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Current Developments in Pilot Nationally Appropriate Mitigation Actions of Developing Countries (NAMAs)

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Summary

To achieve the global emission reductions that are necessary to reach the 2°C target, increased efforts are necessary not only in developed countries but also in developing countries. Expectations are high that the newly evolving mechanism of Nationally Appropriate Mitigation Actions (NAMAs) will enable large-scale emission reductions in developing countries. Even though modalities and procedures for NAMAs are still evolving, a number of developing countries and consultants are developing concrete actions and policies with the aim of gaining financial, technological and capacity-building support from industrialised countries. This paper analyses current developments in 16 pilot NAMAs. The two main questions are: how far developed are the NAMAs in question and will NAMAs fulfil the expectations of reducing emissions in developing countries on a large scale?

The 16 NAMAs analysed showcase that we are still in a very early stage of development of this new policy instrument. They are quite different with respect to their level of elaboration – from mere sketches to full-grown studies. Nevertheless, most of the NAMAs in fact do aim at a fundamental transformation of the sector(s) they address. This opens up the possibility to develop North-South cooperation at a strategic political level. Furthermore, the limited geographical concentration of the CDM is not replicated in the 16 NAMAs analysed: five are located in Peru, four in South Africa, two in Tunisia and one each in Indonesia, Lao PDR, Mexico, Serbia and Thailand. These countries account for 2% of all CERs issued so far. The imbalance in the CDM's sectoral distribution is also not replicated in the NAMA pipeline so far: of the NAMAs analysed, three are in the transport and two in the building sector. The other NAMAs cover energy (4), the waste sector (3), industry (1) and forestry (1). The Indonesian and Serbian NAMAs include a broad range of sectors.

The information in the proposals on expected GHG emission reductions, costs, barriers, risks, sustainability benefits as well as on MRVing are not detailed enough to allow for an assessment whether to fund or not to fund such a NAMA yet. However, one has to note that this was not the intention of all of the analysed proposals. Many are rather sketches aiming to launch a political process. Nevertheless, it will be necessary to agree on common templates for NAMAs in order to allow for international MRV of NAMAs that seek international support, which are the NAMAs in the focus of this paper.

Beyond specific technical questions, setting up the MRV framework is a highly political process: how to MRV is a function of what purpose MRV is to achieve. International donors for NAMAs demand quantified emission reductions as a key indicator to be MRVed. However, the possibilities for MRVing emission reductions strongly depend on which sector is addressed; it bears noting that the limited success of the CDM in areas such as transport and end-

use energy efficiency is not least due to the methodological complexities. In practice, a mix of emission-based and non-emission based indicators will probably be the best way forward for the success of NAMAs.

This mix will need to strike a balance between practicability and the need for reporting on GHG emission reductions as well as on other benefits, such as the contribution to sustainable development, the context in which, according to the Bali Action Plan, NAMAs are to take place.

Deutsche Zusammenfassung

Das Ziel, die globale Erwärmung auf unter 2 Grad zu begrenzen, bedarf erhöhter Anstrengungen – nicht nur in den Industrieländern, sondern auch in Entwicklungsländern. Es gibt hohe Erwartungen, dass das neue Klimaschutzinstrument der Nationally Appropriate Mitigation Actions (NAMAs) – also national angepasster Aktivitäten zur Reduzierung von Treibhausgasemissionen – zu weitreichenden Reduktionsbemühungen in Entwicklungsländern führen könnte. Die Verfahren und Rahmenbedingungen für NAMAs befinden sich noch in einer frühen Entwicklungsphase. Dennoch gibt es bereits erste Aktivitäten einzelner Länder und Consultants, hierzu konkrete Aktivitäten und Politiken zu entwickeln, mit dem Ziel hierfür internationale Unterstützung einzuwerben.

Dieses Papier untersucht die aktuellen Entwicklungen anhand von 16 ausgewählten Pilot-NAMAs. Die Leitfragen unserer Analyse sind dabei: Wie weit sind die bisherigen NAMA-Vorschläge bereits entwickelt? Und können NAMAs den Erwartungen gerecht werden, zu erheblichen Emissionsreduktionen in Entwicklungsländern beizutragen?

Die 16 untersuchten NAMAs zeigen deutlich, dass wir uns noch in einer sehr frühen Entwicklungsphase dieses neuen politischen Instruments befinden. Sie sind sehr unterschiedlich, was die Detailtiefe ihrer Ausarbeitung angeht – sie reichen von ersten Skizzen bis zu umfassenden Studien. Dennoch ist bereits erkennbar, dass die meisten NAMAs auf eine grundlegende Transformation des jeweiligen Sektors abzielen. Dies eröffnet neue Möglichkeiten einer strategischen Kooperation zwischen Industrie- und Entwicklungsländern. Außerdem zeigt sich eine breite geographische Verteilung, die die Konzentration des CDM auf wenige Länder aufzubrechen scheint: Fünf NAMAs wurden für Peru vorgeschlagen, vier für Südafrika, zwei in Tunesien und je eines in Laos, Mexico, Serbien und Thailand. Zum Vergleich: Auf diese Länder entfallen nur 2% der bisher ausgestellten CERs. Auch die starke sektorale Eingrenzung, wie sie bisher im CDM zu beobachten war, wiederholt sich bei den NAMAs nicht: Drei der analysierten NAMAs sind im Verkehrsbereich angesiedelt, zwei im Gebäudebereich. Die anderen NAMAs schlagen Aktivitäten in den Bereichen Energie (4), Abfall (3), Industrie (1) und Forstwirtschaft (1) vor. Die NAMAs in Indonesien und Serbien umfassen eine Vielzahl von Sektoren.

Die bisherigen Informationen über Treibhausgasemissionen, Barrieren, Risiken, Nachhaltigkeitsnutzen und MRV sind noch nicht detailliert genug, um bewerten zu können, ob das jeweilige NAMA förderungswürdig ist oder nicht. Dies war jedoch auch noch gar nicht die Intention der meisten der bisherigen Vorschläge: Viele sind lediglich Skizzen, deren Ziel es ist, entsprechende nationale politische Prozesse auszulösen. Dennoch kann man jetzt bereits festhalten, dass es dringend notwendig ist, möglichst schnell ein gemeinsames Format zu entwickeln, das festlegt, welche Informationen NAMA-Vorschläge beinhalten sollen, um eine mögliche internationale Förderung prüfen zu können.

Jenseits spezifischer technischer Fragen ist die Ausgestaltung des MRV, also der Messung, Berichterstattung und Verifizierung gesetzter Ziele, ein hoch politischer Prozess: Letztlich wird hierüber die Ausrichtung des Instruments NAMA insgesamt definiert. Die Quantifizierung von Emissionsreduktionen stellt für internationale Förderer einen Schlüsselindikator dar. Die Möglichkeiten, tatsächliche Reduktionen nachvollziehbar zu messen, sind jedoch von Sektor zu Sektor sehr unterschiedlich. Der begrenzte Erfolg des CDM im Gebäude- und Verkehrsbereich ist gerade eben auch auf die methodische Komplexität in diesen Sektoren zurückzuführen.

Daher sollten zur Erfolgsmessung von NAMAs auch andere Indikatoren jenseits der Treibhausgasemissionen gewählt werden. Dabei muss eine Balance gefunden werden, die einerseits den Aufwand für das MRV im Rahmen hält und andererseits auch die Berücksichtigung der nachhaltigen Entwicklung der jeweiligen Länder ermöglicht, wie es im Bali-Aktionsplan vorgesehen ist.

Contents

1 Introduction

Further action is needed that goes far beyond what has been agreed so far under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol to “prevent dangerous anthropogenic interference with the climate system”, the ultimate objective of the UNFCCC. The most ambitious scenarios so far assessed by the IPCC, which gives a 50% chance of stabilising temperature increase below 2°C, considers a peak of global CO_2 emissions in the timeframe 2000-2015, followed by a reduction of 50-85% by 2050 (IPCC 2007). To achieve these global emission reductions, increased efforts are not only necessary in Annex I (developed) countries but also in non-Annex I (developing) countries.

Expectations are high that the newly evolving mechanism of Nationally Appropriate Mitigation Actions (NAMAs) will enable large scale emission reductions in non-Annex I countries. According to the Bali Action Plan (BAP), the current negotiations on the future climate regime include consideration of “nationally appropriate mitigation actions 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 manner.“ The BAP hence maintains the fundamental balance between Annex I and non-Annex I efforts that was struck in the Convention. Art. 3.1 of the Convention stipulates that climate protection is to be based on the principle of common but differentiated responsibilities and respective capabilities and that accordingly industrialised countries should take the lead in combating climate change. While the Convention also calls on non-Annex I countries to take mitigation actions, Art. 4 requires industrialised countries to financially and technologically support developing countries to enable them to implement the Convention and clarifies that “The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of developing country Parties.”

Even though modalities and procedures for NAMAs are still evolving, many developing countries have already pledged NAMAs under the Cancún Agreements. These are often at the level of aggregate targets and often do not include much detail. Also, it is usually not clear which part of these actions countries intend to pursue from their own resources and where they require support from industrialised countries. In addition, however, a number of non-Annex I countries and consultants is developing concrete actions and policies with the aim of gaining financial, technological and capacity-building support from industrialised countries.

This paper analyses current developments in 16 pilot NAMAs. To limit the scope to an adequate level and as modalities and procedures for supported NAMAs are going to be substantially more stringent than those for unilateral NAMAs, only NAMAs aiming at international support were considered in this paper. Furthermore, only NAMAs where governments are involved in the NAMA development process were selected as these are deemed to be the ones that are most likely to come to fruition instead of staying mere academic exercises.

There are two guiding questions underlying our analysis:

1. Will NAMAs fulfil expectations of reducing emissions in developing countries on a large scale?

2. How far developed are the NAMAs in question?

The paper first looks at the evolving definition of what a NAMA is. Second, to approach the first of the above questions, we look at the geographical and sectoral distribution of the 16 NAMAs as compared to the Clean Development Mechanism (CDM) as well as at their scope and GHG emission reduction potential. For the second question, we analyse the NAMAs with respect to the current status of elements we consider essential for their successful implementation. These elements include GHG calculations, measuring, reporting and verification (MRV), cost calculations, barrier and risk assessments, sustainability benefits and financing structures. Each topic is treated in a different chapter and is introduced by a short theoretical overview of the subject. Extensive background information on the 16 NAMAs analysed is provided in the annex of this paper.

The starting point for the research for this paper was a survey of the NAMAs that were presented at the 16th Session of the Conference of the Parties (COP 16) in Cancún. Additional information was gathered via internet research as well as e-mail and telephone enquiries to research institutes, consultants and official government bodies. Unfortunately, however, not all of the enquiries were successful. Furthermore, as most NAMAs are still in an early stage of development, in many cases only limited information is publicly available. Thus, it is important to stress that the analyses on pilot NAMAs in this paper are preliminary and only interpret the current status of the NAMAs derived from the information available. Statements in this paper on the need for further elaborations on elements of specific NAMAs are therefore not meant as criticism of these NAMAs but are rather made to provide an overview of the work that will have to be done (and is being done at the moment) before the NAMAs analysed may be implemented. Judging the NAMAs will have to wait until final proposals are made. Nevertheless, this paper may provide important insights on the newly evolving mechanism. It aims at providing an overview of current developments in pilot NAMAs.

2 Defining NAMAs

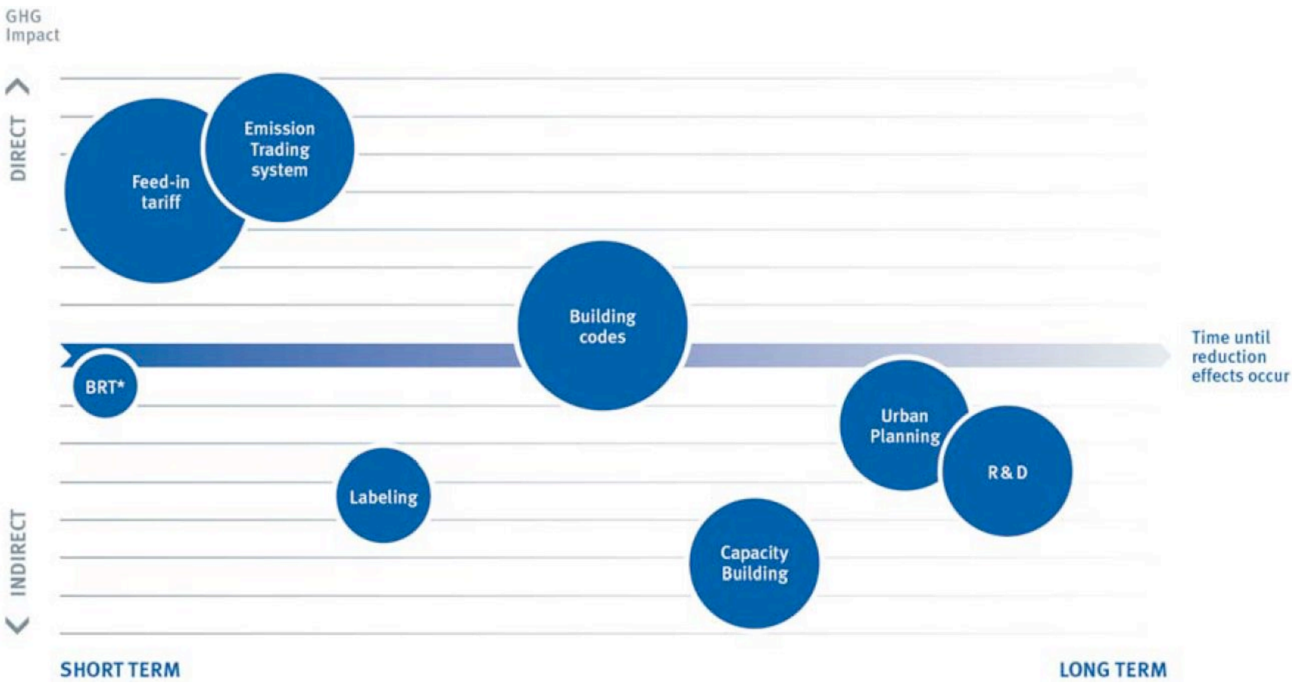
Neither the Bali Action Plan nor the subsequent negotiations have so far provided a specific definition of NAMAs. The provisions in the BAP can be broken down into the following elements:

- Developing countries are to undertake mitigation actions.
- These are to be nationally appropriate, i.e. tailored to countries' national circumstances and in line with the Convention's principle of common but differentiated responsibilities.
- They are to take place in the context of sustainable development, meaning they are to be embedded in the countries' broader sustainable development strategies.
- They are to be measurable, reportable and verifiable.
- They are to be supported by developed countries in an equally measurable, reportable and verifiable manner.

At the moment it seems that NAMAs are likely to be defined as any kind of activity that reduces greenhouse gas (GHG) emissions. This opens up vast possibilities for NAMAs. NAMAs can be defined in a narrow sense and consist of specific actions (e.g. similar to a CDM project) or in a broader sense referring to superordinate policies or aggregated targets such as emission targets. Furthermore, NAMAs may include a combination of specific actions plus an aggregated emission target that is supposed to be achieved with these actions. NAMAs can have a nation-wide approach (such as an energy tax or a comprehensive action plan) or be restricted to a specific region (e.g. one municipality or even just one local project) or (sub-)sector. Also, (sub-)sectors may be targeted by several NAMAs. NAMAs may be designed to relate to various sectors, too (Jung et al. 2010).

