

A New NAMA Framework for Dispersed Energy End-Use Sectors

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ABSTRACT

This paper presents a new approach for a Nationally Appropriate Mitigation Actions (NAMA) framework that can unlock the huge potential for greenhouse gas mitigation in dispersed energy end-use sectors in developing countries; specifically, the building sector and the industrial sector. These two sectors make up the largest portions of energy consumption in developing countries. However, due to multiple barriers and lack of effective policies, energy efficiency in dispersed energy end-use sectors has not been effectively put into practice. The new NAMA framework described in this paper is designed to fulfill the demand for public policies and public sector investment in developing countries and thereby boost private sector investment through project based market mechanisms, such as CDM. The new NAMA framework is designed as a need-based mechanism which effectively considers the conditions of each developing country. The building sector is used as an example to demonstrate how NAMA measures can be registered and implemented. The described new NAMA framework has the ability to interface efficiently with Kyoto Protocol mechanisms and to facilitate a systematic uptake for GHG emission reduction investment projects. This is an essential step to achieve the global climate change mitigation target and support sustainable development in developing countries.

Keywords: NAMAs, building-sector, post-2012

1. INTRODUCTION

The Bali Action Plan (BAP) calls for “Nationally appropriate mitigation actions (NAMAs) by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable (MRV) manner”. In the series of negotiation sessions leading to the 15th session of the Conference of the Parties (COP15) in Copenhagen, NAMAs was one of the main negotiation focuses and potentially will become a new mechanism to support mitigation efforts in developing countries. The Copenhagen Accord noted that “non-Annex I Parties” (developing country parties)” to the Convention will implement mitigation actions”. It was also noted that “ nationally appropriate mitigation actions seeking international support will be recorded in a registry along with relevant technology, finance and capacity building support. These supported nationally appropriate mitigation actions will be subject to international measurement, reporting and verification in accordance with guidelines adopted by the Conference of the Parties” (UNFCCC, 2010). As of April 2010, 35 developing countries have officially expressed their support to the Copenhagen Accord and have agreed to implement NAMAs in their countries¹. Designing a new mechanism to operationalize NAMAs, that takes into account the elements stipulated in the BAP and the Copenhagen Accord, is critical for committing and advancing support for mitigation

actions in developing countries.

As outlined below, there are three prominent issues to be worked out in designing new NAMA mechanisms that will be feasible and operational and that all Parties can agree upon and abide by.

i. Operationalizing the Bali Action Plan and the Copenhagen Accord. The United Nations Framework Convention on Climate Change (UNFCCC) Parties have struggled to define new mechanisms that can address and support the critical elements agreed to in BAP 1b(ii); namely, common but differentiated responsibilities, sustainable development, technology transfer², capacity building, financing and MRV of mitigation actions. The same principles also guided the NAMAs element in the Copenhagen Accord. Defining and designing mechanisms that take into account all these critical elements guiding the BAP and the Copenhagen Accord should be an integral part of a NAMA mechanism.

ii. Double Counting. Developing country Parties regard NAMAs as one of the main mechanisms to support mitigation actions in their countries after the first commitment period. Current NAMA proposals on the table (UNFCCC, 2008)

cannot clearly eliminate the concerns about double counting of emission reductions by two financing mechanisms. In other words, how NAMAs interface with project-based mechanisms supported by the Kyoto Protocol and, at the same time, avoid double counting are major challenges in its design.

iii. Financing. Operability and sufficient sources of funding are essential to support mitigation actions in developing countries in the post-2012 regime. In the Copenhagen Accord, developed countries have agreed to commit 30 billion USD for the period 2010–2012 and to mobilize 100 billion USD dollars a year by 2020 to support adaptation and mitigation actions in developing countries (UNFCCC, 2010). However, the funding sources and mechanisms have not been specified. For mitigation actions, developing countries have called for sustainable, adequate, predictable and stable financing, while developed countries prefer use of public financing to leverage private sector financing. Designing a financing mechanism for NAMAs that could satisfy all Parties and mobilize as much funding as possible is a key issue surrounding negotiations in the NAMA debate.

Among other benefits which will be outlined in detail, the NAMA framework developed and illustrated in this paper solves the three prominent and difficult issues

discussed above in the design of Post-2012 NAMA mechanisms.

The paper first provides a brief analysis of the characteristics of dispersed energy end-use sectors in buildings and SME industries. Second, the paper explains the multiple barriers and market failures that hamper mitigation actions in dispersed energy end-use sectors followed by a brief discussion and an overview of policy instruments that could be used to eliminate these barriers. Next, a new NAMA framework is proposed based on needs of the developing countries with financial, capacity-building and technological support mechanisms. A building sector NAMA framework is then used as an example to illustrate the registry, MRV, financing, and interfacing with existing project based financing mechanisms of the new NAMA mechanism. Finally, the paper concludes that a NAMA framework of this kind can provide the urgently needed support to help systematic uptakes of mitigation actions in developing countries.

2. BACKGROUND AND ISSUES

Dispersed energy end-use sectors, specifically the building sector and industrial small and medium enterprises (SMEs), make up the largest portions of energy consumption in developing countries. These two sectors are characteristically dominated by

enormous dispersed energy end-use activities. Because of their dispersed nature, the building and industrial sectors are typically the most difficult sectors to tackle by government policies in developing countries and are in great need of support through the UNFCCC process in the post-2012 regime.

2.1 Characteristics of Dispersed Energy End-Use Sectors

The dispersed energy end-use sectors discussed in this paper include the *building sector*, which is the largest energy end-use sector, and the *industrial sector*, which is comprised primarily of SMEs in developing countries. These two end-use sectors contribute to the largest share of energy end-use in today's economy, and combined account for more than two thirds of energy consumption and carbon dioxide (CO₂) emissions. The building sector alone accounts for 30-40% of energy use worldwide (United Nations Environmental Program (UNEP), 2007, World Business Council for Sustainable Development (WBCSD), 2009). Manufacturing industries are responsible for nearly a third of the world's energy consumption (International Energy Agency (IEA), 2007).

According to Intergovernmental Panel on Climate Change (IPCC) (see Fig. 1), in terms of energy savings and mitigation at low cost, of all sectors the building sector holds the largest potential for emission reduction in developing countries. The industrial end-use

sector has a larger greenhouse gas (GHG) emission reduction potential than that of the energy supply sector in developing countries and its potential is second only to the building and agricultural sectors. As they are closely linked to lifestyle and economic development, the building sector and industrial energy end-use sectors are intimately related to the sustainable development of a country. However, because of a variety of barriers, the huge potential for emission reductions in the building and industrial energy end-use sectors is difficult to realize.

