw material inputs into manufacturing processes. Energy efficiency reduces the resource intensity of manufacturing, in terms of product inputs and materials use throughout the manufacturing process. Cement blending in particular diversifies the raw materials used, thereby reducing intensity of specific resources. This can be measured in terms of the reduction of natural resource consumption (tons, acres, etc.), compared with the baseline. Additionally, sector specific resource efficiency, measured in terms of resources consumed per unit of value added (e.g. tons/$) can be gathered by industry and then aggregated nationally. Tracking this indicator over time will identify trends in resource exploitation and efficient use.

**Air pollution** – Fossil fuel combustion in power plants produces a variety of harmful air pollutants. Most prominent among these are sulphur oxides, nitrogen oxides, smoke and suspended particulates. Efficient industrial processes reduce energy use and subsequently the amount of pollutants released from power plants. By determining the emissions intensity of the electrical grid (tons of emissions per MWh) and the amount of energy reduced through energy conservation and efficiency measures (MWh), one can estimate the reduction of annual air pollutant emissions attributed to energy efficiency (tons or concentration).

**Waste Management**

As populations and incomes rise in developing countries, effectively managing waste becomes increasingly challenging for developing countries, in particular for municipalities responsible for handling
waste with limited financial resources. Lack of proper waste management can reduce the quality of life for residents. An integrated solid waste management system is a comprehensive program that manages waste at all points of the life cycle. Key components include “Reduce, reuse, recycle” strategies, decentralized house-to-house collection, composting of organic material, disposal in sanitary landfills and utilizing landfill gases to produce energy.

**Economic Indicator**

**Public expenditure** – Strategies that minimize waste generation through 3R programs and composting to eliminate organic waste matter reduce pressure on municipalities to site more landfills, which require significant investments to purchase land for siting and the construction of the landfill. Thus, *deferring or avoiding these infrastructure costs* can create significant *public expenditure savings* ($).

**Job creation** – Employment is created through the manufacturing, installation, operation and maintenance of waste facilities. Additionally, the informal waste sector provides income for the nation’s poorest, who are often waste scavengers. Professionalizing waste collection, transport and disposal will create employment opportunities, but will also displace many of those working informally. Thus, employment indicators should measure the *net number of jobs created* to accurately account for the impact on employment.

**Technology transfer** – Pioneering projects can demonstrate the financial viability of urban solid waste systems and introduce new technology such as landfill-gas-to-energy equipment. The *total annual investment and financial flows in climate change technologies*, especially from the private sector, bilateral and multilateral sources highlights the flow of investment in new climate technologies into developing countries. Domestic development of new technology can be captured in terms of the *volume or value of joint research, development and demonstration (RD&D) activities*, and includes gross domestic expenditure on RD&D on capital expenditures and current costs related to technological innovation. Knowledge exchange can be measured by estimating the *number of training programs, workshops and site visits*, or the *number of participants* in these activities.

**Energy production** – Waste treatment facilities that utilize methane emissions to produce power contribute to local *energy production* (kWh) and self-sufficiency. If power generation exceeds the facility’s needs, this power can be sold back to the local grid to improve the availability of power to local communities.

**Tax revenue** – The privatization of waste management contributes to municipal *tax revenues* ($) both from firms managing waste operations and from increased employment.

**Value of waste related by-products** – Waste reduction activities such as composting and recycling create by-products with an economic value, as do waste elimination activities such as incineration to produce refuse-derived fuel. These can be measured in terms of their *economic value* ($).
**Social Indicator**

**Access to waste management services** – Uncollected waste has many negative impacts on human health, the environment and even economic growth. Thus access to services, measured by the share (%) of population or households with access to waste management services, is an important component of sustainable development. This indicator could be disaggregated by socio-economic class and geography to highlight equitable access by previously underserved communities.

**Health** - Uncollected waste and open landfills facilitate the proliferation of disease vectors such as rodents, flies and mosquitoes. As a result, residents in the periphery of uncollected waste or landfills are exposed to a range of diseases including typhus, salmonella, leptospirosis,48 dengue and malaria. Waste scavengers are particularly vulnerable to waste-related disease, suffering from skin infections, parasitic infections, injuries from hazards on disposal sites, and tissue damage through respiration, ingestion or skin contact. Harvesting reliable data on health outcomes and directly attributing them to municipal solid waste management practices can be challenging. As indicated above, there are numerous diseases that result from exposure to untreated waste, thus monitors must determine which diseases and afflictions will be measured. The poor in particular are less likely to solicit medical treatment at central facilities due to cost of care, transportation and time off of work, for example, therefore it may be necessary to collect data through household surveys to determine the change in disease prevalence.

**Capacity building** – Due to the decentralized nature of urban solid waste generation and management, the sector provides an opportunity for education and community participation, especially of marginalized groups and women, to develop local strategies for reducing and managing waste. Although the economic benefits of these activities can be difficult to quantify, developing countries value the role waste NAMAs can play in empowering local communities. Capacity building can be measured by number and type of knowledge assets produced, such as publications and workshops.

**Quality of employment** – Laborers in the informal waste sector often operate under hazardous conditions with low income and few social benefits. Shifting these workers into the formal sector can provide additional skills (number of training sessions), increased wages (per capita or household income), a safer worker environment (share of laborers with access to safety equipment), and access to benefits. Data can be gathered from employment, training and social security documents and surveys.

**Environmental Indicator**

**Water quality** – Capturing and treating leachates in sanitary landfills reduces the pollution load of discharged effluent and runoff, thereby improving the quality of ground and surface water. These co-benefits can be measured by the level of pollutants in ground and surface water near landfills (in mg/l), in particular biological oxygen demand, chemical oxygen demand, and coliforms, among others. The weighted average percentage change can be used when analyzing more than one pollutant.

**Air quality** – Although the waste sector is a significant contributor to GHG emissions, it does not produce large quantities of air pollutants unless incinerated.49 Thus air quality considerations are
typically centered around odor produced by decaying organic waste, and can be measured through household surveys indicating the change in number of households affected by waste-related odor. Where waste is incinerated, air pollution can be measured with monitoring devices at waste incinerating facilities to determine the concentration of pollutants emitted, or through household surveys to determine the number or share (%) of households burning waste.
1 Interview with Dario Hidalgo, Director for Research and Planning, EMBARQ on October 12, 2012.
4 UNDP. *Bogota, Colombia Bus Rapid Transit Project – TransMilenio Case Study*. From http://www.ncppp.org/undp/bogota.html
15 Northwind. (December 23, 2005). *op. cit.*
18 Interview with Shaanti Kapila, Global Support Program Coordinator, Climate Investment Funds, on October 15, 2012.
20 Center for Clean Air Policy. (January 2011). *op. cit.*

MRV of NAMAs: Guidance for Selecting Sustainable Development Indicators