Università Ca'Foscari Venezia

DOTTORATO DI RICERCA IN SCIENZA E GESTIONE DEI CAMBIAMENTI CLIMATICI

SCUOLA DOTTORALE INTERATENEO IN GLOBAL CHANGE SCIENCE AND POLICY

(A.A. 2009-2010)

ENHANCED ACTION ON MITIGATION IN THE FUTURE CLIMATE CHANGE REGIME: IMPLICATIONS OF THE USE OF STANDARDIZED MULTI-PROJECT BASELINES FOR THE IMPROVEMENT OF PROJECT-BASED MECHANISMS

SETTORI SCIENTIFICO DISCIPLINARI DI AFFERENZA: SECS-P/01

TESI DI DOTTORATO DI FRANCESCO PRESICCE (MATR. 955467)

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List of Acronyms and Abbreviations

AWG-LCA	Ad-hoc Working Group on Long Term Cooperative Action
AWG-KP	Ad-hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
AR4	Fourth Assessment Report of the IPCC
BAU	Business as usual
BOD	Biological Oxygen Demand
CCAR	California Climate Action Registry
CCS	Carbon Capture and Storage
CCX	Chicago Climate Exchange
CER	Certified Emission Reduction
CO_2 eq	CO_2 equivalent
COD	Chemical Oxygen Demand
COP	Conference Of the Parties
COP/MOP	Conference of the Parties acting as Meeting of the Parties
CDM	Clean Development Mechanism
CMP	COP/MOP
CP	Commitment Period
CSI	Cement Sustainability Initiative
DFID	Department For International Development (UK)
DNA	Designated National Authority
EB	Executive Board
ERU	Emission Reduction Unit
FAR	First Assessment Report of the IPCC
GHG	Greenhouse Gas
GGAS	New South Wales GHG Reduction Scheme
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
IET	International Emission Trading
IETA	International Emission Trading Association
IPCC	International Panel on Climate Change

IRR	Internal Rate of Return
JI	Joint Implementation
JISC	Joint Implementation Supervisory Committee
LCDS	Low Carbon Development Strategies
LCDP	Low Carbon Development Plans
LDCs	Least Developed Countries
LFG	Landfill Gas
LOA	Letter of Approval
LULUCF	Land Use, Land Use Change and Forestry
MSW	Municipal Solid Waste
NAMA	Nationally Appropriate Mitigation Action
PIN	Project Idea Note
PDD	Project Design Document
PoA	Programme of Activities
REDD	Reducing Emissions from Deforestation and Forest Degradation
RGGI	Regional Greenhouse Gas Initiative
SAR	Second Assessment Report of the IPCC
SBI	Subsidiary Body for Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SIDS	Small Island Developing States
TAR	Third Assessment Report of the IPCC
UNFCCC	United Nations Framework Convention on Climate Change
WWTP	Wastewater Treatment Plant

Executive summary

New approaches to enhance mitigation actions are currently being discussed in the context of the UNFCCC, in order to set the stage for the future of the Kyoto Protocol and for a larger involvement of all countries in emissions reduction policies.

One of the key issues under consideration is the improvement of project-based mechanisms. These mechanisms, designed to enhance sustainable development and technology transfer in developing countries, have often been argued not to deliver on such objectives. Some concerns have been raised over the environmental integrity of some project types (including the determination of additionality), the regional distribution of project activities (some regions have attracted poor investments), project-type distribution (some projects, such as renewable energies have not fully benefited from the mechanisms) and complexity of the project cycle. Specific options to improve the project based mechanisms have been proposed at various stages during the negotiations, including the establishment of new sectoral mechanisms and the enhancement of the existing Joint Implementation (JI) and Clean Development Mechanism (CDM).

A specific option, currently discussed in UNFCCC negotiations, is the use of standardized approaches for the determination of baselines (emission scenario in absence of the project activity) and demonstration of additionality.

A standardized baseline is a baseline applicable to multiple projects in one sector (same methodology applicable to “similar” types of projects). The use of this kind of baselines may contribute to reduce transaction costs, increase transparency, ensure better predictability of emission reductions and allow faster preparation of

PDDs. Yet, its use may not be appropriate for all types of projects, it might be data intensive and could require significant upfront costs and efforts to be developed.

Countries are discussing various standardization approaches, whether their use should be mandatory or optional, the possible scope of their application (“project activity types”, “sectors” or “sub-sectors”), their geographical scope (application at global, regional, national or sub-national level), time dependence issues, etc. Since different technical options can have significant consequences in terms of project feasibility and generation of carbon credits, negotiations are often difficult and sometimes driven by political choices.

Some issues are particularly controversial. For instance, while standardized baselines may reduce the transaction costs associated with the project cycle, on the other hand they might result in less accuracy, with the risk of overcrediting and compromising environmental integrity. Conservativeness of baselines might be a solution, although this might make the CDM too “selective” in generating credits and attracting investments.