While emission targets may be emission neutrality targets, emission intensity targets or emission targets relative to a business as usual (BAU) scenario, specific actions and targets can consist of only one measure, a set of measures of a more holistic action plan or the development and/or implementation of a holistic action plan itself. Measures, again, may be developed especially for NAMAs, supplement or enhance existing measures and actions. NAMAs may comprise direct actions such as research activities, pilot projects and the definition and/or implementation of strategies or regulations as well as the support of emission reducing activities via financial incentives or capacity and institution building and awareness raising. While some types of action such as feed-in tariffs and emission trading systems have a direct, short term effect on GHG emissions, others such as capacity building and research activities take some time until they result in emission reductions and are rather indirect (see Figure 1; the size of the bubble indicates the NAMAs' emission reduction potential) (Jung et al. 2010; Sterk 2010).

Figure 1: Indirect vs. Direct GHG Impact of NAMAs Over Time



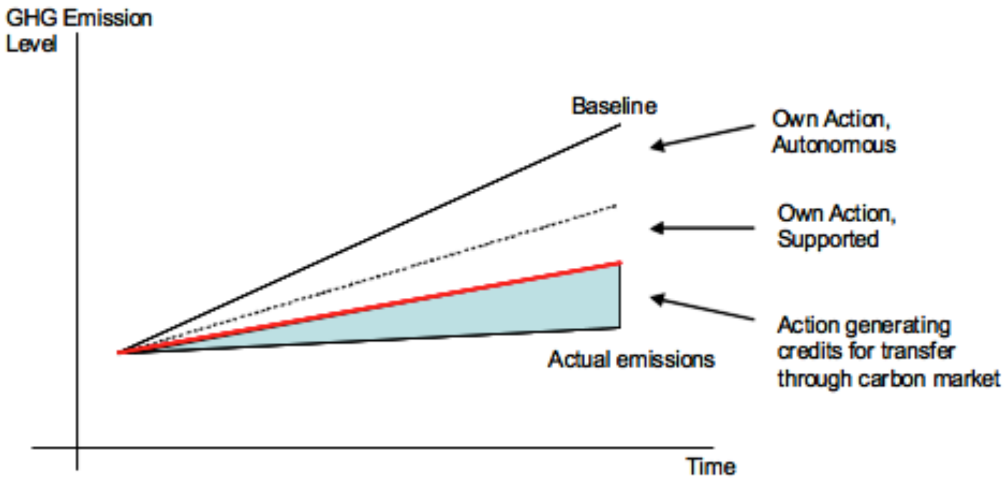
Source: Jung et al. 2010.

As a lot of activities are interconnected, emission reductions and other effects may not be attributed clearly to a specific one of them. Some activities may even have opposing effects. Thus, comprehensive NAMAs may have advantages over individual measures regarding their effectiveness and MRVability (Jung et al. 2010).

In addition to different types of NAMAs there is a discussion about different "layers" of NAMAs. Several countries including the EU have proposed to distinguish three layers of NAMAs:

- Unilateral NAMAs, i.e. actions implemented unilaterally by a country from its own resources;
- Supported NAMAs, i.e. additional actions enabled and supported by technology, financing and capacity building;
- Credited NAMAs, i.e. further actions supported through the carbon market.

Figure 2: EU View of Future Developing Country Emissions



Source: European Commission 2009.

As noted above, in this paper only NAMAs aiming at international support were considered (credited and supported NAMAs). It bears noting, however, that this "layers" concept has so far not been universally accepted. While many developing countries have taken up this approach, many others, including large ones such as Brazil, China and South Africa, have so far been rather sceptical towards this concept of layers. South Africa has for example staked out the position that all NAMAs should be supported internationally, be it directly or through the carbon market.

3 Geographical and Sectoral Distribution of Analysed NAMAs in Comparison to the CDM

The CDM is frequently criticised for the imbalance in the geographical distribution of project activities and generated Certified Emission Reductions (CERs). As of June 2011, 57% of all CERs issued under the CDM resulted from project activities in China. India, the Republic of Korea and Brazil account for another 35% of CERs issued so far. Only 2% of all registered CDM projects are located in Africa (Website UNFCCC 2011a). Hopes are high that a new instrument will support the reduction of emissions in geographical areas that have so far not been able to benefit from the CDM. The CDM is a market-based instrument driven by private companies which naturally concentrate on countries where the framework conditions are the most promising. In contrast, national governments are to take the initiative with NAMAs. Therefore, NAMAs will hopefully provide opportunities for countries the carbon market has neglected so far.

At least in the analysed NAMAs, the CDM's geographical concentration was in fact not replicated. Of the sixteen NAMAs, five are located in Peru, four in South Africa, two in Tunisia and one each in Indonesia, Lao PDR, Mexico, Serbia and Thailand. These countries account for only 2% of all CERs issued so far. Of the eight countries the analysed NAMAs are located in, three have so far mostly been neglected by CDM project developers: While there are only two CDM projects in Tunisia and only one in Lao PDR, so far no project has been registered in Serbia. The other countries in question have between 19 (South Africa) and 127 (Mexico) registered CDM projects (see Table 1).

Table 1: Number and Sector of Analysed NAMAs, Issued CERs and Registered CDM Projects in Host Countries of Analysed NAMAs

	No. of Analysed NAMAs	Sector of Analysed NAMAs	Issued CERs	Number of CDM Projects
Indonesia	1	Integrated multisectoral approach including forestry and peatland, agriculture, energy, industry, transportation and waste	2.597.902	68
Lao PDR	1	Transport	2.168	1
Mexico	1	Buildings	8.340.029	127
Peru	5	Transport, energy, industry, forestry, waste	609.611	24
Serbia	1	Integrated multisectoral approach including energy efficiency in residential buildings, public and commercial services, industry, transport and energy	0	0
South Africa	4	Energy (2), transport, buildings	1.900.276	19
Thailand	1	Waste	851.541	51
Tunisia	2	Energy, waste	0	2
Total	16		14.301.527	292
World			636.809.975	3.163

Source: Website UNFCCC (2011a).

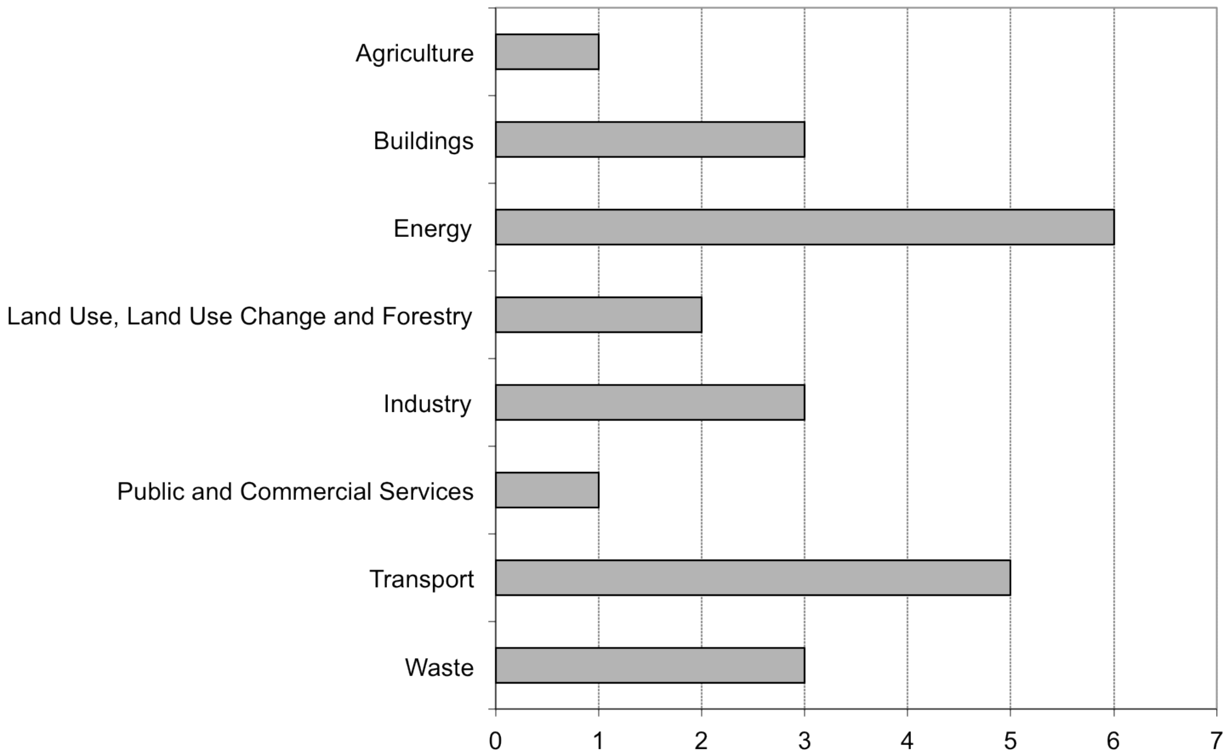
Also, the CDM has not been able to reach all sectors relevant for emission reductions. Especially the transport and building sector have hardly benefited from this mechanism: So far, only 0.22% of all registered project activities are linked to the transport sector and 1.58% to energy demand. The great majority of all CDM projects (88%) are related to energy industries (renewable/ non-renewable sources), another 18% to waste handling and disposal[1] (Website UNFCCC 2011b).

Even though the sample is too small to draw general conclusions on NAMAs, at a first glance, the imbalance in the CDM's sectoral distribution is not replicated in the NAMA pipeline so far: Of the NAMAs analysed, three are in the transport and two in the building sector. The other NAMAs cover energy (4), the waste sector (3), industry (1) and forestry (1). The Indonesian and Serbian NAMAs include several sectors. While the Indonesian NAMA comprises forestry and peatland, agriculture, energy, industry, transportation and waste,

[1] Projects may be linked to more than one sector.

the Serbian NAMA covers energy efficiency in sectors such as residential buildings, public and commercial services, industry, transport and energy (Figure 3).

Figure 3: Number of NAMAs Linked to Sector[2]



4 Status and Scope of Analysed NAMAs

The analysed NAMAs differ substantially in terms of format and level of sophistication. While some have already been extensively developed (one of them with documentation of over 100 pages), for others only relatively rough concept notes are publicly available so far. The later may serve the purpose of policy briefs very well, but leave many questions to be answered (see following chapters). A lot of work will have to be done (and is being done at the moment) before most of the NAMAs analysed are ready for implementation. Thus, it is important to stress that the analyses on pilot NAMAs in this paper are preliminary and only interpret the current status of the NAMAs derived from the information available. In this respect, the heterogeneous state of the NAMAs is a mirror of the general situation: The policy instrument of NAMAs is still at a very early stage of development.

Most of the NAMAs analysed in this paper focus on one sector and have a nation-wide approach. Only the NAMA in Lao PDR is restricted to just one municipality (Motoda 2010). The NAMAs range from feasibility studies, funding proposals and comprehensive action plans to investment plans and rather general lists of

[2] Some NAMAs are linked to more than one sector.

targets and measures. While most of the NAMAs are still in an early stage of development, some already include detailed measures and concrete actions. Parts of the Tunisian NAMA on energy production and exportation (Plan Solaire) have even been implemented already (MEDD 2010). The Mexican NAMA in the building sector builds on existing activities, too (Wehner et al. 2010).

While 12 out of the 16 NAMAs analysed in this paper define specific actions, three of the Peruvian NAMAs also include specific targets, such as that 5% of the vehicle fleet should be hybrid until 2012 (transport sector) and combined cycles in 60% of companies generating electricity from natural gas (energy sector) and a share of 50% of pozzolanic cement (industry sector). However, no specific actions are suggested to reach these targets (MINAM et al. 2010). The Indonesian NAMA has set an emission target relative to a BAU scenario and develops actions to realise it (Thamrin 2011).

The following section gives an overview of the 16 NAMAs analysed. The essence of the analysis regarding the NAMAs' type, scope, type of action, level of detail, status as well as institutions and partners involved is summarised in Table 2. Specifications regarding the NAMAs' emission reduction potentials, basis for GHG calculations, MRV, costs, financing, risks, barriers and sustainability benefits are discussed in the following chapters, where available. Extensive background information on the 16 NAMAs analysed is provided in the annex of this paper.

Table 2: Summary of Analysed NAMAs

	Type of NAMA	Scope	Type of Action	Level of Detail	Status	Responsible Institutions and Partners
Indonesia – RAN-GRK	Specific actions plus aggregated emission targets	National, various sectors	Integrated action plan for the period 2010-2020 aiming at serving as guidance on investment and designing programs and activities ranging from subsidies, policies and regulation improvement to capacity building and feasibility studies	Concrete, measureable and practical action plan including targets, indicators, locations, budget and sources	Submitted to be signed by the government; various issues (e.g. baseline determination, MRV, revising of mitigation actions) still need clarification	National Development Planning Agency (BAPPENAS), Indonesian Ministries (Environment, Forestry, Agriculture, Public Works, Industry, Transport, Energy, Finance)
Lao PDR – Urban Transport	Specific actions	Municipal, sectoral	Feasibility study including surveys of host country's practices, policies and strategies, data collection for emissions calculations, proposals for scenario analysis and MRV	Set of specific actions for the Urban Transport Master Plan for the capital city of Vientiane which aims at emission reductions via road network development, public transport development and traffic management and safety	Taskforce has been set up and feasibility study is now being performed	Lao Ministry of Public Works and Transport, Lao Water Resources and Environment Administration (WREA), Global Environment Centre Foundation (GEC), Ministry of the Environment Japan (MOEJ), Shimizu Corporation
Mexico – Energy Efficiency in Residential Buildings	Specific actions	National, sectoral	Enhancement of existing programmes which subsidize energy efficiency measures in low-income housing and provide credits for new houses that use sustainable and energy efficient technologies (larger scope, technology up-scaling, increased subsidies, more ambitious efficiency standards, capacity building, promotion and enforcement of building codes)	Very sophisticated integral plan including specific measures and activities as well as national policies; four different scenarios of NAMA activities	Draft working paper on NAMA design concept completed; some financial flows already exist, energy surveys have already been conducted; outreach to donors at COP 16	Mexican National Agency of Housing (CONAVI), Mexican Secretariat of the Environment and Natural Resources (SEMARNAT), German Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Point Carbon, Perspectives
Peru – Transport Sector	Specific actions and targets	National, sectoral	Identification of targets and focal points for incentives in second national communication	List of targets and focal points for incentives, some measures, no details on concrete actions	List complete, not initiated yet, to be developed further	Peruvian Ministries (Environment, Transport and Communications)

	Type of NAMA	Scope	Type of Action	Level of Detail	Status	Responsible Institutions and Partners
Peru – Energy Sector	Specific actions and targets	National, sectoral	Identification of targets and measures in second national communication	List of targets and measures, no details on concrete actions	List complete, not initiated yet, to be developed further	Peruvian Ministries (Environment, Energy and Mining)
Peru – Industry Sector	Specific actions and targets	National, sectoral	Identification of targets and measures in second national communication	List of targets and measures, no details on concrete actions	List complete, not initiated yet, to be developed further	Peruvian Ministries (Environment, Production)
Peru – Forestry and Land Use	Specific actions	National, sectoral	Identification of measures and concepts in second national communication	List of general measures and feasible concepts, no details on concrete actions	List complete, not initiated yet, to be developed further	Peruvian Ministries (Environment, Agriculture)
Peru – Waste Sector	Specific actions	National, sectoral	Identification of measures and concepts in second national communication	List of general measures and feasible concepts, no details on concrete actions	List complete, not initiated yet, to be developed further	Peruvian Ministry of Environment
Serbia – Energy Efficiency	Specific actions	National, various sectors	Project developing capacity on NAMAs, MRV and a set of MRVable measures by assessing financial needs and the time necessary for their realization	Large set of clearly defined mitigation measures including their duration and expected emission reductions for residential buildings, public and commercial services, industry, transport and energy; new standards and energy efficient management systems; Energy Efficiency Fund and energy efficiency and RES credit lines are being established	Under development	Serbian Ministries (Environment and Spatial Planning, Energy and Mining), Serbian Energy Efficiency Agency, Japan International Cooperation Agency (JICA)
South Africa – Energy Specifications New Low-Income Housing	Specific actions	National, sectoral	Financing proposal: incremental upfront capital for solar water heaters and thermal efficiency measures in a million of new-build low-income houses by 2020; money for maintenance	Detailed, concrete design for financing of proposed measures	Part of NAMA is in advanced design phase: National Sustainable Settlements Facility (centralised revolving fund)	South African Department of Environmental Affairs, Development Bank of Southern Africa, Energy Research Centre (ERC)
South Africa – CSP	Specific actions	National, sectoral	Investment plan for 5 GW of CSP up to 2020	Definition of concrete targets and required framework for investment; deployment schedule for the capacity to be installed	Study completed, further use to be determined	South African Departments (Environmental Affairs, Energy, Trade and Industry), Eskom, National Energy Regulator of South Africa, Energy Research Centre (ERC), independent power producers (CSP developers), trade unions, universities