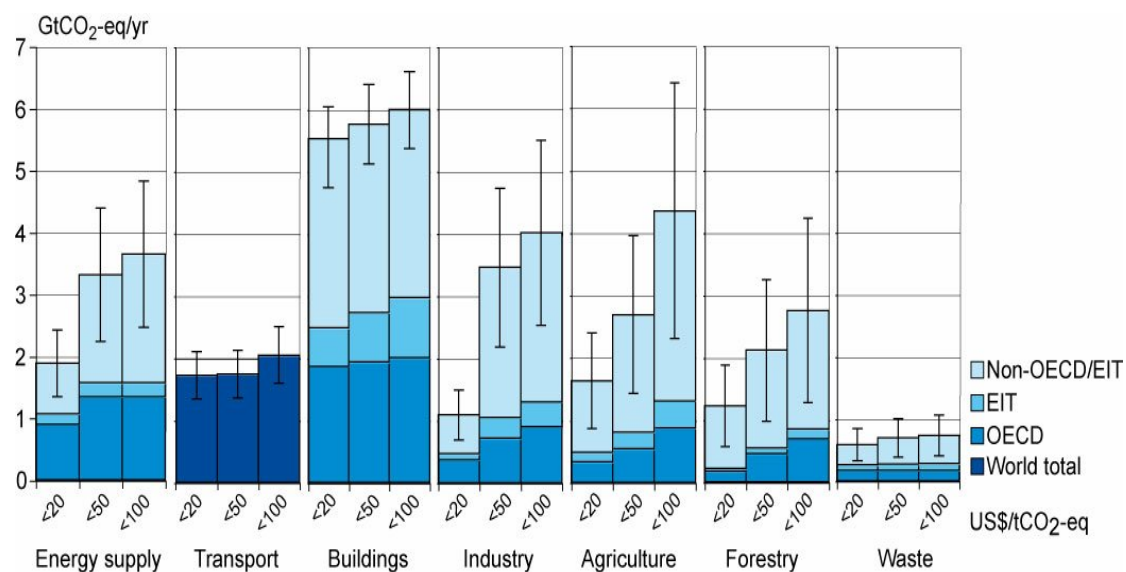


Fig. 1. Potential emission reductions in different sectors in 2030 as a function of the cost assigned to reduction measures (US\$/tonne of CO₂ equivalent). In all sectors, building and industrial sectors hold the largest low-cost CO₂ mitigation potential.

Source: Barker, et al., 2007.

Barriers that affect uptake of mitigation actions from energy end-use activities have

been well studied in the literature (Hinojosa, et al. 2007, WBCSD, 2007, Levine et al.,

2007) and include technological, financing, institutional, informational, managerial, and policy barriers. The underlying causes for many of these barriers come from the dispersed nature of energy end-use activities and the relatively small energy saving potential of Energy Efficiency (EE) technology improvements. As addressed later in this paper, the dispersed nature of energy end-use sectors makes government regulation of emission reduction difficult and costly, especially in developing countries.

The dispersed nature of buildings and SME industries has been recognized and described by Clean Development Mechanism (CDM) researchers as “long-tail” characteristics (Hinojosa, et al. 2007, Cheng, et al., 2008). Energy end-use in buildings and industrial SMEs present distinct characteristics of dispersed end-use patterns, in terms of location, adopted technologies, size, stakeholder’s knowledge and technical capacity, end-use conditions, and stakeholder and end-user’s decisions.

Since a large number of activities occur at the tail-end, the aggregated energy consumption, and therefore the energy saving potential, often outweighs the potential from large scale projects (see Fig. 2). Moreover, the measures needed to spur actions from the building and industrial sectors require engagement of a substantial number of stakeholders and actors, across all sections of the country’s economy.

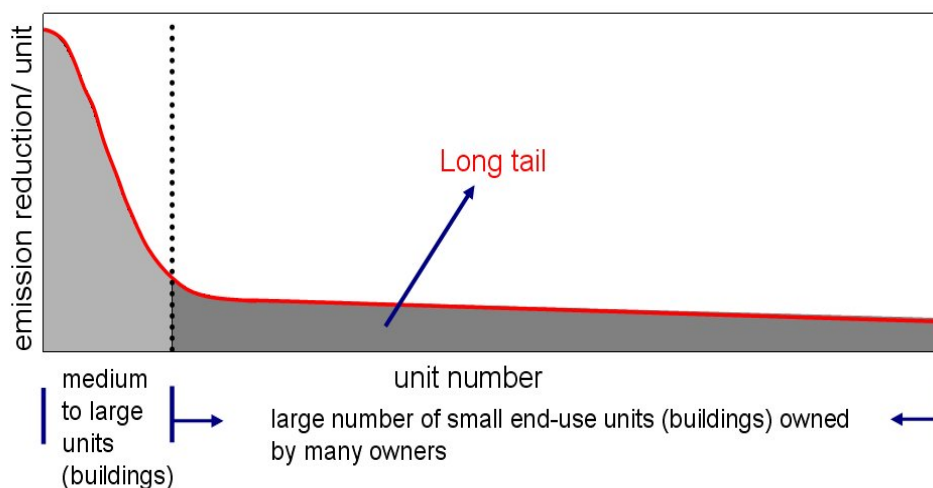


Fig. 2. Large aggregated savings and emission reduction potential from large numbers of end-use units in the long-tail section of the building and industrial sectors. Source: Cheng, *et al.*, 2008.

2.2 Spread and Magnitude of Dispersed Energy End-Use Activities in Building and Industrial Sectors

To better understand the magnitude of the difficulties involved in implementing policies and upgrading the technology in dispersed end-use sectors, it is important to know the *spread and magnitude* of their energy end-use activities, as well as the stakeholders and workforces that are involved. These are briefly discussed below.

Building sector

Buildings, which comprise residential housing and commercial buildings (apartments, schools, offices, hospitals, etc.) exist everywhere, from cities, towns, to rural areas. The square meters of buildings, which must be heated and cooled and contain other energy

consuming devices, is enormous. For example, in China, the existing building stock in 2007 accounted for 32.3 billion square meters (m^2), of which 27.1 billion m^2 is for residential buildings and the remainder commercial buildings. In 2007 alone, 0.8 billion m^2 of new building areas was constructed in China; an additional one billion m^2 is expected to be built each year up to 2020 (Ministry of Housing and Urban-Rural Development, China, 2009). The number of professionals and workers involved in the building sector, through design, construction and maintenance, is also significant. Worldwide, the building sector typically contributes approximately 5-10% of the workforce at national level (UNEP, 2007).

Climate zone and building function are two of the primary factors that influence the energy consumption of a building. The climate zone in which a building is situated determines the cooling and heating needs and influences the design and choice of building materials and technologies required to achieve the desired level of comfort. The typology and functions of buildings determine the types, amount and end-use patterns of energy consumption.