In some cases (e.g. projects with a large magnitude of emission reductions), project specific baselines may be more appropriate, because of the need of meticulous calculation of emission reductions. On the contrary standardized baselines could be more appropriate for smaller projects, because the high transaction costs associated with producing a baseline scenario may discourage potential investors.

A number of these issues have been examined in the present study, exploring the links among possible negotiating evolutions and consequences on project development. Practical case studies were considered in the Northern African Region, taking into consideration the project category of methane capture and use, in order to assess possible methodology evolutions and standardization.

Methane capture offers interesting opportunities for both energy production and carbon revenues. Yet, very often UNFCCC methodologies are not well suited for local technologies and practices, especially for projects located in rural areas. In fact, calculation of baseline emissions and monitoring requirements represent a significant barrier for potential investors.

Following a project scouting exercise in Morocco, a number of project opportunities were identified in the wastewater sector. The feasibility of these projects was assessed and the UNFCCC methodology AMS.III.H was applied for the determination of the baseline.

This methodology already contains some elements of standardization (default values, benchmarks for greenfield projects, etc.), yet its diffusion has been successful only for industrial wastewater projects, with easier data availability and monitoring equipments already installed. Testing such methodology on the selected project opportunities highlighted some issues and limits of application, both on technical definitions (e.g. “lagoon” definition) and on other requirements (provision of historical data, application in conjunction with other methodologies, additionality tests).

Provision of historical data represented one of the hardest barriers, both in the methodology itself and in the application of the “emission factor tool”, required to calculate the electricity delivery component in case of methane utilization for energy production. In this regard, uncommon grid delivery layouts (with onsite diesel generators, very frequent in rural areas) may complicate calculations.

Another major barrier is linked to monitoring and verification. A very high number of parameters are required by the methodology (e.g. methane content at different locations), with high risks for the phases of verification and issuance of credits.

Following methodology application on the cases studies and examination of other applications (also in other geographical areas), standardization can be recommended in the following areas:

- calculation of emissions and monitoring of energy use component: AMS.III.H should specify directly how the energy baselines/monitoring would be applied;

- monitoring and verification: the number of monitoring parameters should be reduced;
- calculation of the COD removal efficiency: a simpler approach, based on IPCC guidelines, should be adopted.

In general, for underrepresented regions, the methodology should return to the original intention of being a practical and manageable methodology. Calculations in PDDs should be simplified so as to increase certainty on project registration and CERs generation; monitoring should be easier, so as to increase certainty of delivery and issuance of CERs.

Some of the difficulties highlighted for AMS.III.H are common to other UNFCCC methodologies. In fact, some of them are becoming more and more complicated in order to deal with micro-aspects that could mean a micro-difference in emission reductions. There should be some recognition that errors leading to a minor difference in percentage of emission reductions should be deemed acceptable in underrepresented regions, where technology developments or other environmental benefits will outweigh such difference.

The Executive Board is already working on the improvement of existing methodologies, including through standardized approaches. Following the recent COP/MOP6 decision on “further guidance relating to the clean development mechanism”, there is a stronger mandate for the Executive Board, with a number of objectives and principles agreed to by Parties. Yet, next UNFCCC sessions should increase clarity on a number of issues and pave the way for fully exploiting the potential of standardization.

General remarks on how to move forward in the international process are the following:

- Geographical distribution should be kept as the main priority for development of standardized baselines;

- Hybrid approaches, already successful in some experiences outside the UNFCCC, might be the right solution in some cases, where a certain degree of standardization still needs to be adapted to project specific conditions;

- Conservativeness, while being a very important issue, should not be the main driver in under-represented regions. Some degree of overcrediting should be deemed acceptable if it leads to a deeper penetration of a certain technology, with indirect benefits in terms of emission reductions and sustainable development.

The issue of standardized baselines can also be linked to other negotiations topics. For instance, within "low carbon development strategies or plans" (a recently introduced concept in UNFCCC negotiations) countries could receive support for areas where the CDM is not successful and related barriers could be addressed in the standardization exercise. Such elements should emerge in the overall work to identify NAMAs (Nationally Appropriate Mitigation Actions) and distribute finance.

In addition, given the current status of negotiations and future perspectives of the CDM, the "non-Kyoto" hypothesis cannot be neglected. The carbon market may evolve towards multiple approaches and the establishment of linkages among different markets. Standardized rules and criteria for baseline and additionality may be a means to facilitate this process.

1. Enhanced Action on Mitigation in the Future Climate Change Regime

The Kyoto Protocol and its flexible mechanisms

The existing international regime to combat climate change is provided by the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol.

The UNFCCC includes the ultimate objective of stabilizing greenhouse gas concentrations at safe levels, along with the principles of precaution, cost-effectiveness and common but differentiated responsibilities. It also sets reporting obligations on emissions and national measures to combat climate change, as well as commitments for assistance and technology transfer to developing countries.