	Type of NAMA	Scope	Type of Action	Level of Detail	Status	Responsible Institutions and Partners
South Africa – Wind Power	Specific actions	National, sectoral	Investment plan for 10 GW of wind power up to 2020	Definition of concrete targets and required framework for investment; deployment schedule for the capacity to be installed	Study completed, further use to be determined	South African Department of Environmental Affairs, independent power producers, Eskom, Energy Research Centre (ERC)
South Africa - Electric Vehicles	Specific actions	National, sectoral	Investment plan centering on the production and use of electric vehicles	Vague definition of targets and required framework	Study completed, further use to be determined	South African Departments (Environmental Affairs, Transport, Trade and Industry, Science and Technology), South African National Energy Research Institute (Saneri), Energy Research Centre (ERC)
Thailand – Waste and Wastewater Management	Specific actions	National, sectoral	Feasibility study including surveys of host country's practices, policies and strategies, data collection for emissions calculations, proposals for scenario analysis and MRV	Set of specific actions and targets: transfer of waste and wastewater management technologies (e.g. composting and incinerators for mega-cities)	Taskforce has been set up and feasibility study is now being performed	Global Environment Centre Foundation (GEC), Ministry of the Environment, Japan (MOEJ), Thailand Greenhouse Gas Management Organization (TGO), Bangkok Metropolitan Administration (BMA), Pacific Consultants Co., Ltd.
Tunisia – Plan Solaire	Specific actions	National, sectoral	Comprehensive plan to enhance energy generation from renewables and energy efficiency: specific projects to expand installed capacity of solar and wind power and enhance energy efficiency in transport and buildings; expansion of infrastructure to interconnect Tunisia and Italy; studies	Comprehensive set of projects with briefly described concrete actions, responsible institutions and timeframe	Preliminary proposal completed; parts of plan already financed and implemented; outreach to donors at COP16	Tunisian Ministry of the Environment and Sustainable Development, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Ecofys, bifa environmental institute
Tunisia – Biowaste Treatment	Specific actions	National, sectoral	Funding proposal for biowaste treatment of agricultural and market waste, residues from food production, food preparation, public parks and sewage sludge: plants, studies, concepts, awareness and capacity building, training, norming and standardisation	Set of components and specific actions for the treatment of waste streams and their subtypes including identification of responsible institutions and timeframe	Preliminary proposal completed; outreach to donors at COP16	Tunisian Ministry of the Environment and Sustainable Development, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Ecofys, bifa environmental institute

Description of Analysed NAMAs

Indonesia is developing a comprehensive National Action Plan For Reducing Greenhouse Gas Emissions (Rencana Nasional Penurunan Emisi Gas Rumah Kaca, RAN-GRK) for the years 2010 to 2020 under its NAMA programme (Thamrin 2011). RAN-GRK is being developed to define targets and indicators as well as concrete and practical mitigation actions for various sectors (forestry, peatland, agriculture, energy, industry, transportation, waste). From the information available it seems that Indonesia considers to choose from a great number of national as well as sectoral instruments and policies such as regulations, standards, taxes (or tax breaks for e.g. green technology), charges, informational instruments, subsidies and research and development assistance to achieve emission reductions. Capacity building, additional budget and potential participation in domestic or international carbon markets are suggested to incentivise local governments to contribute to the aims of RAN-GRK. As of March 2011, the RAN-GRK has been submitted to be signed by the government. However, various issues such as baseline determination, MRV and the revising of mitigation actions still need clarification (Thamrin 2010; Thamrin 2011).

Regarding the urban transport NAMA in **Lao PDR** and the waste and wastewater management NAMA in **Thailand,** the only information that was available to the authors are the ongoing feasibility studies by the MOEJ/GEC. The studies are set out to survey the host countries' practices, policies and strategies, acquire data for emissions calculations and propose options for scenario analyses and MRV. In Lao PDR, the feasibility study focuses on the capital city of Vientiane, where it determines concrete activities suitable for the Urban Transport Master Plan that aims at emission reductions via road network development, public transport development and traffic management and safety. Moreover, future traffic volumes are estimated using model simulations. In Thailand, Japanese waste and wastewater management technologies are being transferred such as composting and incinerators for mega-cities (Motoda 2010).

Information on the nation-wide **Mexican** NAMA on energy efficiency measures in residential buildings is available in great detail. The NAMA includes specific measures and activities as well as national policies and proposes four different scenarios of activities boosting existing support programmes providing subsidies for energy efficiency measure in low-income housing and credit lines for new houses that use sustainable and energy efficient technologies (Wehner et al. 2010). The enhancement of the programmes can be achieved by including more houses in a programme in the same period, technology up-scaling (more ambitious efficiency standards, use of additional technologies) or a combination of these mitigation options. As the NAMA builds on existing programmes, some financial flows have already been established and energy surveys of beneficiary households have been conducted. As of April 2010, the NAMA was in its preparatory phase. Implementation and operation are expected to start before the end of 2012 (Wehner et al. 2010).

In its second national communication, **Peru** has identified NAMAs that could be developed nation-wide in the energy, transport, industry and waste sectors as well as in forestry and land use (MINAM/ GEF/ PNUD 2010). For these NAMAs a wide variety of targets with dates as well as focal points for incentives are presented. However, many of the targets are still rather general and are not underpinned with proposals for action or implementation. The NAMA in the **energy sector**, for example, includes targets for higher shares of renewable energy (e.g. 65% hydroelectricity in the national grid by 2017) and energy efficiency measures (e.g. combined cycles in 60% of electricity generating companies) but does not spell out respective incentive schemes or policy measures to reach these targets yet. Peru considers its NAMA on **forestry and land use** to be the most important of its NAMAs because of its relevance for Peru's national GHG inventory, biodiversity as well as erosion and flood prevention. It proposes considering mitigation options such as sustainable forest management and the use of the CDM and the emerging mechanism for Reducing Emissions from Deforestation and Degradation (REDD). The NAMA does not specify the content of the suggested mitigation options (MINAM et al. 2010).

Serbia is currently developing NAMAs on energy efficiency under the "Capacity Development Project on Nationally Appropriate Mitigation Actions (NAMAs)". The project is set out to develop capacity on NAMAs, their promotion and MRV and to determine MRVable appropriate mitigation actions by assessing financial needs and the time necessary for their realization. Energy efficiency was chosen as priority area. Already, a detailed list with numerous concrete energy efficiency measures including their duration and expected emission reductions for residential buildings, public and commercial services, industry, transport and energy is available. Also, new standards and energy efficient management systems are listed. An Energy Efficiency Fund as well as energy efficiency and RES credit lines are being established (Božanić 2010; Kawanishi 2010; Spasojević 2010).

In **South Africa,** four studies have been conducted on behalf of the Department of Environmental Affairs on potential NAMAs employing concentrating solar power (CSP), wind power, electric vehicles and energy efficiency in low-income housing.

- While the further use of the studies on CSP, wind power and electric vehicles have yet to be determined, the National Sustainable Settlements Facility (NSSF), an integral part of the NAMA **"Financing Upgraded Energy Specifications of New Low-income Housing",** is already in an advanced design phase: The Development Bank of Southern Africa has already decided to host the NSSF, which is proposed to establish a centralised revolving fund to allocate money for maintenance as well as incremental upfront capital for solar water heaters and thermal efficiency measures in a million of new-build low-income houses by 2020 (ERC 2010d; Winkler 2010).
- The two renewable NAMAs put forth targets for the **incremental funding of 5 GW for CSP and 10 GW for wind energy in 2020**, respectively. These are to be reached, inter alia, by increasing the existing national feed-in tariff and by concessional finance for the national utility. The NAMAs include a deployment schedule for the capacity to be installed (ERC 2010a; ERC 2010b; Winkler 2010).
- The NAMA investment plan **"Rollout of Electric Private Passenger Vehicles in South Africa"** centres on the production and use of electric vehicles which are to reach a share of 60% by 2030. To achieve this, the NAMA stresses that government support concerning regulation and infrastructure is required. Proposed actions are sketched only vaguely and focus on supporting a local manufacturer in developing electric vehicles (ERC 2010c; Winkler 2010).

Furthermore, two NAMAs in **Tunisia** are analysed in this paper. Both were selected from a short list of potential NAMAs in a national stakeholder process. Detailed information including funding proposals is available for both of these NAMAs.

- The first of these NAMAs is the Tunisian **Plan Solaire** which was developed in 2009 by the national agency for energy conservation and endorses Tunisia's aim of becoming an international hub for energy production and exportation. The Plan Solaire includes 40 concrete public-private projects (energy efficiency, RES) of which parts are fully financed and have already been implemented. Responsible institutions as well as a timeframe are identified for each briefly described action. The latest project components shall be finalised in 2016 (MEDD 2010).

- Prior to the national stakeholder process, no project concept existed for the Tunisian NAMA on **methane prevention through sustainable biowaste treatment**. While existing CDM projects in the Tunisian waste sector focus on biowaste from private households, this NAMA covers agricultural and market waste as well as residues from food production, food preparation, public parks and sewage sludge. The technical NAMA components are suggested to be complemented by research, capacity building, norming and standardisation. For all components, specific actions as well as a timeframe and responsible government institution(s) are clearly identified. Actions are divided into different parts providing clear guidance for the NAMA's implementation (MEDD 2010).

5 GHG Impact

This chapter analyses the NAMAs' emission reduction potentials and the bases for their GHG calculation. Most of the analysed NAMAs clearly define their emission reduction potential. However, of the 16 NAMAs assessed in this paper, only seven elaborate on the (potential) basis of GHG calculations. Only one of them – the Mexican NAMA in the building sector – provides details on the calculations made to determine the NAMA's impact on GHG emissions.

Emission Reduction Potential

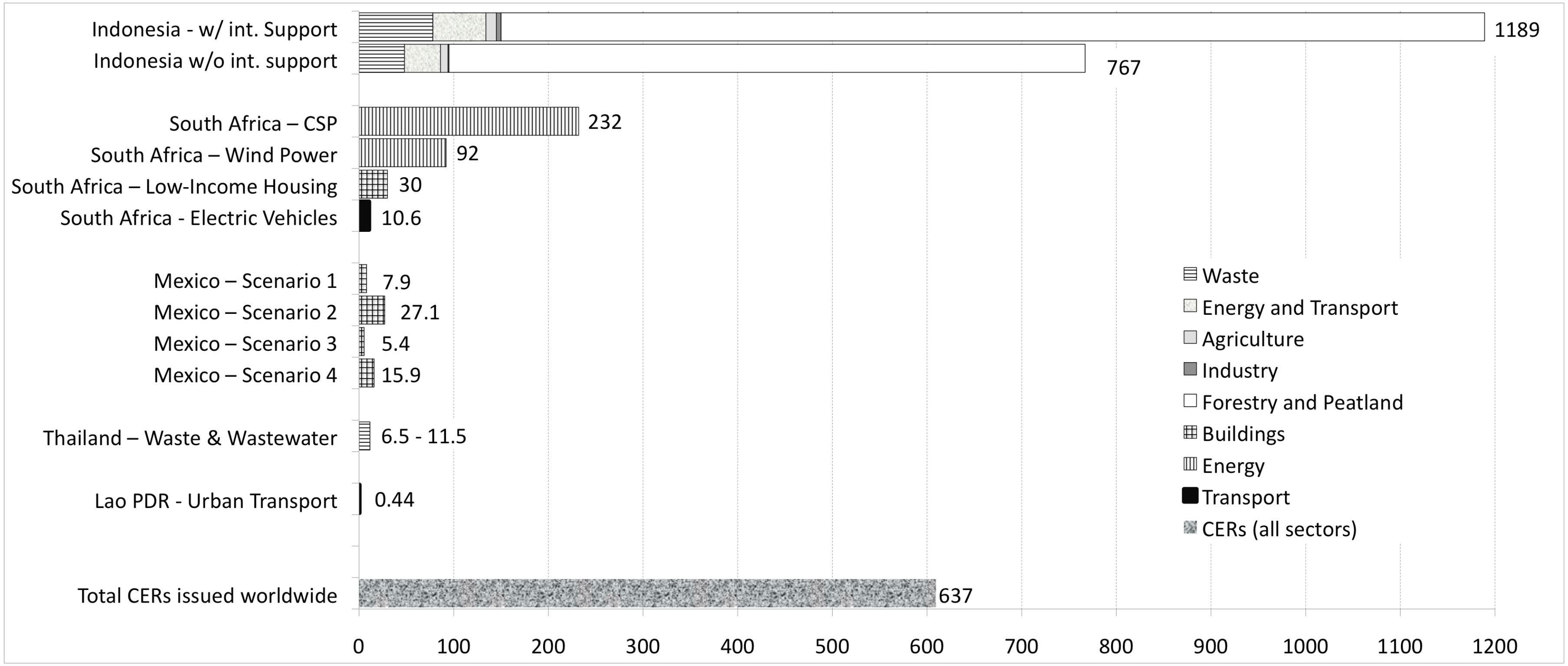
Half of the NAMAs analysed (8 out of 16) provide information on absolute emission reductions in a time period (e.g. from 2012-2020). The others either indicate emission reductions per year (Tunisia), give fragmented information with differing points of reference for individual actions (Peru) or so far only provide information on energy savings for a preliminary list of measures (Serbia). Detailed information on all emission reduction or energy saving potentials is presented in Table 6 in Annex B.

Figure 4 provides an overview of the estimated cumulative absolute emission reductions of the **Indonesian, South African, Mexican, Thai and Lao NAMAs** until 2020. These range from 0.44 Mt CO_2-eq. (Urban Transport in Lao PDR) to 1,189 Mt CO_2-eq. (Indonesia with international support; almost 90% coming from forestry and peatland). It is important to note that the emission reduction potential of a NAMA does not necessarily reflect the ambitiousness of its host country. Factors such as the size and status of development and energy consumption of a country or a specific sector in a country as well as other local conditions strongly influence a NAMA's emission reduction potential. Furthermore, it is easier to reduce emissions in some sectors than it is in others. Thus, comparing the NAMAs' emission reduction potentials is rather difficult.

Of the NAMAs providing information on cumulative absolute emission reductions until 2020, by far the largest emission reduction potential is in forestry and peatland. All of these emission reductions are envisaged to take place in Indonesia. Substantial emission reductions also come from renewable electricity production. In comparison, the emission reductions envisaged by the remaining NAMAs that estimate their cumulative absolute emission reductions until 2020 and focus on other sectors are relatively small.