The building sector presents all of the distinctive characteristics of typical long-tail projects (Fig. 2). These include, large numbers of buildings, widespread locations,

diverse technologies used to achieve efficiency improvements, small savings per technology improvement, various specifications for dispersed end-use requirements, varying end-user knowledge levels and decentralized energy use decision making. All of these factors affect individual decisions for EE improvements in buildings and the effectiveness of managerial and policy measures to control emissions.

A large number of buildings in developing countries are built by low-skill “informal” procedures and often utilize sub-standard materials, construction approaches, as well as untrained workers. These buildings mostly appear in rural areas, and in some cases represent the majority of building construction. For example, in Brazil, 75% of single-family homes are believed to be built by the informal section of the building sector (WBCSD, 2009). Upon completion, these buildings typically do not go through any auditing or inspection of construction quality - let alone EE auditing. Regulation compliance for EE in buildings is essentially non-existent.

Industrial sector

For the industrial sector, long-tail characteristics are also very prominent. In developing countries, SMEs make up the majority of economic activity and are the largest workforce employers. For example, in Brazil, SMEs account for 99.2% of

registered business enterprises, contribute approximately 60.8% of the country's Gross Domestic Product (GDP) and provide 66.8% of the country's employment (Mandal, 2007). In China, one of the fastest developing economies, SMEs comprise approximately 99% of the enterprises in all sectors, contributed 55% of the GDP in 2005 (NDRC, 2006) and employed 73% of the work force (Mandal, 2007). In China, 273,263 industrial sector SMEs were registered as of 2004 (NDRC, 2006). In the least developed countries, nearly all economic activities are conducted by SMEs. Informal industrial SMEs that are not registered and outside of regulatory control are also prominent in developing countries.

In terms of technological capacity, SMEs often lag behind large enterprises, in particular for developing countries. The problem of low technological capacity for EE improvement is especially prominent in enterprises at the very end of the "long tail".

For example, as a newly industrialized country, China still suffers from inefficient use of energy in industrial SMEs. The EE performance of commonly used industrial equipment, such as boilers, fans and motor is lower than that in Western countries.

The efficiency of boilers used in China-based SMEs is approximately 20% below that achieved in Western countries. Electric motors in China are approximately 3-5% less efficient on average than motors in the U.S. and Canada. Fans and pumps are

reportedly 8-10% less efficient than those in developed countries (Nadel *et al.*, 2003).

2.3 Policy Intervention and Financing Barriers of Energy End-use Sectors

Policy interventions are particularly weak in developing countries, especially in dispersed end-use energy sectors. Moreover, even if policies are implemented, stakeholders in these sectors typically do not readily comply. The underlying reason for the lack of compliance is the dispersed nature of the energy end-use sectors. As discussed below, from a business and end-user point of view, the primary barriers to adoption of the technology and practices include high upfront and transaction costs, lack of financing, fragmentation and lack of awareness (Hinojosa, *et al.*, 2007, WBCSD, 2007, Cheng, *et al.*, 2008).

High upfront costs for EE and energy efficient building (EEB) investments

The upfront costs associated with EE technology installation or upgrade is regarded as a hurdle for investment. Investors often consider the capital investment for buildings and industrial equipment without taking into account their long term operational costs and savings. Total life-cycle savings for EE and EEB projects are often not properly accounted for or are under-estimated in the investment decision process. Part of the reason for this is that energy expenses are often regarded as part of business operation

expenses or part of building operational cost.

High transaction cost for technology deployment

Due to the dispersed nature of the technologies, and inadequate access to new energy saving technologies and knowledge, the transaction costs for technology adoption and dissemination can be exceptionally high in developing countries. Transaction costs are often not taken into account in life-cycle based economic analyses, such as McKinsey cost curves (McKinsey & Company, 2009). This often results in a perception among policy makers that the economic benefits of EE projects are high and that business owners will take up projects on their own.

Insufficient financing mechanisms for EE investment

Financiers and investors of manufacturing and real estate projects often do not have sufficient information or appropriate tools to evaluate the risk and returns from EEB and EE investment. Therefore, risk assessment methods for EE investment and securitizing revenues generated through life-cycle energy savings have yet to be established. Because of this, industrial project implementers and potential EEB investors have difficulty accessing funding through conventional financing mechanisms, which are largely based on conventional risk analysis for investment

projects.

Uncoordinated stakeholders and fragmented industry

Buildings and industrial facilities normally have a long life-cycle. In a building's or a factory's lifetime, various stakeholders involved in the construction and operational phases typically only have limited interaction. Different aspects of energy management in buildings and industrial facilities, such as design, construction, engineering, management and end-use are often poorly, or not at all, coordinated. There is therefore no natural incentive for an integrated approach to managing energy use in buildings and industrial SMEs.

Lack of awareness and general inertia restricting uptake of EE among stakeholders

One of the largest barriers occurs because stakeholders at all levels have insufficient knowledge about energy end-use and cost-effective approaches to save energy. EE has not been a main concern for most businesses or individuals due to the relatively low cost of energy. Moreover, the practice of saving energy often interferes – sometimes conflicts – with companies' and individuals' daily routines and tested-and-true common practices. It is also often disconnected with a company's managerial goals such as increasing production or expanding market share. This barrier creates strong inertia that

is difficult to overcome. It takes tremendous effort for most companies and individuals to overcome their business as usual (BAU), apprehensions and lack of attention, as well as to change their mind-sets and practices. This “inertia” is evident in industries, designers and builders, and individual energy users.

2.4 Significant Needs Exist for Policy Intervention, Technology Assistance, Capacity Building and Financing

Dispersed energy end-use activities in buildings and in industrial SMEs are often difficult to tackle with traditional policy interventions. These sectors typically have a large number of actors and economic activities with little coordination.

Command-and-control type government policies work best when targeting large energy consumers, but rarely reach the tail effectively. The dispersed locations and uncoordinated stakeholders typical of energy end-use sectors do not respond well to policy intervention. Even in developed countries, EEB and EE standards often have a low compliance rate. For instance, in the UK the compliance rate is only 40 percent in new buildings. This figure is as low as 20 percent in the Netherlands (Koepfel and Ürge-Vorsatz, 2007).

Significant capacity building efforts and high transaction costs are often required to

engage stakeholders in the tail-end of the energy end-use sectors. Moreover, substantial barriers in these sectors often hamper the willingness of investors and financial institutions to finance EE projects. Although the total sum of energy use and energy saving from these activities is substantial, the dispersed end-use nature of the building sector and industrial SMEs hampers the effectiveness of policy intervention. Due to the complexity of these sectors, mandatory policies have been found to be more effective than voluntary ones.

In the building sector, a number of policy studies, including the 4th Assessment Report of IPCC, highlight various policy instruments that can be used to guide GHG emission reduction. The policy instruments targeting building construction and retrofits include building codes, building certification and labelling systems, and education, training and energy audit programs (IPCC, 2007). A comprehensive policy study done by Koepfel and Ürge-Vorsatz (2007) highlighted the emission reduction effectiveness and cost-effectiveness of various policy instruments in the building sector (see Table I).

Efficiency standards and building codes and mandatory measures were identified as the most effective measures. IEA 2007 recommendations to the G8 countries (IEA, 2007) and WBCSD's recent report (WBCSD, 2009) also stress the urgency of implementing mandatory building efficiency codes to transform the building sector, both in developed

and developing countries. In the recent IEA report investigating building code implementation in various countries, Lausten (2008) also identifies building codes and appliance standards as the most important policies and measures to improve EE in buildings, but emphasizes that their success depends on effective enforcement and periodic update.

Table 1.

Emission Reduction Effectiveness and Cost Effectiveness of Policy Instruments for buildings. Source: Koepfel and Ürge-Vorsatz, 2007.

Policy instruments	Emission Reduction Effectiveness	Cost-effectiveness ^(a)	Special conditions for success, major strengths and imitations, co-benefits
Appliance standards	High	High	Factors for success: periodic update of standards, independent control, information, communication, education
Building codes	High	Medium	No incentive to improve beyond target. Only effective if enforced
Public leadership programs, including procurement regulations	Medium /High	High/ Medium	Can be effectively used to demonstrate new technologies and practices. Mandatory programs have higher potential than voluntary ones. Factors for success: ambitious EE labeling and testing.
EE obligation and quotas	High	High	Continuous improvements necessary: new EE measures, short term incentives to transform markets
Mandatory audit requirement	High, but variable	Medium	Most effective if combined with other measures such as financial incentives.
Energy savings performance contracting (EPC)/ESCO support ^(b)	High	Medium	Strength: no need for public spending or market intervention, co-benefit of improved competitiveness.
Cooperative procurement	High	Medium /High	Combined with standards and labeling, choice of products with technical and market potential
Demand-side management programs (DSM)	High	High	Tend to be more cost-effective for the commercial sector than for residences.
EE certificate	Medium	High	No long-term experience. Transaction

schemes/white certificates		/Medium	costs can be high. Institutional structures needed. Benefits for employment.
Kyoto Protocol flexible mechanisms ^(c)	Low	Low	So far limited number of CDM and JI projects in buildings
Taxation (on CO or fuels)	Low	Low	Effect depends on price elasticity. Revenues can be earmarked for further efficiency. More effective when combined with other tools.
Tax exemptions/reductions	High	High	If properly structured, stimulate introduction of highly efficient equipment and new buildings.
Public benefit charges	Medium	High	Success factors: independent administration of funds, regular monitoring & feedback, simple & clear design.
Capital subsidies, grants, subsidized loans	High	Low	Positive for low-income households, risk of free-riders, may induce pioneering investments.
Labeling and certification programs	Medium /High	High	Mandatory programs more effective than voluntary ones. Effectiveness can be boosted by combination with other instrument and regular updates.
Voluntary and negotiated agreements	Medium / High	Medium	Can be effective when regulations are difficult to enforce, combined with financial incentives, and threat of regulation.
Education and information programs	Low / Medium	Medium/ High	More applicable in residential sector than commercial. Success condition: best applied in combination with other measures.
Detailed billing and disclosure programs	Medium	Medium	Success conditions: combination with other measures and periodic evaluation.

Note: (a) Cost-effectiveness is related to specific societal cost of carbon emissions avoided. (b) Energy service companies. (c) Joint Implementation, Clean Development Mechanism, International Emissions Trading (includes the Green Investment Scheme).

Similar EE policy instruments described above for the building sector often are also implemented in the industrial sector. Minimum energy performance standards could be implemented for various industrial systems, such as boiler and steam delivery systems, pump and fluid transport systems, and other process-specific systems. The integrated optimization of industrial systems is often more cost-effective than

optimizing individual pieces of equipment (such as a boiler). Other methods for Measuring Energy Efficiency Performance (MEEP) in industries cover the whole production process, product life-cycle, or energy consumption intensity, as recommended by IEA in its information paper prepared for the G8 Summit (IEA, 2008).

Implementation of energy performance standards in industry needs to be coupled with mandatory auditing and plant-wide energy management and accounting systems to achieve optimal results. Mandatory auditing and energy management systems have proven to be effective tools to improve efficiency in the manufacturing sector. However, these regulatory tools have not been adopted or implemented in most developing countries. For example, China has only recently passed mandatory standards for boilers and pumps, as well as intensity standards for various industries. Moreover, in developed countries, voluntary international standards for industrial energy management systems have only recently been implemented or under development in developed countries and have not been adopted by developing countries. European Committee for Standardization (CEN) released CEN EN 16001 in September 2009 (CEN, 2009), while International Standards Organization's energy management systems standards (ISO 50001) are still in development process.

Many pillars are needed to support the implementation of minimum energy performance standards and gradually push for higher performance. These include; capacity building, technology assistance and financial support. The vast amount of activities and uncoordinated stakeholders, actors, and professionals in the two sectors make the regulatory costs, required efforts and resources exceptionally high, compared to non-dispersed sectors. This is one of the main reasons why mandatory building codes and EE standards have not been widely adopted or enforced effectively, in both developed and developing countries.

Within the Kyoto Protocol, the recently approved Programmatic CDM rules allow aggregation of small scale project activities within coordinated programs to overcome problems of small scale activities in traditional CDM. Hinostroza, et al. (2007) highlighted that opportunities in energy end-use sectors that have long-tail characteristics are difficult to tackle. For these sectors, programmatic CDM is a suitable mechanism to realize potential in the energy end-use sector. A recent UNEP report on CDM and the building sector (Cheng, et al, 2008) studied existing CDM projects in the building sector and concluded that project-based mechanisms are not sufficient to scale-up action in developing countries; *government policy is the main*

mechanism to foster transformation in the building sector. However, project and program-based mechanisms are good *bottom-up* private sector mechanisms to support *top-down* policy implementation in fragmented sectors.

3. PROPOSED NEW NAMA FRAMEWORK

The author proposes a developing country need-based NAMA mechanism which is not financed by carbon credits. The mechanism includes an overall framework as well as sectoral applications to create enabling conditions for transformational uptakes for climate change mitigation actions. The proposed NAMA mechanism is well suited for dispersed energy end-use building and industrial sectors. However, it could also be modified for use in sectors where minimum energy performance standards are useful and strong government interventions are needed, such as the transportation and agriculture sectors.