What is striking is that the emission reductions that are projected for the NAMAs go far beyond those that have so far been achieved by the CDM. Since the CDM first started issuing CERs in 2005, CERs equivalent to a total of 637 Mt CO_2-eq. have been issued worldwide until June 2011. The Indonesian NAMA alone plans to reduce more emissions than this until 2020 – even without international support (767 Mt CO_2-eq.) (Figure 4). The four South African NAMAs (wind, CSP, efficient buildings, electric vehicles) add up to emission reductions of 365 Mt CO_2-eq. until 2020. This is half the amount of all CERs issued under the CDM and nearly 200 times the CERs issued in South Africa so far (1.9 m CERs). This stresses the transformative power NAMAs may have and gives an indication of an answer to the first of the guiding questions of this paper: Current pilot NAMAs do not only reach sectors and countries that have so far been neglected by the CDM but also aim at large scale emission reductions. Rather than isolated local projects under the CDM, NAMAs may significantly contribute to sectoral transformations and combat climate change more effectively on a much bigger scale.

Figure 4: Estimated Cumulative Absolute Emission Reductions from NAMAs until 2020 and Total Cumulative CERs Issued Worldwide until June 2011 (in Mt CO_2-eq.)



Basis for GHG Calculations

Even though there is no international agreement on NAMA rules and modalities yet, there are some generic quality criteria that should be applied when calculating emission reductions, such as:

- Is the description of the supposed baseline plausible and detailed (e.g. technologies employed/ activities taken place)?
- Is there an adequate assessment why the proposed baseline is the most likely alternative to the proposed NAMA?
- Are all assumptions, rationales, data, and calculations used to determine the baseline explicitly stated, justified appropriately, supported by evidence and reasonable?
- Do the proponents cite independent sources (feasibility reports, research, public announcements, etc.)?

Of the 16 NAMAs assessed in this paper, only seven elaborate on the (potential) basis of GHG calculations. While the basis for GHG calculations of the **Indonesian RAN-GRK** is not yet described in detail in the information available so far, it includes the assumption that international requirements will probably demand the creation of a national baseline as well as mitigation scenario containing abatement cost calculations. The national baseline is expected to consist of the different sectors' baselines and to use factors suitable to justify national and sectoral targets. The Indonesian NAMA points out that the emissions reduction phase and trajectory will have to be determined per year and per sector. Its emission reduction potential is calculated using emission projections for the business-as-usual (BAU) scenario for several sectors. However, no information is given on how these projections were calculated. Indonesia stresses that a BAU scenario should be determined using sophisticated model and scenario building and not just rely on the extrapolation of past and current trends. While Indonesia's total emission reduction target is fixed, the individual sectors' shares will be adjusted after recalculations and evaluations of the current numbers. Further adjustments may be necessary over time (Thamrin 2010; Thamrin 2011).

To estimate GHG emission reductions, the **South African NAMA on financing upgraded energy specifications of new low-income housing** refers to an existing Gold Standard CDM project. In principle the methodologies applied there (using a suppressed demand approach) could be used or adapted for the NAMA calculations (ERC 2010d; Winkler 2010). Both the **South African CSP and the wind power NAMA** suggest to consider emission reductions relative to a BAU scenario. The NAMA on wind power further elaborates on systems modelling methodology that has been used in the NAMA's incremental cost and GHG savings calculations and names assumptions made such as regarding technology learning and the sourcing of technology, operating and fuel costs from the country's current Integrated Resource Planning process (ERC 2010a; ERC 2010b; Winkler 2010).

The fourth **South African NAMA** raises some questions: It proposes to substitute conventional cars (diesel and petrol) with **electric vehicles.** However, electricity for the vehicles will come from the national grid which is largely coal-fired (ERC 2010c) and thus implicates a high emission factor. Hence, it is highly doubtful whether this NAMA would lead to significant emission reductions. According to Özdemir 2010 and Tomaschek 2011, the high carbon intensity of South African power would most likely lead to higher emissions depending on fuel mix assumptions. The information given in the publicly available documentation of the South African NAMA is not (yet) sufficient to assess this question and clarify the underlying GHG calculations (Winkler 2007; Winkler 2010; ERC 2010c). In principle, the information needed should be available in South Africa and the consultant to the NAMA (Energy Research Center, University of Cape Town) has an outstanding and internationally acknowledged expertise in this field.

The **Mexican NAMA design on energy efficiency in residential buildings'** GHG emission reductions are estimated using the empirical data available from surveys that have been conducted in 2009/2010 as well as further research and assumptions, e.g. regarding the annual penetration rate of the "Vivienda eficiente e hipotecas verdes" and "Ésta es tu casa" programmes and emission factors. The NAMA documentation points out that emission reductions in some of its calculations are likely to be overvalued because the assumption that the households' energy consumption will not increase in the future is unrealistic. However, it states that restrictions regarding data availability impeded designing a dynamic baseline of GHG emissions of the houses under the "Vivienda eficiente e hipotecas verdes" programme. Nevertheless, the Mexican NAMA states that it considers the estimations of GHG emission reductions made to be a good proxy and points out that so far it was not possible to make a detailed benchmarking analysis because of a lack of available data (Wehner et al. 2010). Apart from this, the baseline and emissions calculations seem highly straightforward and reasonable.

As regards Tunisia, details on emission calculations or baseline setting are provided for neither of the two NAMA proposals. However, the **Tunisian Plan Solaire** defines indicators to track its implementation (e.g. collector surface, power installed, amount of exchanged refrigerators) and states that these can be used to calculate and monitor the NAMA's emission reductions (MEDD 2010). In addition to indicators, assumptions and uncertainties regarding the emission reductions of the Tunisian NAMA on **biowaste treatment** are presented in the second Tunisian NAMA proposal. While the assumptions include parameters of different waste treatment options, the uncertainties described range from necessary baseline adjustments over time and the influence of CDM projects to a lack of available data. Moreover, the NAMA draws from studies that estimate the emission reduction potential of different options of biowaste treatment and future developments in the Tunisian waste sector. Furthermore, the NAMA states that IPCC methodology and good practice guidance should be used in emission calculations (MEDD 2010).

So far, neither one of the Peruvian NAMAs nor the Serbian, Lao or Thai NAMAs or the South African NAMA on electric vehicles provide information on their GHG calculations. An overview of the NAMAs' estimated impact on GHG emissions as well as the basis for GHG calculations – where available – is included in Table 6 in the annex.

6 Sustainability Benefits

According to the Bali Action Plan, NAMAs are to take place "in the context of sustainable development". Developing countries generally emphasise the Convention's principle that economic and social development and poverty eradication are "the first and overriding priorities of the developing country Parties" (Art. 4.7 UNFCCC). By contrast, the main interest of the donors in the UNFCCC framework is financing mitigation and not financing development in general. Parties tried to bridge this divide in the CDM by establishing two objectives in Art. 12 of the Kyoto Protocol. In practice, however, the mitigation objective of the CDM has so far clearly trumped the objective of contributing to sustainable development. The question is whether the modalities and procedures for NAMAs will be able to achieve a better balance.

So far, eight of the NAMAs analysed mention having sustainability benefits other than GHG emission reductions, see Table 3. None of them, however, are substantiated by independent sources.

The **Mexican NAMA on energy efficiency in residential buildings** points out the monetary benefits the NAMA will have. A positive impact on the national economy is forecast based on the NAMA's investments in energy efficiency and renewable energy technology (Wehner et al. 2010).

The **Peruvian NAMA in the waste sector** indicates potential sustainability benefits. The production of an alternative fuel to generate energy and develop new technologies could improve the quality of life of marginalised people (MINAM et al. 2010).

Significant sustainability benefits in the fields of health (reduced in respiratory diseases), safety (reduced fire risk) and energy service delivery are predicted to result from the **South African NAMA "Energy Specifications in New Low-Income Housing"** because it delivers improved quality housing to poor households. Furthermore, employment creation (installation and maintenance), education and awareness-raising around clean energy issues are claimed to follow from this NAMA (ERC 2010d; Winkler 2010).

Both the **South African CSP and wind power NAMA** pioneer renewable energy and relevant institutional mechanisms and develop industrial capacity in CSP and wind power, respectively, from which further developments in these branches of the economy could evolve. The NAMAs point out that this helps in overcoming South Africa's power shortage and in diversifying the country's energy mix, making it less prone to nuclear and coal fuel price volatility. Moreover, it reduces South African electricity's emission factor thereby improving the country's export opportunities due to the smaller carbon footprint of goods produced with electricity. The location of theses NAMAs' energy generation would also decrease transmission losses. Furthermore, the NAMAs stress that they enhance regional development and provide significantly greater job opportunities than coal based electricity generation. The NAMA would also result in capacity building, technology learning and the development of a skilled local workforce specialised in green technologies. Negative environmental effects of coal based electricity generation such as local air pollution and extensive water use is expected to decrease (ERC 2010a; ERC 2010b; Winkler 2010).

The **South African NAMA on electric vehicles** claims to reduce local air pollution, too, especially in urban areas. The necessary supporting infrastructure for electric vehicles would generate new jobs and the NAMA points out that it lowers the need for the import of crude oil and raises the potential to export refined petroleum products leading to benefits for South Africa's balance of payment (ERC 2010c; Winkler 2010).

Likewise, the **Tunisian** NAMAs clearly name their potential sustainable development benefits. **Plan Solaire** points out employment opportunities and the qualification of workforce as well as technology transfer and the reduction of Tunisia's dependency on fossil fuels. Furthermore, experience will be gained for the market and market intelligence as well as in innovation, testing, project management and statistics. Also, the NAMA emphasises that sustainable energy could be exported to Europe and the quality of life of the people would increase due to the valorisation of reused biomass and enhanced buildings and health resulting from less pollution (MEDD 2010).

Table 3: Environmental, Social and Economic Sustainability Benefits Mentioned in Analysed NAMAs

	Sustainability Benefits		
	Environmental	**Social**	**Economic**
Mexico – Energy Efficiency in Res. Buildings			• Monetary benefits • Benefits for national economy
Peru – Waste Sector		• Increase of quality of life of marginalised people	• Generation of alternative energy • Development of new technologies
South Africa – Energy Specifica-tions New Low-Income Housing		• Reduction in respiratory diseases • Reduction of fire risk • Improvements in energy service delivery • Education and awaren-ess-raising	• Employment generation
South Africa – CSP – Wind Power	• Reduction of electricity's emission factor • Reduction of local air pollution • Reduction of water use	• Capacity building	• Pioneering of renewable energy and relevant institutional mechanisms • Development of industrial capacity in CSP and wind power • Reduction of power shortage • Diversification of energy mix • Reduction of vulnerability to nuclear and coal fuel price volatility • Increase of export opportunities due to the smaller carbon footprint of goods • Reduction of transmission losses • Enhancement of regional development • Employment generation • Technology learning • Development of skilled local workforce specialised in green technologies
South Africa - Electric Vehicles	• Reduction of local air pollution		• Employment generation • Reduction of import of crude oil • Increase of exports of refined petroleum products • Benefits for balance of payment
Tunisia – Plan Solaire	• Reduction of pollution	• Increase of quality of life • Enhancement of buil-dings • Health benefits	• Employment generation • Qualification of workforce • Technology transfer • Reduction of dependency on fossil fuels • Experience for the market, market intelligence, in innovation, testing, project management and statistics • Export of sustainable energy to Europe • Valorisation of reused biomass
Tunisia – Bio-waste Treatment	• Closing of material-cycle • Saving of primary stockpiles • Reduction of scattered waste • Shrunk landfills and fewer leachate • Enhancement of air quality • Reduction of odour • Reduction of volatile organic compounds (VOCs) • Reduction of methane concentrati-ons near landfills • Reduction of negative environmen-tal impacts on water and other environmental resources	• Awareness building • Health benefits • Reduction of risk of explosion and fires	• Monetary benefits • Development of new economic branches of sustainable waste management and organic agriculture • Higher yields of taxes which could be transferred to local communities • Employment generation • Formation of personnel for the construc-tion and operation of the plants • Opportunities for donors to show their engagement • Increase in capacities in landfills

The Tunisian NAMA on **biowaste treatment,** too, describes its sustainability benefits: It mentions that the generation of energy and fertilizer from compost by this NAMA has substantial monetary benefits for the plant and could support the development of new economic branches of sustainable waste management and organic agriculture in Tunisia. Additional proceeds could result in higher yields of taxes which could be transferred to local communities, as the NAMA explains. Moreover, the NAMA indicates that it entails the generation of employment, the formation of personnel for the construction and operation of the plants and includes campaigns for awareness building. The NAMA points out the opportunities for donors to show their engagement in different parts of Tunisia with these activities. Regarding environmental sustainability, the NAMA states closing the material-cycle and saving primary stockpiles. Furthermore, reduced amounts of biowaste would lead to less scattered waste, more capacities in landfills or shrunk landfills and fewer leachate. The NAMA mentions that this will enhance air quality, lower odour, volatile organic compounds (VOCs) and methane concentrations near landfills and reduce negative environmental impacts on water and other environmental resources (e.g. less effluent of nutrients into watercourses, averting of algae formation). These effects are beneficial to health and human safety, as well: The risk of explosion and fires diminishes with reduced methane concentrations, as the NAMA points out (MEDD 2010).

7 MRV

7.1 MRV of Mitigation

Generally, how to measure, report and verify (MRV) NAMAs is not yet clearly defined. While the literature does go into some detail on possible options, the negotiations have so far mainly focused on the broad outlines of the MRV mechanism: Whether to MRV nationally or internationally, how often to MRV and through which channels reporting should take place. However, there has been little consideration of the details on what parameters should be MRVed in what way.

In order to assess different MRV options it is important to distinguish various definitions of NAMAs:

- **Broad vs. narrow definition of NAMAs:** NAMAs can range from superordinate policies and aggregated targets to specific actions at national or local level. The challenges for MRVing differ substantially for the different kinds of NAMAs.
- **Layers of NAMAs:** Depending on the funding of the NAMA (unilateral, supported, credited), the requirements for MRVing are quite different:
    - MRVing for credited NAMAs needs to be very strict in terms of quantifying GHG emission reductions, as credits generated by a NAMA would be used to offset emissions in Annex I countries. Thus, it needs to be ensured that only real emission reductions are credited. Otherwise global emissions would increase.
    - MRV requirements for supported NAMAs may be somewhat less rigorous depending on the needs of international financiers. If the key MRV purpose is transparency, it may suffice to

focus on whether actions are actually implemented and assess intermediate indicators that have a positive correlation to GHG emissions. This might enable NAMAs with greater sustainability benefits.

- Requirements for MRVing unilateral NAMAs may mainly reflect the host country's needs.

- **Sector targeted by a NAMA:** The challenges for MRVing vary with respect to the sector in which a NAMA is proposed. E.g. in transport and energy efficiency, substantial methodological difficulties exist to measure GHG emission reductions.

When the quantification of GHG emission (reduction) is difficult, one option is to choose indicators other than GHG emissions to MRV the implementation of a NAMA, e.g. the R&D budget spent on low-carbon technologies (Okobo, Hayashi and Michaelowa 2011). This means shifting from an output-based MRVing of GHG emissions towards a more input-based MRVing of indicators for implementing the action itself. Figure 5 ranks different kinds of policies and actions with respect to the quantifiability of the policies' outcome in terms of CO_2 emission reduction.

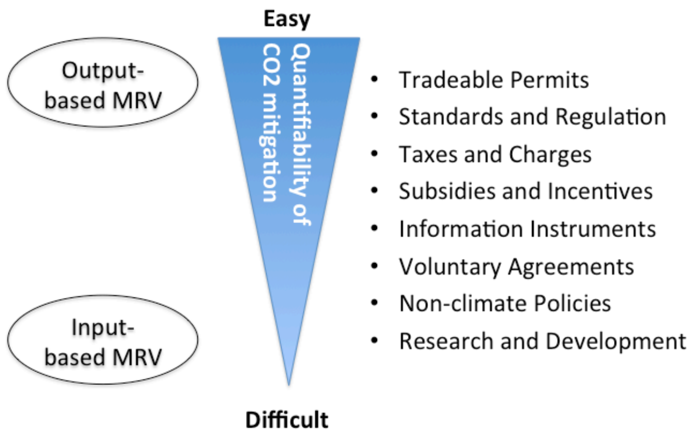


Figure 5: Quantifiability of Policy Impacts and Suitable MRV Schemes (Okobo, Hayashi and Michaelowa 2011).

International donors for NAMAs may demand quantifying emission reductions as a key indicator for any MRV. On this issue, the European Union puts forth the position that "the allocation of support to developing countries should move towards a performance-based system, strongly incentivising the promotion of actions which maximize climate value for climate money" (European Council 2009). However, if NAMAs do not explicitly aim at offsetting carbon emissions of industrialized countries (credited NAMAs), then MRV may not necessarily have to be based on direct GHG emission reductions alone (Jung et al. 2010). Due to the long-term nature of NAMAs, the outcome may not so much result in direct emission reductions but can provide enabling conditions for long-term (indirect) emission reductions (Cheng/ Zhu 2009). Furthermore, non-emission based MRV can help to reduce the MRV effort (e.g. in case of high complexity) and thus be a key to large-scale implementation of NAMAs in general. As highlighted above, a shift towards input-based MRV could be beneficial to reduce transaction costs. In summary, an adequate mix of emission based and non-emission based indicators will be crucial for the success of NAMAs with respect to both practicability and balancing GHG emission reductions vs. other benefits.

Boundaries and Overlaps

Accurate MRV will be especially difficult if several actions overlap. For example, one NAMA may promote the introduction of electricity-saving appliances while another NAMA promotes the expansion of electricity generation from renewable sources. Both actions result in reducing electricity generation from fossil fuel power plants. Specifying the emission impact of each NAMA individually would therefore require to separate out the impact of each measure (and important external factors). Such problems can be minimised if related NAMAs are proposed and evaluated as a package. However, due to their capacity restraints many developing countries may not be able to design comprehensive packages ex ante but may instead develop NAMAs in a more piecemeal approach. This is underlined by the differing levels of sophistication of the NAMAs submitted under the Copenhagen Accord and the Cancún Agreements.

The relationship between NAMAs and the carbon market is equally unclear in practical terms. To prevent double counting of emission reductions, the determination of additionality and baselines for any generation of credits, be it credited NAMAs or CDM projects, would in principle need to take into account all the related unilateral and supported NAMAs. For example, if a country introduces a renewables feed-in tariff as a unilateral or supported NAMA, only those renewable energy installations should be eligible for crediting that are still not profitable despite the feed-in tariff. Otherwise, reductions would be counted twice, first as the reduction of the developing country and second as credits counting towards Annex I targets. Also, if the feed-in tariff NAMA was financed by Annex I countries, they would pay twice for the same reduction: First for the tariff and second for the credits. According to the current CDM rules, however, new emission reduction policies do not need to be taken into account when determining the baseline of a project. This rule has the effect that eventually, as more and more ambitious policies are getting implemented, any project could pass the additionality test.

The current CDM rules may therefore need to be revised if developing countries start to introduce comprehensive NAMAs at an aggregate level and these are funded by industrialised countries. The result of such a rule change might be to severely restrict the scope of the CDM as probably only reduction options with relatively high costs would remain eligible. From the perspective of effectiveness, though, comprehensive approaches that aim at a sector-wide transformation are usually preferable to individual lighthouse projects.

MRV in the NAMAs Analysed

We assessed the 16 analysed NAMAs against the following minimum requirements for MRV:

- Does the NAMA clearly describe which parameters will be measured and reported as well as the associated means of measuring?
- Are the proposed parameters suitable to assess implementation and effectiveness of the proposed NAMA?
- Are the means of implementation of the MRV provisions, including the data management and quality assurance and quality control procedures, sufficient to ensure that NAMA implementation and achieved emission reductions can be reported ex post and verified?

So far information on suggestions for MRV is available for seven of the analysed 16 NAMAs, even though some of them are rather limited. While no information is available for the **Lao PDR's NAMA on urban transport** and **Thailand's NAMA on waste and waste management** so far, both **Serbia and Peru** point out the importance of MRV for their NAMAs but do not specify on this issue yet (Božanić 2010; Kawanishi 2010; MINAM et al. 2010; Spasojević 2010). **Indonesia** recognises that there still are several technical questions to be answered for its NAMA: An MRV system has to be established, a GHG inventory and monitoring system is necessary for all sectors. No further details are provided yet (Thamrin 2010; Thamrin 2011).

More detailed information exists for the **Mexican NAMA on energy efficiency in the residential building sector.** Though monitoring of installations is already in progress, a reliable MRV metric still has to be designed. The NAMA concept points out that the MRV metric will have to be adapted to the final design of the NAMA including the question of whether or not credits shall be generated. Current proposals for the Mexican NAMA in residential buildings include direct monitoring of GHG emissions with large-scale data analysis and the use of energy performance benchmarks as well as minimum appliance standards. The NAMA stresses the advantage of a whole-building energy performance approach that would make it possible to consider the effects of the installation of renewable energy technologies on total energy use. Benchmarks are seen as favourable because they can be used both in baseline and additionality determination as well as to distinguish BAU measures from supported and credited NAMAs and thus streamline MRV procedures. Moreover, they can be adjusted over time as needed. A lot of data, however, is necessary for benchmarking. Thus, the NAMA points out that it is important to consider the benchmarks' user friendliness without jeopardizing environmental integrity. Furthermore, the NAMA boundary should include all relevant houses and be determined using the whole building approach to allow for the consideration of renewable technologies, too. The NAMA concept further elaborates on the key technical aspects for benchmarking system boundary, key performance indicator, aggregation level, stringency, data requirements and updating procedures (Wehner et al. 2010). Overall, proposals on MRV for the Mexican NAMA on energy efficiency in residential buildings are the most elaborate of the NAMAs analysed in this paper. Many of the elements and contemplations included may very well satisfy emerging international MRV requirements in the building sector.

The four **South African NAMAs'** suggestions on MRV vary substantially with respect to their sophistication and reliability:

- The NAMAs for **CSP** and **wind power** list both output and input indicators for tracking their successful implementation: establishment of the necessary funding mechanisms, finance disbursed to utilities, installed capacity and electricity generation (ERC 2010a; ERC 2010b; Winkler 2010). If the electricity generated from wind and CSP was monitored, the calculation of related CO_2 mitigation would be straightforward once a general baseline or reference scenario for the South African power sector has been agreed upon. In fact, the CO_2 reduction potential given in the NAMA uses such a reference scenario (based on MARKAL modelling). CO_2 emission reductions could then be calculated using the amount of power (MWh) produced in CSP and wind plants and the emission factor of electricity in the national grid. In summary, even certified emission reductions seem feasible if a baseline scenario for the South African power sector was agreed upon.
- The technical measures proposed in the NAMA on **energy specifications in new low-income housing** have already been implemented in a Gold Standard CDM project in 2,300 state-funded low-income houses (Kuyasa CDM 2009). For this CDM project, a detailed MRV metric has been developed. The preliminary proposal suggests using this methodology (ERC 2010d). However, to reduce transactions costs, it would be preferable to use an MRV metric for the proposed NAMA which is less rigid than the one developed for the CDM project. If the NAMA was to be supported but not credited the accuracy requirements could be lower compared to the CDM requirements. For example, the CO_2 mitigation effect of solar water heaters strongly depends on the exact local solar irradiation, which would need to be measured for a CDM project for all those sites all across the country where low-income houses are to be built. For the purposes of a unilateral or supported NAMA, simplified regional approximations may be sufficient.

- Concerning the NAMA for the **rollout of electric private passenger vehicles** the MRV proposals mirror prevalent difficulties of MRVing in the transport sector: listed options are to track progress via the displacement of conventionally fuelled vehicles, sales volumes of electric vehicles as well as the corresponding use of petrol and diesel over time (ERC 2010c; Winkler 2010). However, the link between the NAMA's success and some of the indicators is rather indirect. To determine CO_2 reductions, the number of electric vehicles is not sufficient – energy consumption would have to be approximated by car type, use patterns, driving distance etc. Reductions or increases in petrol and diesel consumption as well as decreasing or growing numbers of conventional vehicles are relatively easy to link to emission reductions. However, it would be extremely difficult to attribute these developments to the respective NAMA as other factors may also influence these indicators substantially. In summary, with the given indicators, only very coarse estimates of the NAMAs CO_2 mitigation effects are possible. More input-based indicators could be helpful to assess the implementation of this NAMA. Then, however, crediting would not be possible as calculations are not exact enough.

The two **Tunisian** NAMAs provide details on possible indicators for tracking the implementation of individual NAMA components and the related emission reductions. Both stress the importance of indicators being specific, measureable, attributable, realistic and timely (SMART). However, only the Plan Solaire provides an exact time frame for its individual components.

- Most of the indicators for the **Plan Solaire** focus on the installed technology (collector surface, power installed) and realized pilot projects (e.g. the amount of exchanged refrigerators and distributed energy efficient light bulbs, infrastructure projects) from which related emission reductions can be estimated. Furthermore, the drivers and/or the amount of installed information devices are monitored for the energy efficiency measures in transport. Indicators with an indirect emission reduction effect such as studies conducted are to be monitored, too (MEDD 2010).
- MRVable outcomes of the Tunisian NAMA on **biowaste treatment** include a large variety of input based indicators. Long-term indictors range from the commissioning of studies and the implementation of research programmes and capacity building to communication campaigns. A second set of indicators addresses the development of an adequate concept on biowaste treatment: These range from the existence of a consensus within the Tunisian government on the promotion of the biowaste strategy to the identification of suitable locations for plants and suitable technology for biowaste streams. It is also suggested to assess whether stakeholder processes have been started. A third set of indicators focuses on the implementation of the construction and operation of composting and anaerobic digestion plants, e.g. counting initiated tenders and approved bids (MEDD 2010).

The suggestions on MRV for both of the Tunisian NAMAs are already quite sophisticated. Parameters to be MRVed are described in detail and seem to be suitable to assess the implementation and effectiveness of the NAMAs. Further elaborations will have to be made regarding the implementation of MRV provisions.

In summary, only seven of the 16 NAMAs provide essential information on MRVing. Four of these (Mexico, Tunisian Plan Solaire, South African CSP and wind) already include reliable output based indicators, which would allow estimates of GHG emission reductions. This is in line with general experiences from the CDM, where it also proved to be easier to certify power sector emission reductions compared to energy efficiency or transport. Input based indicators could be an option to broadly MRV a NAMA's impact, especially in those fields where GHG emission reductions are difficult to assess. However, only one of the analysed NAMAs (Tunisian biowaste) spells out detailed input based indicators, which would be needed to develop a reliable MRV metric.

7.2 MRV of Sustainability

As highlighted above, the concept of NAMAs as defined in the Bali Action Plan strongly refers to the broader concept of sustainable development. Thus, reducing an impact assessment of NAMAs to GHG emission reductions would arguably fall short of the original intention of the instrument. Sustainable development benefits should be assessed as an integral part of any NAMA MRV metric. In this respect, the reasons for including other indicators in a MRV metric for NAMAs is not only a question of *handling the complexity,* but a necessity to address the original objectives of this new policy instrument adequately. This would also help avoiding a development similar to the one seen in the CDM: While the CDM, too, has the dual aim of both contributing to GHG mitigation and sustainable development, it so far fails to adequately address sustainable development (Olsen 2007, Sterk et al. 2009).

One example for MRVing sustainable development components of mitigation activities is the CDM Gold Standard. Under the Gold Standard, project proponents are to apply the UNDP safeguarding principles (do-not harm analysis) as well as a sustainable development matrix, consisting of environmental, social and economic criteria such as air and water quality, livelihood of the poor, or quantitative employment and income generation. A variation of these criteria could in principle also be applied to all CDM projects (Sterk et al. 2009). Yet, MRVing the sustainability of NAMAs aiming at transforming whole industry sectors will certainly be far more complex than at the Gold Standard's project level.

The COP should therefore develop binding sustainability requirements and clear guidance on how sustainability benefits and risks are to be assessed, validated, monitored and verified. These requirements should include an assessment of potentially negative effects and require that project proponents spell out how these will be addressed. For example, projects that lead to a loss of livelihood, e.g. if the local population needs to resettle, should clearly address how vulnerable populations are compensated or offered alternatives. Moreover, a detailed impact assessment in terms of sustainable development should be mandatory.

In order to prevent negative impacts and to achieve broad-based support, introducing NAMAs should be as transparent and participatory as possible. Any guidelines for NAMA development should therefore also include provisions for meaningful stakeholder consultations. Again, the CDM Gold Standard offers a valuable reference for successful involvement of stakeholders (Sterk et al. 2009).

8 International Support – Costs and Barriers

One crucial aspect in the development of NAMAs is why and what forms of support are needed. In principle, there are two main reasons for requiring international support:

- **Costs:** The NAMA is economically less attractive than other alternatives that would lead to higher emissions.
- **Barriers:** There are substantial non-economic barriers to implementation, e.g. lack of trained work-force.

NAMAs seeking international finance should therefore include a robust elaboration of the costs and benefits of implementation and, where applicable, other constraints to implementation. In particular, NAMAs should clearly identify where and why financial, technological and capacity building support is required. This assessment should include a description of the methodology and assumptions used.

So far, no requirements have been defined internationally for demonstrating why a NAMA needs international support and how much. The following section analyses how the pilot NAMAs analysed in this paper address these issues.

8.1 Costs and Financing

While there is not yet an internationally agreed framework for developing NAMAs, there are some generic quality criteria that should be applied when calculating costs, such as:

- Are the parameters and assumptions used accurate and suitable?
- Did the proponents validate financial calculations adequately (e.g. benchmarks/discount rates)?
- Is there a sensitivity analysis and, if yes, are the conditions supposed in the sensitivity analysis relevant?
- Are all assumptions, rationales, data, and calculations used explicitly stated, justified appropriately, supported by evidence and reasonable?
- Do the proponents use independent sources (feasibility reports, research, public announcements, etc.)?

So far, eight of the NAMAs analysed in this paper specify neither their costs nor their financial needs yet. While one of the NAMAs provides information on costs but not on financing (Mexico), another one proposes a financing structure but yet neglects to define its costs (Indonesia). The two Tunisian and all four South African NAMAs, in contrast, define both their costs and the international support they strive for (Table 4).

Table 4: Costs and Financing of NAMAs[3]

	Costs	Financing
Indonesia – RAN-GRK	Not specified	Domestic public sources: 3.1 billion € from 2010 to 2014 Further funding to come from domestic public, private sector and international sources, amounts not specified
Lao PDR – Urban Transport	Not specified	Not specified
Mexico – Energy Efficiency in Residential Buildings	Until 2020: Scenario 1: 2.2 billion € Scenario 2: 5.2 billion € Scenario 3: 1.4 billion € Scenario 4: 4.8 billion € Supportive actions: 14.7 million €	Not specified
Peru – Transport Sector	Not specified	Not specified
Peru – Energy Sector	Not specified	Not specified
Peru – Industry Sector	Not specified	Not specified
Peru – Forestry and Land Use	Not specified	Not specified
Peru – Waste Sector	Not specified	Not specified
Serbia – Energy Efficiency	Not specified	Not specified
South Africa – Energy Specifications New Low-Income Housing	Capital costs: 2 billion € in ten years	International sources: 2 billion €
South Africa – CSP	Total incremental system costs: 1.4 billion € (120 million € per year)	International sources: 1.4 billion € by 2020
South Africa – Wind Power	Total incremental costs: 2.4 billion €	International sources: 2.4 billion €
South Africa - Electric Vehicles	Incremental costs of rolling out electric vehicles: 233.9 billion € from 2010 to 2050	International sources: 233.9 billion € from 2010 to 2050
Thailand – Waste and Wastewater management	Not specified	Not specified
Tunisia – Plan Solaire	1.852 billion € from 2010 to 2016	Domestically – private: 1.362 billion € Domestically – funding: 111 million € Already agreed international support: 9 million € New international financing: 372 million €
Tunisia – Biowaste Treatment	138 million € plus operation costs	Unilaterally: 96 million € New international climate support: 42 million €

The **Indonesian NAMA** proposes to reduce country emissions by 26% below BAU levels by 2020 unilaterally and by up to 41% with "adequate international support (…) to the government" (Thamrin 2011). While the costs of the envisaged mitigation actions are not determined yet, domestic public as well as private and international sources are identified to finance them:

- Government budgets are expected to provide the largest share of financing for the unilateral component. While domestic financing for the time period 2015-2020 has yet to be determined, the Indonesian Mid Term Development Plan (RPJMN) allocates 3.1 billion € to emission reductions for the time period from 2010 to 2014. These sources could either be distributed through government bodies and state-owned enterprises or redistributed to the private sector.