3.1 The Need-Based NAMA Mechanism with Sectoral Options

To support mitigation efforts in developing countries, NAMAs should be formulated as a mechanism to support the creation of an overall framework for enabling policies and provide an environment to overcome barriers and scale-up mitigation actions. The mechanism is a *need-based* mechanism, proposed and registered by developing

countries and follows preset rules and certain preferred policy options. The country proposals and registry of NAMAs are based on national circumstances and sustainable development needs and include capacity building, technology and knowledge transfer, and financing, in a MRV manner. Depending on the circumstances and needs of a specific developing nation, a NAMA must in part address overarching national climate change issues, such as establishment of national institutional capacity and national policy framework for climate change. Examples of such NAMAs, could include establishment of a national institution for climate change mitigation, setting up enabling policy framework and mechanisms to scale-up mitigation actions, reducing barriers for trades and investment, establishing a carbon market or energy tax scheme, etc.

In addition to overarching mechanisms, NAMAs also need to go down to the sectoral level to target unique opportunities in each economic sector. In other words, policy options in critical sectors for GHG mitigation need to be reviewed and considered within the framework of NAMAs. This is particularly important in energy end-use sectors where emission reduction opportunities are sectoral specific, technological options are based on sectoral needs, socio-economic circumstances in each sector are unique and stakeholder interests and capacities differ. Therefore, the requirements for

capacity building, technology transfer and financial incentives need to specifically address the circumstances of the specific energy end-use sector. Moreover, because each sector's mitigation options and required international support differ, it is most effective to define sectoral specific MRV methods accordingly.

Within sectors, implementation of a set of carefully designed policy measures or a policy package is often the most effective way to spur and foster mitigation actions.

These often include a mandatory approach to force compliance and supplementary incentive, and a set of educational, and financing mechanisms to support implementation. For designing effective sectoral NAMAs, a country should assess relevant policies and successful elements of effective policies and implemented them as a package.

A sectoral NAMA approach is especially important and could potentially create the strongest impact in dispersed energy end-use sectors, including buildings and industrial SME sectors. *In these two sectors, implementation of minimum energy performance standards, in conjunction with other complementary policy instruments and market mechanisms for greenhouse gas emission reduction could potentially form an integrated NAMA framework and effectively spur mitigation actions in the dispersed*

energy end-use sectors.

3.2 Registration of NAMAs

Current NAMA proposals on the table (UNFCCC, 2009) have suggested a NAMA registry as a mechanism and a basis for a developing country to receive funding support.

Several initial steps may be required at the country level to establish a NAMA framework (or registry) that will be effective, operational and fulfill the country needs.

It also requires assistance and consensus at the UNFCCC level before a new NAMA framework could become operational. The essential steps include:

- a. ***Policy need assessment conducted at the country level.*** Policy need assessment could include overarching policy options, as well as sectoral level options. To assist policy need assessment and incorporate international goals for emission reductions, UNFCCC and the Secretariat could suggest a recommended list of NAMAs and priority of policies that will be potentially supported and assisted.
- b. ***NAMA registry at the international level.*** This process determines the eligibility of policies or NAMA options which could be registered and supported under a NAMA registry. This will require an UNFCCC process to set criteria for NAMA

registry (or registered NAMAs) that are proposed by a country. The NAMA registry of each country could include several NAMAs packages or schemes according to the country's climate change mitigation and sustainable development needs.

- c. ***Determination of the level of support for each registered NAMA.*** UNFCCC will define supporting mechanisms, including MRV, and determine criteria for the level of support for each registered NAMA, including policy formulation, implementation, capacity building, and technology assistance needs once a particular NAMA (overarching and sectoral) is registered.

3.3 Operationalizing the Bali Action Plan and the Copenhagen Accord

Section 1b(ii) of Bali Action Plan calls for NAMAs in developing countries to be supported by technology, financing and capacity-building, in a MRV manner. Under the proposed NAMA framework, the capacity building and technology assistance needs of each registered NAMA could be developed and proposed by a country as capacity building and technology transfer and assistance *programs*. The programs could be flexible and innovative to fit the county conditions, but must include effective measures to support implementation of registered NAMAs. In terms of sectoral NAMAs, the capacity building and technology assistance programs can be sectoral wide, or target a

specific action, sub-sector or region in a country.

Technology transfer and assistance programs which aim to create enabling environments, such as technology needs assessment, research and development (R&D) support, technology incubation, business consultation setup, demonstration and dissemination of best practices and trade barrier reduction, etc., would be eligible for NAMA support. Capacity building programs could include auditing, public awareness raising, personnel training, design of necessary tools for enabling policies, institutional set up, dissemination of best practice, etc.. In some countries, capacity building for policy assessment, formulation and NAMA registration will also need assistance and financing.

3.4 MRV for NAMAs and Avoidance of Double Counting

MRV of NAMA programs would be an integral part of the proposed NAMA mechanism and is strongly linked to their financing. Current reporting mechanisms based on carbon emissions are insufficient to indicate the success of NAMAs and NAMA programs. Kyoto Protocol uses one and only one indicator as the measurement of success-- tonnes of carbon emission reduction. This indicator may not be suitable for NAMAs. The direct emission reduction effects of enabling policies and measures are

difficult to evaluate because desired mitigation actions taken by a private sector actor often do not happen only because of a specific policy or intervention. On the other hand, the impact of a specific policy or intervention does not necessarily result in emission reduction but is essential to create a favorable environment or enabling conditions for businesses and individuals to take up mitigation activities. Because it is almost impossible to draw a line to determine the real emission reduction effect of an enabling policy or measure, if carbon credits become a basis for NAMA financing, double counting will almost inevitably become a problem that may later overshadow NAMAs. Moreover, by focusing only on measures for which it is easy to draw a line, many policies and measures that have profound long-term impacts and create extensive co-benefits may not be considered and implemented in developing countries, such as auditing, training, awareness raising and R&D programs.

The attribution of causes has always been difficult when determining the additionality of a CDM project and has proven to be questionable in most CDM projects (Schneider, 2007). This issue is especially prominent when CDM projects are developed in areas that have government policy support. NAMAs will run into more difficulties if emission reduction again becomes the only measurement of success and MRV is entirely based on one indicator. Trying to attribute the emission reduction of many

mitigation activities taken by thousands or millions of “long tail” entities to a specific NAMA intervention and associated MRV will pose exceptional difficulties to developing countries.

To avoid the above problems, and to properly account for the achievement of policy interventions and determine their financing, and at the same time avoid double counting, MRV for NAMAs should move beyond carbon credit accounting. Other indicators of success can be used to measure the success of NAMAs in a *quantitative* manner when selected *according to the desired outcomes each NAMA aims to achieve*. As discussed in Section 4, the indicators of success could be specific to each NAMA and each sector and can be used for their MRV. To enable comparison across countries using a common base, the indicators of a specific NAMA should be determined at the UNFCCC level.