[3] In this paper, the following exchange rates are used: 1 Euro (€) = 12,322 Indonesian Rupiah (IDR); 1 € = 16.98 Mexican Pesos (MXN); 1 € = 9.83 South African Rand (ZAR); 1 € = 1.43 US Dollar (US $).

- Furthermore, Indonesia suggests to identify and raise funding in the domestic private sector. Incentives could be provided to the private sector, banks could be incentivised to provide loans for emission reduction efforts and green technology and business activities relating to Corporate Social Responsibility (CSR) could be directed to focus on emission reductions. The kind of incentives envisaged is not specified any further so far. Criteria such as an activity's conformity with sustainable development principles and cost effectiveness are used to prioritise unilateral NAMAs.
- Moreover, international funding via the Green Climate Fund and REDD+ are mentioned as potential sources for the 26 to 41% range of Indonesia's emission reduction target. However, the NAMA does not specify why it needs international funding yet.
- The Indonesian NAMA includes the option of NAMA crediting for emission reductions beyond Indonesia's emission reduction target of -41%. It is suggested that the NAMAs Registry should be responsible for classifying such emission reducing activities as CDM or REDD+ activities or credited NAMAs.

To increase investments in mitigation and adaptation beyond the domestic budget resources, Indonesia has established the Climate Change Trust Fund (ICCTF). The ICCTF shall receive and hand out funds from development partners, international funds and other climate change funding mechanisms such as the Adaptation Fund and the EU Global Efficiency and Renewable Energy Fund and coordinate funds from other governments and private entities. In addition, Indonesia suggests that further bilateral and multilateral cooperation mechanisms could be used for NAMA financing. Particularly, cooperation between private sectors or public private partnerships (PPP) is mentioned. Also, Indonesia suggests that it will establish domestic carbon trading before participating in the international carbon market (Thamrin 2010; Thamrin 2011).

The **South African CSP NAMA** proposal states that its total incremental system costs will amount to 1.4 billion € (120 million € per year) relative to the baseline scenario. It seeks international support especially to cover costs for up-front investments which are expected to add up to about 100 million in 2011 and rise to 2.5 billion € in 2019. The NAMA includes information on the possibility of even higher investment costs should less commercial CSP technologies be used. Support is suggested to be delivered to the Renewable Energy Feed-In Tariff (REFIT) and the Solar Park Initiative. The Solar Park Initiative aims at the development of CSP. While the total amount of international support required is not defined exactly in the available documentation, another source for this NAMA determines a total of 1.4 billion € to be sought by 2020 as grant or concessional loan to the REFIT or the Solar Park Initiative (Winkler 2010). This amount equals the total incremental system costs. Additional international support is requested for technological (in particular for commercializing CSP and developing water-saving technologies) and capacity support (for feasibility studies and establishing an independent systems operator). However, no details are provided on how these financing requirements were calculated (ERC 2010b; Winkler 2010).

International support sought by the **South African wind power NAMA** amounts to the full incremental cost of the programme of a total of 2.4 billion € (discounted at 8% to 2010). No further information is given on data sources that were used and how costs or required financing were calculated (ERC 2010a; Winkler 2010).

The **South African NAMA on electric vehicles** seeks funding for incremental costs of rolling out electric vehicles which increase constantly from 1.1 billion € per year from 2010 to 2015 to 8 billion € per year from 2031 to 2050 and amount to a cumulative total of 233.9 billion € for the time period from 2010 to 2050 (in 2008 prices). The available documentation does not specify the sources and calculations behind these numbers. Furthermore, technical support is required regarding battery charging stations and battery swapping facilities (ERC 2010c; Winkler 2010).

The **South African NAMA "Energy Specifications in New Low-Income Housing"** aims at covering its total capital costs with international support which amount to € 2 billion in ten years. Furthermore, international support is sought for technical, institutional, financing and marketing elements for the establishment of the envisaged National Sustainable Settlements Facility (NSSF) (ERC 2010d; Winkler 2010).

The financial needs of the **Mexican NAMA on energy efficiency in residential buildings** are described in detail. They vary depending on the four different scenarios considered in the NAMA. Thus, scenario 1 is estimated to need subsidies of 2.2 billion € and scenario 2 of 5.2 billion € until 2020 while scenario 3 requires 1.4 billion € and scenario 4 4.8 billion € until 2020. While the exact calculations for the costs are not included in the publicly available documentation yet, the proposal explains the components causing the costs in each scenario, e.g. subsidies under the "Ésta es tu casa" programme, loans under the "Vivienda eficiente e hipotecas verdes" programme, the penetration rate and costs of efficient appliances and PV. This makes the financial requirements both comprehensible and plausible. However, basing scenarios on the maximum loan awarded under the "Vivienda eficiente e hipotecas verdes" programme might result in an overestimation of the financial requirements in the corresponding scenarios. A further 14.7 million € is expected to be necessary until 2010 for supportive actions – including capacity building and technology transfer – for the implementation and operation of the Mexican NAMA. A detailed cost allocation for these costs is presented in the appendix of the NAMA. Moreover, the working paper explains that the Mexican NAMA could result in monetary benefits for house owners and the Mexican government and mentions that these could (partly) be used to refinance the investments over time. For some scenarios, monetary benefits could even exceed investments. As international rules and procedures for the financing of NAMAs are not yet determined, the proposal suggests to aim for bilateral financing of the NAMA and create a NAMA fund to coordinate the financing of the NAMA. Depending on the mitigation cost, NAMAs are proposed to be financed unilaterally, supported and via crediting, should the Mexican government support this approach. Private as well as public sources may be included in the NAMA fund. The exact amount to be contributed by different sources is not determined yet in the NAMA. It is suggested, however, that the continuation of the "Ésta es tu casa" and the "Vivienda eficiente e hipotecas verdes" programmes which amount to a total of 3.5 billion € by 2020 might be seen as a unilateral NAMA whereas further investments could be financed from different multi- or bilateral sources (Wehner et al. 2010).

The **Tunisian Plan Solaire NAMA** proposal suggests that there are detailed cost estimates for the implementation of most of the envisaged components of the plan and that they amount to a total of 1.852 billion € for the time period from 2010 to 2016. In the preliminary proposal, the costs of all ten components of the Plan Solaire are divided into costs that are covered domestically (privately and by funding), international support that is already agreed upon and costs to be covered by new international (climate) support. The NAMA proposal suggests that the parts of the Plan Solaire that already have secured finance could be denominated "unilateral NAMAs" while the remaining parts are suggested to require international financing and are supported NAMAs. 1.362 billion € are proposed to be financed domestically from private sources, another 111 million € via domestic funding. A further 9 million € is already to be covered by international donors. Thus, the NAMA asks for new international financing of the remaining 372 million €, particularly for solar electricity generating and wind projects. While an overview of cost and financing estimates is provided, there are no details on calculations and what data sources were used in the preliminary proposal (MEDD 2010).

The Tunisian NAMA on **biowaste treatment** points out that cost planning will have to be done within the NAMA. So far, only information on investment costs for individual composting plants is provided. Nevertheless, the NAMA states that government sources are insufficient to even fully finance already existing landfilling activities. The total costs are estimated in a financial plan to amount to 138 million € plus operation costs of composting and anaerobic digestion plants that have yet to be determined. 96 million € are to be financed unilaterally, 42 million € should be covered by new international (climate) support. So far, there is no additional information regarding the data sources and cost calculations (MEDD 2010).

8.2 Barriers and Risks

Even if a measure is the economically most attractive option, there may be substantial non-economic barriers to implementation. Experience from industrialised countries shows that even where investments are in principle profitable, implementation is often nevertheless difficult. Industrialised countries dispose of gigatonnes of no-regret potential that would generate a net economic benefit, and yet have on the whole so far not been very successful in actually achieving their pledged emission reductions. Typically, a whole range of considerable financial, institutional, technical, information and capacity barriers prevent implementation, such as high upfront costs, limited access to capital, lack of skilled labour, small project sizes coupled with high transaction costs or limited awareness of options, split incentives (e.g. landlords unwilling to pay for efficiency measures that lower tenants' energy bills without any benefit to the landlords themselves while tenants are unwilling to invest in improvements that revert to the landlord on lease expiry).

While there is not yet an internationally agreed framework for developing NAMAs, there are some generic quality criteria that should be applied when assessing barriers, such as:

- Are the barriers real, i.e. are they substantiated by independent sources, such as national legislation, surveys of local conditions or national or international statistics?
- Are the barriers substantial enough the prevent implementation of the NAMA?
- Is the data used accurate and suitable?
- Are all assumptions, rationales and calculations used explicitly stated, including references and sources, and are they justified and reasonable?

So far, no detailed analysis of barriers is available for the NAMAs analysed. Only three of the NAMAs proposals explicitly point out some existing barriers and risks for their implementation: the South African NAMA on CSP and the two Tunisian NAMAs. However, so far, the NAMAs do not substantiate their barriers and risks with independent sources.

The **South African NAMA on CSP** indicates the existence of a barrier resulting from the lack of technological know-how and infrastructure (grid, road and water access) as well as problems concerning component supply. Other challenges are stated to result from Eskom's monopoly control of electricity supply which would be reduced with the creation of an independent system operator, as is envisaged in the NAMA. No further details are provided on these barriers or why international support is required to remove them (ERC 2010b; Winkler 2010).

Barriers are also described in the **Tunisian Plan Solaire.** The NAMA states that the timetable is ambitious and the availability of technologies, products, problem awareness, a skilled workforce and experts might become bottlenecks for the NAMA and result in high transaction costs. Moreover, upfront costs are mentioned to be high for some NAMA elements but financing mechanisms are seen as being insufficient for mitigation action investment. Other NAMA elements are said to depend on private sector demand or to require technology transfer. Additional institutional barriers are mentioned in the NAMA proposal for the implementation of the Plan Solaire: public procedure does not fit the requirements of the carbon market and there is a lack of a system for statistics, monitoring and evaluation (MEDD 2010). However, the listed barriers are not substantiated from independent sources.

Various factors are named as barriers for the Tunisian NAMA on **biowaste treatment.** The NAMA proposal states that there is not only a lack of knowledge about biowaste streams and real potential for special treatment, but also about the mitigation capability of treatment processes such as composting and anaerobic digestion. Additional problems described concern the availability of adequate experts and techniques suitable for Tunisia (foreign techniques are frequently too complex, maintenance and service not at hand where necessary) as well as of a systematic strategy for the marketing of compost gained from biowaste treatment. Moreover, the NAMA proposal assumes that there is the risk that necessary studies will be obstructed by a lack of laboratories or equipment and that outcomes of conducted studies will not be accepted by relevant stakeholders. Reasons for this assuming this risks are not provided, however. Furthermore, the NAMA states that the introduction of biowaste treatment might not be approved by relevant stakeholders and tasks might not be completed on schedule, e.g. due to diverging ideas and interests or a lack of competence. Furthermore, financial problems are feared to arise in case the proceeds from electricity from biogas fed into the grid and natural fertilizer might not cover the costs and there is not enough capital for investment. Another barrier mentioned in the NAMA proposal is that the coverage of biowaste collecting might frequently be insufficient to operate a plant. While the Tunisian NAMA on biowaste treatment includes a list of sources used it remains unclear whether or not the barriers claimed in the NAMA proposal originate from these sources (MEDD 2010).

9 Conclusions

In this paper, we have analysed 16 pilot NAMAs which are currently under development. Five of them are located in Peru, four in South Africa, two in Tunisia and one each in Indonesia, Lao PDR, Mexico, Serbia and Thailand. The respective governments are involved in all of the NAMA development process and all of the NAMAs aim at international support.

The guiding questions underlying our analysis were:

1. Will NAMAs fulfil expectations of reducing emissions in developing countries on a large scale?
2. How far developed are the NAMAs in question?

A Dimension of Change – Large Scale, New Countries, All Sectors

The most striking feature of the NAMAs analysed is that they really do aim at a fundamental transformation of the (sub)sector(s) they address. Very much unlike the CDM, which so far has been confined to local projects, most of the NAMAs analysed aim at whole sectors or at the implementation of new technologies at national level. Thus, the cumulative absolute emission reduction potential of the Indonesian NAMA with international support alone is nearly equivalent to twice the total cumulative CERs issued worldwide so far. Also, the four South African NAMAs add up to emission reductions of 365 Mt CO_2-eq. until 2020. This is half the amount of all CERs issued under the CDM and nearly 200 times the CERs issued in South Africa so far (1.9 m CERs). For the international community, especially donors from industrialised countries, this means that NAMAs do indeed have the potential to address CO_2 mitigation at an adequate scale. It also opens up the possibility to develop North-South cooperation at a strategic political level.

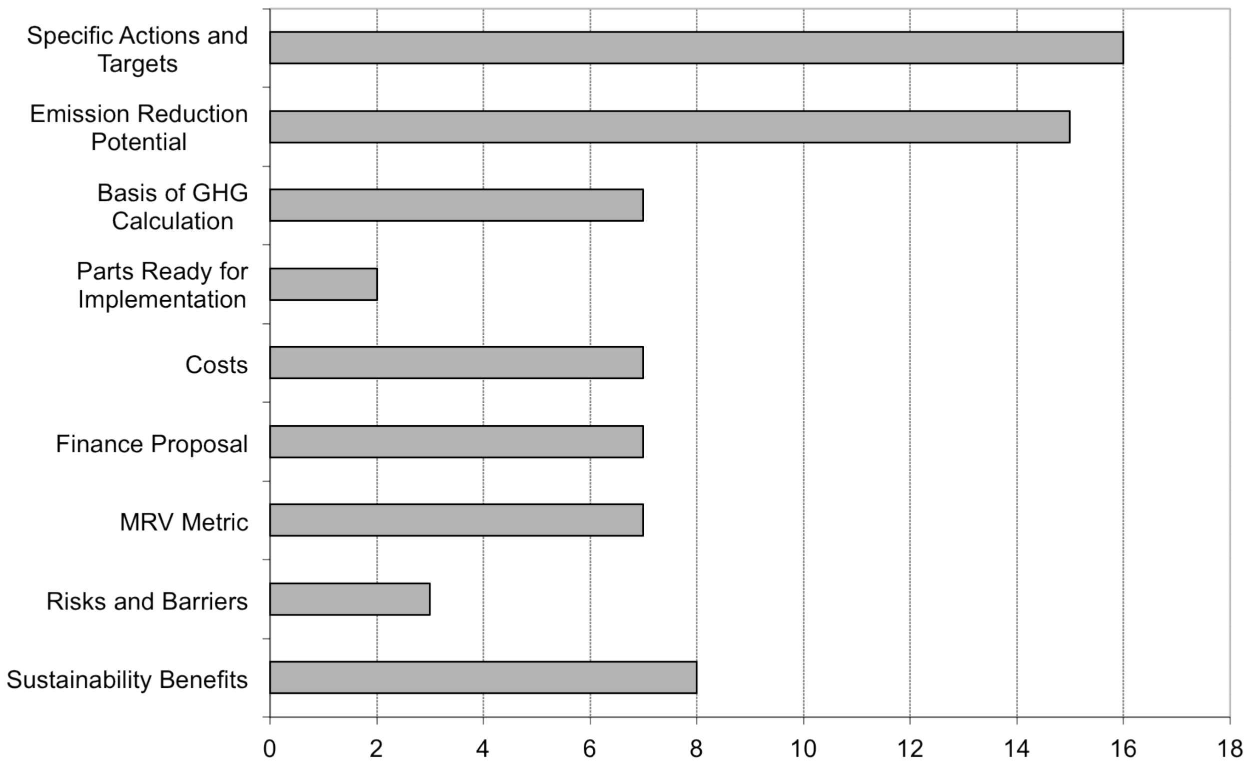
Furthermore, the pilot NAMAs analysed take place in some countries and sectors the CDM has hardly been able to reach so far. Especially Tunisia, Lao PDR and Serbia have so far been neglected by CDM project developers nearly completely. The eight countries in which the 16 NAMAs are located account for only 2% of all CERs issued so far. The same is true for the sectoral distribution of the NAMAs: While there are hardly any CDM projects in transport and end-use energy efficiency, the NAMAs analysed do address these sectors. Five of the NAMAs analysed are linked to transport and three to buildings. All in all, the 16 NAMAs cover a wide range of sectors.

Looking at the estimated GHG emission reductions reveals a somewhat different picture: While energy efficiency is fairly well represented in the NAMAs, envisaged emission reduction in the transport sector are rather marginal: so far, the most important transport NAMA is the one in South Africa, estimated at emission reductions of 10.6 Mt CO_2-eq. – a share of 2.9% of the four South African NAMAs' combined emission reduction potential. The other transport NAMAs are either marginal in size or not quantified yet. This is due to the nature of these NAMAs as well as the general characteristics of the transport sector. The proposed Peruvian and South African transport NAMAs mostly aim at improving the GHG emissions of vehicles per kilometre rather than addressing fundamentals, such as overall transport volume and the modal split, which are the key drivers for transport emissions. In addition, transport patterns are to a large extent determined by the locally available infrastructure rather than national policies and the relevant decisions are to a large extent taken at the municipal level. Some experts have therefore stated (half-joking, half-serious) that in transport the issue is not only how to promote NAMAs but also how to promote LAMAs – locally appropriate mitigation actions. The NAMA that is being developed for Lao's capital Vientiane, which aims at fundamental transformations via a comprehensive Urban Transport Master Plan, is a step in this direction.

Information Gaps – Needs for a Common NAMA Template

The 16 NAMAs analysed showcase that we are still in a very early stage of development of this new policy instrument. Currently, the NAMAs are quite different with respect to their format: While some of them are still mere sketches or short policy briefs, others are already full-grown studies with extensive background information. The information available in most NAMAs on expected GHG emission reductions, costs, barriers, risks, sustainability benefits as well as on MRV are not yet detailed enough to allow for an assessment whether to fund or not to fund such a NAMA. An analysis of where details are already available and where they are missing may serve as a clue to identify the most pressing issues for developing the conceptual framework for NAMAs further into a ready-to-apply policy instrument. Figure 6 gives an overview of how many of the 16 NAMAs analysed have already spelled out some of the elements, which would need to be included in full-grown NAMA proposals.

Figure 6: Elements Elaborated in Analysed NAMAs



While only NAMAs which specify their actions and targets were included in the analysis, 15 of the analysed NAMAs also clearly define their emission reduction potential. The Serbian NAMA so far only provides information on energy savings for a preliminary list of measures.

Of the 16 NAMAs assessed in this paper, there are seven which generally provide information on more of the essential NAMA elements displayed than the others: The Mexican, the two Tunisian and the four South African NAMAs. The Mexican NAMA is the most elaborate of these. However, the Mexican NAMA does not spell out its financial needs yet. Also, the South African transport NAMA does not specify the basis of its GHG calculations. The Indonesian NAMA is also relatively detailed, it to some extent discusses the basis of its GHG calculations and financial needs.

Apart from the seven frontrunners, the Peruvian NAMA in the waste sector also mentions some sustainability benefits. The only NAMAs referring to potential risks and barriers are the two Tunisian NAMAs and the South African CSP NAMA. So far, only parts of the Mexican NAMA and the Tunisian Plan Solaire are ready for implementation or are being implemented already.

This lack of a common structure of the NAMAs reflects the early stage of the evolving mechanism. Therefore, some caution has to be taken when comparing the different NAMAs: Information on essential NAMA elements is given in some of the preliminary proposals while it is still missing in others. However, the reasons could be manifold and at this stage it is not possible to assess whether this information would have been available in the country (but was just not given) or whether the information would not have been available – which would point to a need for capacity building and institutional support.

Furthermore, some developing countries explicitly state that they would rather wait for international rules to be agreed before going into details, for example on how to MRV. This raises a bit of a chicken and egg problem: Early movers that take the leap and develop detailed proposals are highly valuable for promoting the international negotiations by showcasing concrete examples of what is possible. However, being an early mover does involve high upfront investments as well as the risk that these investments may not pay off.

In this context, a dimension so far mostly neglected in the debate should not be forgotten: as explained above, the Bali Action Plan calls for NAMAs to be conducted "in the context of sustainable development". It would therefore be most useful to include this dimension in any kind of reporting format.

Eventually, it will be necessary to agree on common templates for NAMAs in order to allow for international MRV of NAMAs that seek international support. The sooner international standards are agreed on and made operational, the faster urgently required emission reductions vial NAMAs may take place. Ecofys (2011) has developed a prototype of what a NAMA template could look like. Based on this work by Ecofys and the analysis of the pilot NAMA done in this paper, Table 5 suggests some core elements that should be covered by a UNFCCC NAMA proposal template.

Table 5: Suggested Elements for a UNFCCC NAMA Template

NAMA Template Items	**Comments**
Background	
Past and present situation of the country	Covering general development status and needs as well as climate policy
Past and present situation of the relevant (sub-)sector	
General description of the (sub-)sector	Definition of the relevant sector or sub-sector and its boundaries with general description of the current status of the (sub-)sector
Emissions and reduction potential	Description of current emissions and reduction potential, including identification of data availability and quality
Relevant political and institutional framework	Relevant institutional and legislative framework and non-regulatory measures that are relevant for the NAMA proposal
NAMA Proposal	
Non-technical description of the proposal	Comprehensive description that is easy to understand
Detailed action(s)	Detailed description of each action, their objectives and how are they to be achieved
Estimated emission reductions	Calculation with transparent treatment of all assumptions and uncertainties, including a detailed description and justification of the supposed baseline and a detailed assessment why the proposed baseline is the most likely alternative to the proposed NAMA All assumptions, rationales, data, and calculations used to determine the baseline should be explicitly stated, justified appropriately, and supported by independent sources
Sustainable development benefits	UNFCCC should agree on a list of indicators and safeguards that should be assessed for positive and negative impacts, such as impacts on the local environment, job creation and quality, access to modern energy services, etc.
Need for International Support	
Costs and financing	Clear description of the parameters and assumptions used with a justification of why they are accurate and suitable, including supporting evidence from independent sources The calculations should include a sensitivity analysis using varying framework conditions that are reasonable and relevant for the proposed NAMA

NAMA Template Items	Comments
Barriers and risks	Detailed description of barriers that may prevent NAMA implementation in the absence of international support Claimed barriers should be substantiated by independent sources, such as independent surveys of local conditions or national or international statistics All assumptions, rationales and calculations should be explicitly stated, including references and sources, and should be justified and reasonable
MRV	
MRV provisions	Clear description of the parameters which will be measured and reported and the associated means of measuring, including a justification of why the proposed parameters are suitable to assess implementation and effectiveness of the proposed NAMA Parameters should be specific, measureable, attributable, realistic and timed (SMART) Clear description of the means of implementation of the MRV provisions, including the data management and quality assurance and quality control procedures which are sufficient to ensure that NAMA implementation and achieved emission reductions can be reported ex-post and verified internationally If a NAMA consists of several components, each component needs to be covered adequately

MRV – The Key Challenge for NAMAs

Procedures of how to measure, report and verify (MRV) the impacts of a NAMA are currently not yet established. However, this will be crucial in order to develop NAMAs into an effective and efficient tool for climate protection and sustainable development. Beyond specific technical questions, at this stage, setting up the MRV framework for NAMAs is a highly political process: How to MRV is a function of what purpose MRV is to achieve. One possible purpose would be to simply assess whether the actions are actually taking place. Another, though not mutually exclusive, purpose would be to assess the mitigation impact of those actions. Yet another purpose is to use the results from MRV as basis for planning future actions. Another distinction is whether MRV is undertaken for the purpose of transparency, or for the purpose of generating emission reduction credits which industrialised countries could use for achieving their targets.

The possibilities for MRV strongly depend on which sector is addressed. For instance, the impact of NAMAs on the promotion of renewables is (generally) quite easy to assess. Major prerequisite is the existence of a commonly agreed baseline scenario of the power mix and the subsequent carbon intensity of electricity. By contrast, while it is possible to determine whether a vehicle efficiency standard has been introduced and it is also possible to measure whether transport emissions are declining, it is not possible to know for certain to what extent the decline of emissions is attributable to the policy, or to other influencing factors, such as changing fuel prices. In fact, while there is substantial experience with monitoring and reporting emission reduction policies and measures in both industrialised and developing countries, these reports have so far generally been illustrative rather than comprehensive (Ellis and Moarif 2009).

When the quantification of emission reductions is difficult, one option is to choose indicators other than GHG emissions to MRV the implementation of a NAMA. Options are either to MRV inputs, such as the level of a CO_2 tax or an efficiency standard, or intermediate outcomes, such as the numbers of highly efficient cars or renovated buildings that are achieved by a programme. International donors for NAMAs demand quantifying emission reductions as a key indicator for any MRV metric. However, it bears noting that the limited success of the CDM in areas such as transport and end-use efficiency is not least due to the methodological complexities. In practice, an adequate mix of emission based and non-emission based indicators will probably be the best way forward for the success of NAMAs with respect to both practicability and balancing GHG emission reductions vs. other benefits. Where emission reductions are not calculated in a robust way, no credits may be generated, however. As credits would be used to offset emissions in industrialised countries, otherwise the newly evolving mechanism would lead to an actual increase in global emissions. Therefore, sources for financing NAMAs will have to be combined effectively as to enable the largest benefits possible for both the climate and a sustainable development in developing countries.

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Annex A: Detailed Description of Analysed NAMAs

The first of the NAMAs to be analysed is **Indonesia's** National Action Plan For Reducing Greenhouse Gas Emissions (Rencana Nasional Penurunan Emisi Gas Rumah Kaca, RAN-GRK) for the years 2010 to 2020. It is an integral part of Indonesia's National Development Plan, shall be updated regularly and has the aim to develop mitigation programs and activities as well as to serve as guidance on national and regional mitigation investment. RAN-GRK is being developed to define targets and indicators as well as concrete and practical mitigation actions for various sectors (forestry, peatland, agriculture, energy, industry, transportation, waste). Feasibility studies such as the one on sustainable peatland management by the MOEJ/GEC (Japanese Ministry of the Environment/Global Environment Centre Foundation) Feasibility Study Programme are being conducted. From the information available it seems that Indonesia considers to choose from a great number of national as well as sectoral instruments and policies such as regulations, standards, taxes (or tax breaks for e.g. green technology), charges, informational instruments, subsidies and research and development assistance to achieve emission reductions. The Indonesian NAMA is designed for the national level but also encourages local mitigation actions by ministries, institutions and regional governments. Local governments are in particular called on to design local action plans of GHG emission reduction (RAD-GRK). These should include provincial targets as well as regional baselines, local mitigation scenarios and local MRV indicators and are coordinated in a national NAMAs Registry. Capacity building, additional budget and potential participation in domestic or international carbon markets are suggested to incentivise local governments to contribute to the aims of RAN-GRK. Potential mitigation action are envisaged to be prioritised depending on their cost effectiveness and level of implementability. Still, various issues such as baseline determination, MRV and the revising of mitigation actions need clarification (Motoda 2010; Thamrin 2010; Thamrin 2011).

Regarding the urban transport NAMA in **Lao PDR** and the waste and wastewater management NAMA in **Thailand,** the only information that was available to the authors concerns the ongoing feasibility studies by the MOEJ/GEC. With the collaboration of host country partners, the studies are set out to survey the host countries' current as well as future practices, policies and strategies, acquire relevant data for GHG emissions calculations and propose options for scenario analyses and MRV. Furthermore, the MOEJ/GEC Feasibility Study Programme includes capacity building. In Lao PDR, the feasibility study focuses on the capital city of Vientiane, where it also determines concrete activities suitable for the Urban Transport Master Plan that aims at emission reductions via road network development (e.g. expansion of road width), public transport development (e.g. introduction of BRT system) and traffic management and safety (e.g. construction of traffic lights). Moreover, future traffic volumes are estimated using model simulations. In Thailand, Japanese waste and wastewater management technologies are being transferred such as semi-aerobic treatment methods, composting of organic wastes, the introduction of incinerators (for mega-cities) and the utilisation of methane recovered through anaerobic digesters to prevent open dumping of municipal solid wastes and the draining of organic wastewater into open lagoons (Motoda 2010).

Information on the nation-wide **Mexican** NAMA on Energy Efficiency in Residential Buildings is available in great detail. The NAMA includes specific measures and activities as well as national policies and proposes four different scenarios of activities boosting the existing "Ésta es tu casa" and "Vivienda eficiente e hipotecas verdes" programmes. (Wehner et al. 2010) These programmes provide subsidies for energy efficiency measures in low-income housing and an additional credit line for new houses that use sustainable and energy efficient technologies respectively. The enhancement of the programmes can be achieved by including more houses in the programme in the same period, technology up-scaling or a combination of these mitigation options. Technology up-scaling refers to the implementation of more ambitious efficiency standards and/or the use of technologies that have not previously not been covered such as more efficient air conditioning (AC) and refrigerators as well as photovoltaics (PV). Further mitigation options are seen in the medium to long term transformation of the programmes into an integrated urban plan with mandatory building codes. Aside from efficiency standards and their enforcement, subsidies as well as capacity building are to incentivise emission reductions. As the NAMA builds on existing programmes, some financial flows have already been established and energy surveys of beneficiary households have been conducted. These can be used for the enhanced programmes. As of April 2010, the NAMA was in its preparatory phase. Implementation and operation are expected to start before the end of 2012 (Wehner et al. 2010).

In its second national communication, **Peru** has identified NAMAs that could be developed nation-wide in the energy, transport, industry and waste sectors as well as in forestry and land use. For these NAMAs targets with dates as well as focal points for incentives are presented. Some of the targets are still rather general and it is yet to be determined how they shall be reached (MINAM et al. 2010).

Thus, the **transport** NAMA sets the targets to modernize the vehicle fleet, optimize the public transport system and promote that 5% of the vehicle fleet should be hybrid until 2012. Furthermore, the system of the national state road transport shall become more efficient by 2017 and the efficient steering of vehicles promoted. Incentives are suggested to be considered to improve the efficiency of inspection mechanisms, the promotion of natural gas, the improvement of fuels and vehicles as well as regulatory policy in transport (MINAM et al. 2010).