The MRV methodologies need to be conducive to measuring the success of the NAMA implementation, technology assistance and capacity building programs. The MRV methodologies for each type of NAMA *programs* could be established following the bottom-up and semi-top down process similar to development of CDM methodologies. The methodologies could therefore be commonly adopted by all developing countries.

How a non-carbon crediting based NAMA mechanism could work, how to avoid

double counting with project-based financing mechanisms, as well as the type of indicators, MRV methods, and a possible mechanism to determine the level of financing will be illustrated later in this paper using the building sector as an example.

3.5 NAMA Financing

The proposed NAMA framework is, by design, public-sector efforts to stimulate and facilitate mitigation actions from the private sector. It is essential that a majority of financing sources, at least initially, come from the public sector. The source of international funding to support developing countries' NAMA activities will also be best served by the public sector or, as proposed by some developing countries, from a percentage of the GDP of developed countries. Depending on a country's public sector financial conditions, partial funding from internal sources will be encouraged or required in fast developing countries. However, for least developed countries, NAMA activities may critically rely on international financing.

In essence, the public sector funding mechanism proposed for NAMAs will create a strong enabling environment to stimulate private sector investment through CDM or the future improved market-based mechanisms in developing countries. The new mechanism will be discussed in detail using the building sector as an example. This

mechanism can also fulfill the goals of many developed countries' to leverage public financing for private sector investment.

Since the launch of UNFCCC, developed countries have been financing and assisting enabling programs for mitigation activities in developing countries, either directly through Foreign Development Assistance programs or indirectly through international financing and development agencies. In the climate change area, these programs mainly focus on building capacity for mitigation activities and facilitation of technology deployment. In part, the purposes of these programs are in line with that of the proposed NAMA program. However, uneven distribution of resources and, sometimes overlapping efforts, are often the center of criticism for these donor programs. The existing financing sources in this area could be pooled to support NAMAs. With the implementation of the NAMA scheme, the funding will be distributed based on needs of developing countries or regions in a systematic manner. Moreover, the extensive experience accumulated from these programs could be utilized for more effective design and implementation of NAMA programs. Through the need-based NAMA mechanism, developing countries' common but differentiated responsibilities for mitigation are supported in a common but differentiated manner.

3.6 Supporting Successful Implementation of the CDM

The CDM has been successful in attracting private sector investment (internally and internationally) and to aggregate small emission reduction activities in projects or programs using a bottom up approach in developing countries. However, the mechanism is insufficient to spur scale-up actions in a systematic way, especially in sectors with dispersed characteristics and in countries that are lacking policy support from the public sector. Some Post-2012 proposals under discussion call for top-down sectoral crediting mechanisms and concentrating CDM to finance programs in the least developed countries. This approach undermines CDM's ability to mobilize private sector investment from the bottom-up, including small-scale activities, when there is presence of government support. Successful examples of government's enabling policies and support which create a strong systematic uptake of CDM projects can be seen in wind energy and small hydro projects in China.

With the stimulation of new NAMA mechanisms to create enabling conditions in sectors and countries that are lacking policy intervention, developing countries could continue to build on CDM's success to mobilize private sector investment. *Eventually, CDM or an improved project/program-based market mechanism could graduate from an off-setting mechanism and become a basis for a more efficient and effective*

developing country carbon market mechanism. With the support of NAMAs, the CDM, or an improved project/program-based market mechanism, has a strong potential to spur bottom-up private sector activities in a systematic manner that will effectively boost mitigation actions in underdeveloped areas (e.g., end-use sectors, transportation, agriculture) and in underdeveloped regions (e.g., least developed countries). This is a fundamental way to change the regional and sectoral imbalances of the CDM and future project/program based mechanisms.

4. USING NAMAS IN THE BUILDING SECTOR AS AN EXAMPLE

This section uses the building sector as an example to demonstrate how the NAMA framework described in the previous section may be feasible in the Post-2012 regime. Certainly, many details need to be determined at the UNFCCC level; however, the principles and the framework designs are laid out here to demonstrate how such a mechanism may work and how it may interface with the existing climate change mechanisms for mitigation in developing countries.

4.1 NAMA Registry

NAMA registry in the building sector may include a policy package and various supplementary programs that are essential for the implementation of the policies. The

following are suggested policies or government measures for consideration of NAMA registry which could also be considered at the UNFCCC level for building sector

NAMA registration:

- a. Mandatory minimum energy performance based standards.
- b. Mandatory or voluntary building rating, labelling and certification programs.
- c. Loans, subsidies, incentives and tax breaks.
- d. Building auditing programs for compliance and certification.
- e. Mandatory building inventory, survey and monitoring programs, including baseline energy performance by typology and climate region for MRV purposes.
- f. Minimum energy performance standards for appliances and equipment.
- g. Building professional (including auditors) certification and education programs.
- h. Technology need assessment, demonstration and model house programs.
- i. Public sector building improvement and high performance building deployment programs.
- j. Research and development programs for new building materials, technologies, and practices.
- k. Awareness raising and informational campaign programs.

The policy package could be registered under the NAMA registry as building sector NAMAs. Some essential items are “required” in the policy package in order to receive financial support by international funding, such as mandatory minimum energy performance standards, building certification, labelling and rating, and loan and subsidy programs. These policies are essential to transform the market of the building sector and need to be adopted as part of a building sector NAMA package. Countries could design their own capacity building and technology related programs that are necessary to implement the registered NAMAs. Depending on needs, some countries could receive funding to start loan and subsidy programs. Such financial assistance could also be a NAMA “program” under the registered building sector NAMA.

Implementation of minimum energy performance standards for buildings is an integral part of the NAMAs package. However, where to set the minimum energy performance standard largely depends on the current technical capacity and socio-economic conditions of the country. The standards could be set at an achievable level to start and should be tightened in stages to strengthen emission reduction efforts when the compliance rate reaches a satisfactory level. To determine appropriate levels of minimum energy performance standards and the step-wise regulatory goals for

various building types and climate zones, a comprehensive building survey and benchmarking program needs to be carried out to derive a clear picture of the current state of the building sector. The establishment of baselines is the ground work for MRV and for determination of future levels of standards. Moreover, consistent measurement and reporting using universally applicable common metrics and protocol for buildings is key to the foundation of data collection and MRV in developing countries.

4.2 Capacity Building, Technology Assistance, and Financing

For effective implementation, once minimum energy performance standards are adopted under a building sector NAMA, supplementary capacity building, technology assistance and financing programs that are included in the package need to be supported and financed under NAMAs. Because of the dispersed nature of the building sector, the costs for capacity building and technology assistance are expected to be high and require support in developing countries.

Some developing countries are capable of paying partial costs for implementation of the policy package; others will depend on the international community to help finance for the transition of their building sector. The proportion of national funding could be

negotiated at the UNFCCC level as part of NAMA registry and the proportion could be adjusted over time based on the financial capacity of the public sector.

4.3 Interfacing with Kyoto Protocol's Project-Based Mechanisms

The proposed NAMA mechanism focusing on implementation of mandatory minimum energy performance standards could interface well with current CDM and JI and maintain their principles for eligibility of carbon credits. The UNEP's report on CDM and buildings (Cheng, et al., 2008) suggested that using overall building performance as a main measurement of success, and establishing performance-based common baselines as crediting benchmarks, could substantially reduce the burden of project developers and effectively scale up CDM project activities in the building sector.

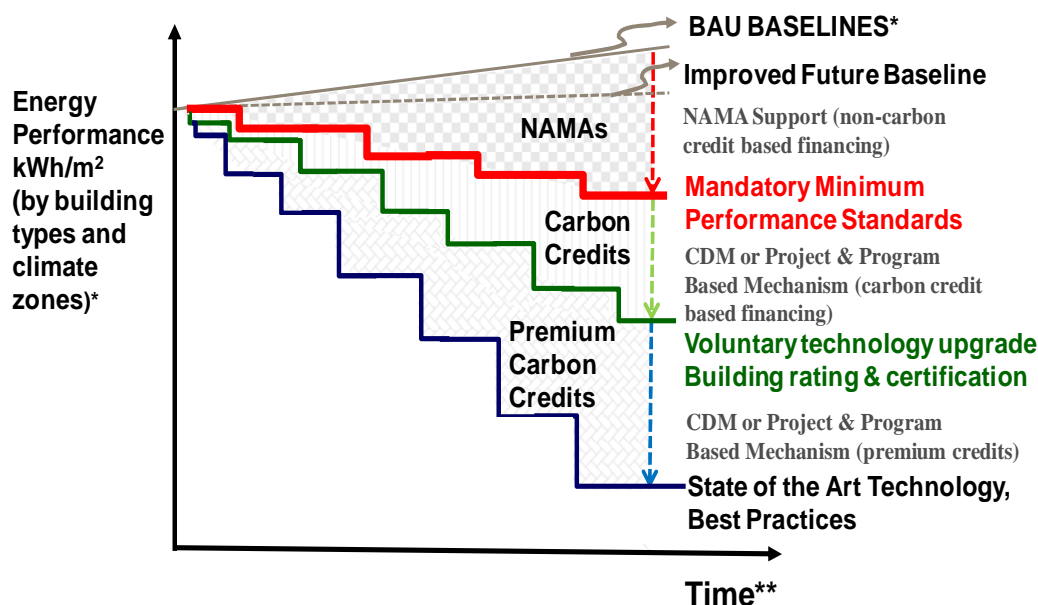
Previous sections of this paper highlighted that implementation of minimum energy performance standards is an effective regulatory tool to systematically phase out low performance buildings and gradually improve the energy performance of the entire building stock. Such a performance based approach for policies and carbon crediting enables NAMAs to interface with project based carbon crediting mechanisms, such as CDM, programmatic CDM, and JI in the building sector.

The performance based building sector model presented in Fig. 3 includes minimum

energy performance based standards and several benchmarks (crediting baselines) as a basis for carbon crediting (see Fig. 3). *Implementation of minimum energy performance standards* makes it possible to interface between non-carbon crediting based NAMAs financing and carbon credit based CDM-type (project and program based) financing (see Fig. 3). As illustrated in Fig. 3, this approach also, by design, eliminates double counting because NAMAs and the CDM will be financed through different mechanisms and by separate MRV logics and bases. However, the minimum energy performance standards serve as a clear cut-off interface between the two mechanisms. In addition, implementation of minimum energy performance standards also gives a definite and clear policy baseline for carbon crediting and determination of additionality for CDM projects. The minimum energy performance standards could automatically become the benchmark for additionality and a baseline for carbon crediting (see Fig. 3).

In the new mechanism, buildings designed to go *beyond* the minimum energy performance standards supported by NAMA financing will be eligible to carbon financing. The additional energy saving of an EEB project, compared to the minimum energy performance standards as the baseline, could be translated into carbon emission reductions and apply for CDM financing in a Program of Activities (PoA) or as a

stand-alone project. This model also aligns well with CDM's additionality principle for policy compliance projects. The higher performance benchmarks could be integrated with benchmarks for building rating, labelling, and certification programs (see Fig. 3). In addition, premium carbon credits are awarded above a certain benchmark to reward entities who are taking further steps to achieve state-of-the-art technologies, such as zero-energy buildings, zero-emission buildings and passive houses, etc., where mitigation and transaction costs are often much higher in developing countries.



Note: * Several baselines and benchmarks may be established for use in building subsectors. The baselines and benchmarks could be determined by building end-use types, climate zones and energy types, etc.

** Minimum energy performance standards and crediting benchmarks are tightened over time and could be negotiation based or voluntarily determined by countries, or a combination of the two.

Fig. 3. Proposed energy performance based model showing the interfacing of non-carbon credit based NAMAs financing and carbon credit based financing for the building sector

Several subsector baselines, minimum energy performance standards and other benchmarks need to be established to represent different subsector conditions, such as commercial, residential buildings, rural and urban households, apartment and single family housing, and different climate zones. All benchmarks could be tightened over time to reflect energy performance improvements in building stock and strengthened commitment (as seen in Fig. 3, all benchmarks decline in stages). The levels of standards and crediting benchmarks for each country could be negotiated at the UNFCCC level, to find a balance between country's ambition for taking responsibility and overall global goals for emission reduction.

In the new financing model, maintaining CDM's current project-and-program-based crediting mechanism is crucial for engaging the private sector's actions in dispersed energy end-use sectors. Recent CDM reform discussions have partly concentrated on changing CDM into a sectoral crediting mechanism and financing sectoral CDM activities through governments' coordination. However, in the author's opinion, the CDM's project/program based mechanism is more effective when used to *leverage private sector funding* and to *motivate private sector emission reduction activities* in an MRVable fashion in developing countries. . UNEP's report on the CDM and buildings

(Cheng, et al, 2008) also concluded that project/program based CDM is an effective mechanism to support government policies and coordinate dispersed end-use activities from the bottom up, with the presence of effective policy intervention. Retaining a project/program based crediting mechanism is especially important in a fragmented sector and in sectors with scattered small emission reduction activities, as well as in countries where most economic activities are long-tail types.

4.4 MRV and Financing for Building Sector NAMAs

Indicators for MRV in the building sector NAMAs should be able to demonstrate the outcome of specific changes or improvements made in the *building sector and the effects of various enabling programs*. The indicators should be reported on a regular basis and could be used as a common denominator to evaluate the success of the NAMA programs. Examples of global indicators and common metrics³ that could be used to measure NAMA program success may include:

- a. Representative/average energy performance of buildings by pre-defined categories (according to building types and climate zones) and their estimated number/floor area (this shows the status quo of the building stock).
- b. Percentage of new buildings built according to minimum energy performance

standards.