The NAMA in the **energy sector** includes somewhat more detail concerning measures. Its aims can be classified into higher shares of renewable energy (5% plus 65% hydroelectricity in the national grid by 2017, increase rural electrification by 10% with electricity from renewable energy by 2017, use of renewables in agriculture and mines, bioclimatic buildings) and energy efficiency measures (combined cycles in 60% of electricity generating companies, improvements in rural kitchens, commercial cooking, urban and public illumination, implementation of an energy efficiency program in the public sector). Furthermore, the NAMA suggests to improve fuel quality, substitute 15% of liquid fuel consumption in government vehicles with natural gas, increase the use of natural gas in power generation and substitute electric motors in various sectors (MINAM et al. 2010).

The **Peruvian industry** NAMA aims at energy efficiency in the cement, steel and brick industries as well as fishing boats and at the substitution of fuel consumption in processing plants. Thus, it prioritizes the targets of controlling the implementation of the environmental management plans and environmental regulations relevant for GHG emissions in industry and fishery, energy efficiency improvements of at least 7% in industrial and fishery boilers, the establishment of obligatory technical checkups for fishing boats, to reach a share of 50% of pozzolanic cement and to switch to natural gas in the cement industry in the Junín and La Libertad regions (MINAM et al. 2010).

Peru considers its NAMA on **forestry and land use** to be the most important of its NAMAs because of its relevance for Peru's national GHG inventory, biodiversity as well as erosion and flood prevention. It proposes considering mitigation options such as an information and control system for forests, CDM reforestation projects as well as the emerging Reducing Emissions from Deforestation and Degradation (REDD) mechanism. Furthermore, it names the possibilities to use international financial instruments to increase the value of existing forests, forest conservation in Natural Protected Areas, integrated land management and the prevention of illegal deforestation. The NAMA does not specify the further content of these mitigation options (MINAM et al. 2010).

Peru's NAMA in the **waste sector** predominantly targets the urban areas. It suggests to trigger the adequate treatment, recycling, composting and final disposal of solid waste, to implement management and treatment programmes for sewage and to promote energetic use of agricultural residues such as biomass using biodigesters, biomass boilers etc. No further elaborations are made on concrete actions (MINAM et al. 2010).

Serbia is currently developing energy efficiency NAMAs under the "Capacity Development Project on Nationally Appropriate Mitigation Actions (NAMAs)". This project is a cooperation between the Japan International Cooperation Agency (JICA) and the Serbian authorities. Project activities were defined in June 2010 and agreed on in August 2010. The duration of the project is until the end of February 2012. The project is set out to develop capacity on NAMAs, their promotion and MRV and to determine MRVable appropriate mitigation actions by assessing financial needs and the time necessary for their realization. A NAMA long list shall be developed based on existing policies, strategies and plans from which a NAMA shortlist shall be extracted based on needs, priorities and feasibility of MRV. Energy efficiency was chosen as priority area. Detailed information will be compiled for each NAMA such as the NAMA's objective and activities, time schedule, responsible organizations, funding source, technical and financial feasibility, emission reduction potential, MRV and challenges.

Serbia acknowledges the importance of a favourable regulatory framework and financial and other stimulating measures for energy efficiency and renewable energy systems (RES). Already, a detailed list with numerous concrete energy efficiency measures including their duration and expected emission reductions for residential buildings, public and commercial services, industry, transport and energy is available. Measures cover a wide range of activities from improvement or replacement (outside doors, windows, incandescent light bulbs, public lighting systems) to the promotion of energy efficient electrical appliances and energy service companies and heating (energy efficient equipment for biomass combustion and heating equipment, e.g. heat pumps, solar collectors, individual metering). Also, new rules of building design and construction as well as minimum energy performance standards and certificates of building energy performance including regular inspection and maintenance of boilers, heating systems and air-conditioning systems are listed. An Energy Efficiency Fund to support energy efficiency and RES projects as well as energy efficiency and RES credit lines are being established. For public and commercial buildings, an energy management system with obligatory energy savings of about 1% per year is being introduced and energy efficiency will be regarded in public procurement and a special energy efficiency project targets public buildings-schools, hospitals and public welfare institutions. Moreover, an agreement regarding energy efficiency was made with the industry, energy audits, energy management and incentive tariffs for highly efficient cogeneration in industrial companies introduced.

In the transport sector, European standards for energy efficiency, road transport fleet management and financial and regulatory incentive mechanisms for the replacement of existing fleets are used and an efficient transport system created. Also, driving and vehicle purchasing behaviour are targeted. In the energy sector, new thermal capacities using lignite are listed as well as replacements, revitalization and modernization of the existing thermal capacities (e.g. steam turbines, condensation facilities, block cooling systems, boilers, auxiliary equipment) (Božanić 2010; Kawanishi 2010; Spasojević 2010).

In **South Africa,** four studies have been conducted on behalf of the Department of Environmental Affairs on potential NAMAs employing concentrating solar power (CSP), wind power, electric vehicles and energy efficiency in low-income housing. While the further use of the studies on CSP, wind power and electric vehicles and their possible implementation have yet to be determined, an integral part of the NAMA **"Financing upgraded energy specifications of new low-income housing",** the National Sustainable Settlements Facility (NSSF), is already in an advanced design phase: The Development Bank of Southern Africa has already decided to host the NSSF which is proposed to establish a centralised revolving fund to allocate incremental upfront capital for solar water heaters and thermal efficiency measures in a million of new-build low-income houses by 2020 as well as money for maintenance. The NSSF's responsibilities are defined in detail: It would be in charge of the system to access energy subsidy finance as well as for carbon and/or energy saving claims and facilitate preferential loans as well as guarantees. These activities are essential for the financing of the NAMA (ERC 2010d; Winkler 2010).

The "**NAMA Investment Plan 5 GW Concentrated Solar Power by 2020"** proposes to promote CSP technologies (initially parabolic trough, in later years mainly central tower technology). The NAMA suggests to cover incremental costs compared to the BAU of modern coal-fired power plants with international support. For its implementation, two routes are named: support through the (existing) national feed-in-tariff system (REFIT). As this depends on regulatory framework for independent power producers (IPPs) which still has to be adapted for this purpose, an alternative route is offered: establishment of a solar park. In the first set-up (feed-in tariff) key implementers would be the national Department of Energy (DoE) with the National Energy Regulator. In the second set-up (solar park) key implementers would be the DoE together with the Clinton Foundation, which has been pushing the solar park initiative in the past already. The NAMA could be realized in a preparation phase (2011-2012) and a rollout phase (2013-2020) with the first plant coming online by 2015 and the full 5GW being installed in 2020 (ERC 2010b; Winkler 2010).

The NAMA **"10GW of Wind Power up to 2020"** proposes funding mechanism for a programme to rapidly develop wind energy in South Africa. For this NAMA, concessional finance shall enable the national utility Eskom to install 3.500 MW of wind power while South Africa's national feed-in tariff REFIT would trigger the installation of another 6.500 MW of wind power by IPPs. REFIT has to be adapted, a funding agency and a fund established. As with the CSP NAMA, necessary institutional arrangements include the incorporation of the investment plan into South Africa's IRP and the establishment of contracting arrangements for IPPs. The NAMA proposal includes a deployment schedule for the capacity to be installed (ERC 2010a; Winkler 2010).

The NAMA investment plan **"Rollout of electric private passenger vehicles in South Africa"** centres on the production and use of electric vehicles. Electric vehicles are expected to reach a share of 10% of private passenger cars by 2015, of 27% by 2020 and of 60% by 2030. To achieve these aims, government support concerning regulation and infrastructure is required. Electricity for the vehicles will come from the national grid which is largely coal-fired. This leads to the question whether it will really be possible to achieve emission reductions with this NAMA. Apart from this information on future activities, the investment plan so far focuses on an illustration of ongoing activities and the institutional framework, e.g. the inclusion of electric vehicles in South Africa's second Industrial Policy Action Plan (IPAP2), the establishment of an interministerial committee to support the commercialisation of electric vehicles, the new carbon tax and the development of electric vehicle models designed in South Africa (ERC 2010c; Winkler 2010).

The two NAMAs in **Tunisia we**re selected from a short list of potential NAMAs in a national stakeholder process based on the criteria local commitment, MRVability, clear determination of financing needs, potential leverage of private investments and sustainability benefits. Detailed information including funding proposals is available for both of these NAMAs.

The first is the Tunisian **Plan Solaire** which was developed in 2009 by the national agency for energy conservation endorsing Tunisia's aim of becoming an international hub for energy production and exportation (MEDD 2010). The Plan Solaire includes 40 concrete public-private projects of which parts are fully financed and have already been implemented. The 40 projects of Plan Solaire are divided into ten components with specific actions which are described briefly. Responsible institutions as well as a timeframe are identified for each action. The latest project components shall be finalised in 2016. The projects cover

- solar thermal projects (residential, multi-family houses, tertiary and industry, swimming pools),
- solar electricity generating projects (grid-connected PV, PV pumping, rural energy, PV public lighting, PV for tank stations, PV for export, PV plant, ISCC, CSP),
- other solar projects (solar cooling food industry, solar drying, PV panel production),
- wind energy (wind parks),
- energy efficiency (rational utilization of energy of appliances, buildings and industry (refrigerators, positive energy buildings, insulation of roofs, energy saving lamps, industry)),
- energy efficiency in transport (driving skills, introduction of innovative information technology for public vehicle fleets),
- projects on energy efficiency combined with the integration of renewable energies (buildings and districts (RE for oasis, eco-village, train-station),
- the valorisation of gas and other combustible resources (poultry, landfill gas, biogas),
- infrastructure (ELMED electric interconnection linking Tunisia and Italy), and
- studies (feasibility studies, project management, pilot projects) (MEDD 2010).

The proposal for the second Tunisian NAMA on **methane prevention through sustainable biowaste treatment** would be specifically developed as a NAMA. In contrast to the Plan Solaire, no project concept existed prior to the national stakeholder process conducted in Tunisia. While existing CDM projects in the Tunisian waste sector focus on biowaste from private households, this NAMA covers agricultural and market waste as well as residues from food production, food preparation, public parks and sewage sludge. The differentiation of the waste streams from the ones covered by CDM projects is challenging but important to prevent double-counting. Composting and anaerobic digestion are chosen as the most favourable options of biowaste treatment as they can be used for several types of biowaste and perform well regarding their organic degradation processes and technical procedures. The waste streams are divided into subtypes which are described in detail and proposals are made for the appropriate treatment of the waste stream subtypes. A national concept is to be designed for this NAMA which shall be detailed and well-coordinated and include a stakeholder process as well as the adaptation of the legislative framework (where required). The technical NAMA components (construction of composting and anaerobic digestion plants) are suggested to be complemented by studies (feasibility, finance, cost-effective measures) and their review, research, capacity building, training, awareness building, norming and standardisation. For these components, specific actions as well as a timeframe and responsible government institution(s) are clearly identified. Actions are divided into different parts providing clear guidance for the NAMA's implementation, e.g. a study aiming at the identification of cost-efficient emission reduction measures for the biowaste in question for different regions of Tunisia contains the tasks of

- determining the study's scope,
- preparing the tender,
- tendering the study,
- developing the study and
- evaluating the study results.

The proposal points out that more detailed steps for the realisation of the Tunisian NAMA on biowaste treatment have to be developed after the proposal is agreed upon by a governmental body (MEDD 2010).

Annex B: Estimated Impact of NAMAs on GHG Emissions

Table 6: Estimated Impact on GHG Emissions

	Estimated Impact on GHG Emissions	
	National Target or Emission Reductions below BAU	Basis for GHG Calculation
Indonesia – RAN-GRK	By 2020: -26% without international support -41% with international support	Accumulation of aggregate baselines of each sector determined using mitigation scenarios which contain abatement cost calculations
	Absolute Emission Reduction in Time Period (t CO2-eq.)	Basis for GHG Calculation
Indonesia – RAN-GRK	-26% without international support by 2020: Forestry and Peatland: 672,000,000 Waste: 48,000,000 Agriculture: 8,000,000 Industry: 1,000,000 Energy and Transport: 38,000,000 Total: 767,000,000 -41% with international support by 2020: Forestry and Peatland: 1,039,000,000 Waste: 78,000,000 Agriculture: 11,000,000 Industry: 5,000,000 Energy and Transport: 56,000,000 Total: 1,189,000,000	Accumulation of aggregate baselines of each sector determined using mitigation scenarios which contain abatement cost calculations
Lao PDR – Urban Transport	2012-2020: 440,000	n/a
Mexico – Energy Efficiency in Residential Buildings	2011-2020: Scenario 1: 7,900,000 Scenario 2: 27,100,000 Scenario 3: 5,400,000 Scenario 4: 15,900,000	Baseline scenario
South Africa – Energy Specifications New Low-Income Housing	2011-2020: 30,000,000 2011-2030: 95,000,000	GS CDM methodologies which use a suppressed demand approach
South Africa – CSP	2011-2020: 232,000,000 2011-2030: 663,000,000 2011-2050: 1,518,000,000	BAU scenario, no further elaboration
South Africa – Wind Power	2011-2020: 92,000,000 2011-2030: 329,000,000 2011-2050: 469,000,000	BAU scenario, elaborations on systems modelling methodology used and assumptions
South Africa - Electric Vehicles	2011-2020: 10,600,000 2011-2030: 92,300,000 2011-2050: 450,000,000	n/a
Thailand – Waste and Wastewater Management	2011-2020: 6,500,000 – 11,500,000	n/a

	Estimated Impact on GHG Emissions	
	Absolute Emission Reduction per Year (t CO_2-eq.)	Basis for GHG Calculation
Tunisia – Plan Solaire	Solar thermal projects: 72,648 Solar electricity generating projects: 204,870 Other solar projects: 1,430 Wind energy: 528,530 Energy efficiency: 576,070 Energy efficiency in transport: 52,210 Valorisation: 94,130 Infrastructure: - Projects on energy efficiency combined with the integration of renewable energies: 12,370 Studies: 235 Total: 1,542,493	n/a
Tunisia – Biowaste Treatment	550,000-800,000	n/a
	Mixed Approach: Absolute Emission Reduction in Time Period and per Year (t CO_2-eq.)	Basis for GHG Calculation
Peru – Transport Sector	Modernizing vehicle fleet (by 2012): 4,337,515 Optimizing public transport (by 2012 per day): 1,761 5% of vehicle fleet hybrid (by 2012): 981,415 National state road transport efficiency (by 2017): 489,967 Efficient steering of vehicles (5 years): 3,000,000	n/a
Peru – Energy Sector	5% renewables in national grid (by 2017): 1,875,691 65% hydropower in national grid (by 2017): n/a 60% electricity with natural gas and combined cycle (by 2017): 2,074,947 Rural kitchen improvements (by 2012, per person per year): 660 Urban illumination (by 2012, per month): 12,392 Rural electrification with 10% renewables (by 2017) and efficient commercial cooking (by 2012): 3,932 Renewables in agriculture (by 2017): n/a Renewables in mines (by 2012): 15,474 Public lighting (by 2017 per month): 0,5 Energy efficiency in the public sector (by 2017): n/a 15% natural gas in government vehicles (by 2017, per vehicle per year): 1.24 Bioclimatic buildings (by 2017): n/a Inclusion of GHG in index of harmfulness (by 2017): n/a Substitution of electric motors (per year): 18	n/a
Peru – Industry Sector	Environmental management plan in fishery and industry (by 2017): n/a 7% of efficient boilers (by 2017): 475 Obligatory technical checkups for fishing boats (by 2017): n/a 50% pozzolanic cement (by 2017): n/a Natural gas in cement industry (by 2017 per year): 220,268	n/a
Peru – Forestry and Land Use	Afforestation and reforestation of 9,2 million ha (by 2017): capture: 644,000,000 Forest conservation, 54 million ha (by 2030): 1,278,607	n/a
Peru – Waste Sector	n/a	n/a
	Absolute Energy Savings per Year (Mtoe)	Basis for Calculation
Serbia – Energ. Eff.	Extract of preliminary list: 0.77	n/a