- c. Percentage of existing building retrofitted according to minimum energy performance standards for building retrofitting.
- d. Percentage (number) of buildings audited, certified or rated according to predetermined benchmarks.
- e. Number (percentage) of state of the art buildings constructed (e.g., zero emission buildings and passive buildings).
- f. Total amount of loans, subsidies, or tax breaks issued.
- g. Number of auditors on job, number of new auditors trained.
- h. Number of building professionals and percentage trained and on job.

Global indicators to present the status and changes of the building sector, as listed above, could be determined at the NAMA building sector registry level. The data collection and reporting preferably follow a bottom-up process or a semi-bottom-up process using sampling and statistical principles. Methodologies for data collection, measurement, and reporting for the global indicators should be established at the UNFCCC level. Methodologies for their verification should also be established.

The methodologies for building sector NAMA programs could be established

following a process similar to CDM methodologies but approved at the UNFCCC level.

The implementation approaches, activities, and MRV methods should be included. The

global indicators should be used as measurements of success whenever possible.

Additional indicators could also be defined and included based on the purpose of the

programs and should be established at the program methodology level. Building

performance related indicators, such as item a, b, c, d, e above, should always be used

for MRV in programs.

Financing for a particular NAMA option (i.e., building sector NAMAs) could be

awarded at the sectoral level or at the individual program level. Differentiating

mechanisms could also be established to enable financing at both levels. Financing at

the sectoral level could be used to support overall sectoral activities and up-front

financing needs to implement NAMA package and programs. The MRVs and financing

could be based on overall improvement of sectoral conditions and indicators that are

difficult to attribute to individual NAMA programs. Financing at the program level

could fulfill the specific financing needs of individual NAMA programs. The MRVs

and financing could be based on both sectoral improvements and improvements of

indicators specific to the program.

It is also important that NAMA registry and programs are designed with a long-term perspective, plans and goals. However, they could be implemented in stages to evaluate the results of implementation and adjust the approaches. NAMA financing therefore should be designed to include both start-up financing and periodic financing. Up-front financing is essential to support NAMA programs in the design and start-up stage⁴.

The periodic financing would be received after program implementation and is based on the improvement of indicators. The implementation results of the earlier stage could be used as criteria to determine the financing of the next stage.

5. SUMMARY AND CONCLUSION

Implementation of NAMAs is regarded by developing countries as a powerful solution for climate change mitigation beyond what has been achieved under the Kyoto Protocol. To undertake their common but differentiated responsibility for global emission reduction, developing countries need to significantly reduce emissions below their business-as-usual level with assistance from developed countries. It is also important for developing countries to utilize critical financial resources from developed countries to spur mitigation actions in sectors which will create the strongest impact and need the most capacity building and technology assistance. A properly designed new NAMA mechanism could provide an enabling policy framework and necessary assistance and,

therefore, systematically foster and strengthen private sector GHG mitigation actions in sectors and countries lagging behind in the Kyoto Protocol regime.

Three immediate issues surrounding the NAMA discussions need to be solved before it is inserted as a new supporting and funding mechanism for emission reductions in developing countries. The issues include 1) taking into account elements of the BAP, 2) avoiding double counting, interfacing with Kyoto Protocol mechanisms and 3) leveraging sufficient private funding from public sector investment. The NAMA framework proposed in this paper offers feasible solutions to all these issues and provides a comprehensive mechanism to create enabling regulatory environments for GHG mitigation in developing countries.

The benefits of the proposed developing country need-based NAMA framework include:

- a. Because carbon credits are not the measurement of success, it avoids the double counting problem associated with existing mechanisms. This eases some of the concerns leveled towards current proposals that are on the table.
- b. For developed countries, the NAMA framework goes beyond offsetting mechanisms and focuses on supporting enabling environment for mitigation

actions in developing countries.

- c. A MRV mechanism is embedded. Indicators are defined to *measure desirable changes in the sector or, for non-sectoral NAMAs, to a specific NAMA measure.*

All activities or programs under the NAMA registry are “MRVable” and supported by international financing mechanisms under NAMAs. This approach could fulfill developed countries’ expectation for MRV and ease the concerns of developing countries about adopting NAMA options that are difficult to measure by emission reduction credits.

- d. Addresses all essential elements in the BAP 1b(ii) and include mechanisms to support activities for capacity building, technology, financing and MRV.
- e. Includes sectoral NAMA options to create enabling environments in sectors with dispersed GHG mitigation potentials.
- f. Integrates funding from developed countries for development aids for capacity building and technology transfer in the climate change sector and implements changes in a more systematic manner.
- g. Utilizes public policy and funding to foster and mobilize private sector investment through the CDM and the future project/program based mechanism for GHG mitigation.
- h. Changes the regional distribution of the CDM or, more specifically, facilitates

private sector investment for mitigation actions in least developed countries.

This is accomplished through establishment of an enabling policy framework

based on a country's needs, with support from international funding.

The new NAMA mechanism proposed in this paper can fill critical gaps in the project-based carbon financing mechanisms under the Kyoto Protocol and, at the same time, support their implementation through fostering private sector investment for GHG mitigation. Using this approach, new and existing developing country supporting mechanisms can be implemented jointly to more effectively realize the significant low-cost emission reductions opportunities that are available from the dispersed energy end-use sectors in developing countries. Establishment of such comprehensive developing country supporting mechanisms is an important step to achieve global climate change mitigation goals and support sustainable development in developing countries in the Post-2012 regime.

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¹ COP 15 did not result in a univocal agreement among UNFCCC Parties. The Parties agreed to take note of the Copenhagen Accord and later, through national communication with UNFCCC, to express an individual country's support to the Accord. As of March 30, 2010, 114 countries have officially stated their support to the Accord and 35 developing countries, including China, Brazil, India and South Africa, have submitted Annex II to state their NAMA needs or commitment as agreed in the Accord (UNFCCC, 2010).

² Technology transfer and technology assistance are sometimes used interchangeably in this paper. It includes technological assistance for research, development, adoption, and dissemination of climate friendly technologies, whether the technology is developed locally or abroad.

³ UNEP-SBCI is working on a set of global common metrics for building monitoring and reporting to facilitate policy development and analysis, carbon trading, and progress reporting on mitigation actions in the building sector. The published index and methodology may be used as a prototype to develop MRV for NAMAs.

⁴ Current CDM does not include an up-front financing mechanism and has been a significant hurdle for project developers who have limited access to initial financing to start capital intensive CDM projects.