The Kyoto Protocol provides quantitative commitments by developed countries to reduce their emissions, in the form of absolute emissions targets, applicable to six different greenhouse gases[1] for a five-year commitment period (2008 – 2012), compared to 1990 levels. The Protocol established a collective GhG emission reduction objective of 5.2% for the "developed" (Annex I) Countries, split in individual emission limitation or reduction objectives. It entered into force in 2005, when a sufficient number of countries (responsible for at least 55% of global 1990 emissions) ratified the Protocol. Parties are also allowed to meet their targets through sinks activities such as reforestation and forest management, as well as by means of the "**Flexible Mechanisms**".

[1] Carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluorocarbons and perfluorocarbons.

These mechanisms (International Emissions Trading (IET), Clean Development Mechanism (CDM) and Joint Implementation (JI)), were introduced to give a degree of flexibility to Parties in meeting their targets, in addition to domestic measures.
The CDM and JI are also known as “project-based mechanisms”, since they allow Parties to fulfill their targets through international projects, if this proves to be more cost-effective than domestic measures. JI enables developed countries to meet their targets by means of mitigation projects in other developed countries, while the CDM regards emission reduction projects in developing countries. Both mechanisms allow the generation of carbon credits or units (Certified Emission Reductions in the case of the CDM and Emission Reduction Units in the case of the JI). Credits can be used for compliance with Kyoto targets or can be traded in the market.

The CDM, in particular, was designed with the additional aim to foster technology transfer and sustainable development in developing countries, since it created an additional driver for private sector investment. This mechanism has indeed generated a huge market, with a considerable volume of certified emission reductions. In January 2011, over 5600 projects could be counted in the CDM pipeline, with more than 2700 already registered. The number of issued Certified Emission Reductions (CERs) amounted to nearly 500 million and the overall volume expected to be generated by the end of 2012 reached 2,7 billion[2].

As of today, based on the latest UNFCCC accounting report [64], the group of Annex I countries having ratified the Kyoto Protocol seems to be in track, collectively, to meet its overall emission reduction goal. Yet, this is also due to the large emission reductions achieved by the economies in transition. In addition, the United States (former main emitter) has never ratified the Protocol and some advanced developing countries (in particular China, currently the world’s largest emitter), are not covered by any emission limitation requirements. Therefore, the

[2] UNFCCC data [64], updated 1 January 2010

Protocol alone is not a sufficient instrument to achieve the objective of GhG stabilization at safe levels.

The global community is aware of the need of enhanced mitigation action, as well as of its increasing urgency based on most recent IPCC evidence. In addition, as the end of the first “commitment period” approaches, continuity of climate change mitigation policy in the post-2012 period could be compromised. Therefore, a negotiating process is currently underway, seeking a global response for future climate change action. Discussions involve both new mitigation approaches and the improvement of the existing mechanisms. The CDM for instance, has generated a successful market but also a lot of criticism. Several authors ([6], [11], [14], [42], [45], etc.) have been arguing that CDM has not been successful in delivering on its objectives, for various reasons. Therefore, the improvement of its rules, methodologies and procedures are fully part of post-2012 discussions.

The CDM project cycle

In order to generate Certified Emission Reductions under the Clean Development mechanisms a number of formal steps need to be fulfilled. The overall formal process is generally referred to as “CDM project cycle”.

The project cycle starts with the identification of a potential emission reduction activity, which is formalized within a “Project Idea Note” (PIN), giving a basic concept of the activity. This is functional to checking project compliance with sustainable development criteria of the host country. Once the project enters the design phase and undergoes feasibility studies, a Project Design Document (PDD) is prepared, according to a standard UNFCCC format. The PDD includes, inter alia:

- The determination of the “baseline scenario”, representing the GhG emissions that would occur in the absence of the proposed project activity. The calculation needs to follow one of the approved UNFCCC methodologies. In alternative, a new methodology can be submitted to the UNFCCC and approval of such methodology can be requested;

- The demonstration of "additionality", whereby the proponent needs to prove that the project would not have occurred in a "business as usual" scenario, without the CDM;
- A monitoring methodology, addressing measurement of actual emission reductions once the project has been implemented.

The final PDD needs to be submitted to an independent body, accredited by the UNFCCC as "Designated Operation Entity" (DOE). The DOE is entitled to evaluate the project against the requirements of the CDM and to issue a report whereby the project is "validated". The DOE can also ask for additional information or clarifications from the applicant. Following validation, the applicant can ask the Host Country's DNA to issue a "Letter Of Approval (LOA)" for the project. Apart from the PDD and the validation report, the applicant will have to submit an approved environmental impact assessment of the project (if required by law) and a written statement that an yearly report on monitoring, certification, and issuance of CERs will be submitted.

Upon issuance of the LOA, a request for registration is submitted to the Executive Board, which reviews the proposal and may ask for additional information or make an invitation for public comments. Registration by the Executive Board is the formal recognition that the project is accepted as a CDM project and will be entitled to generate credits.

After project implementation, verification is required by a DOE (different from the DOE issuing the validation report), in order to demonstrate that emission reductions are consistent with the PDD. This is done according to approved monitoring methodologies. On an annual basis, a certification report produced by the DOE will quantify the actual emissions reductions of the project. On the basis of the verification report, the Executive Board can issue CERs, which will be credited to the project developer's registry account.

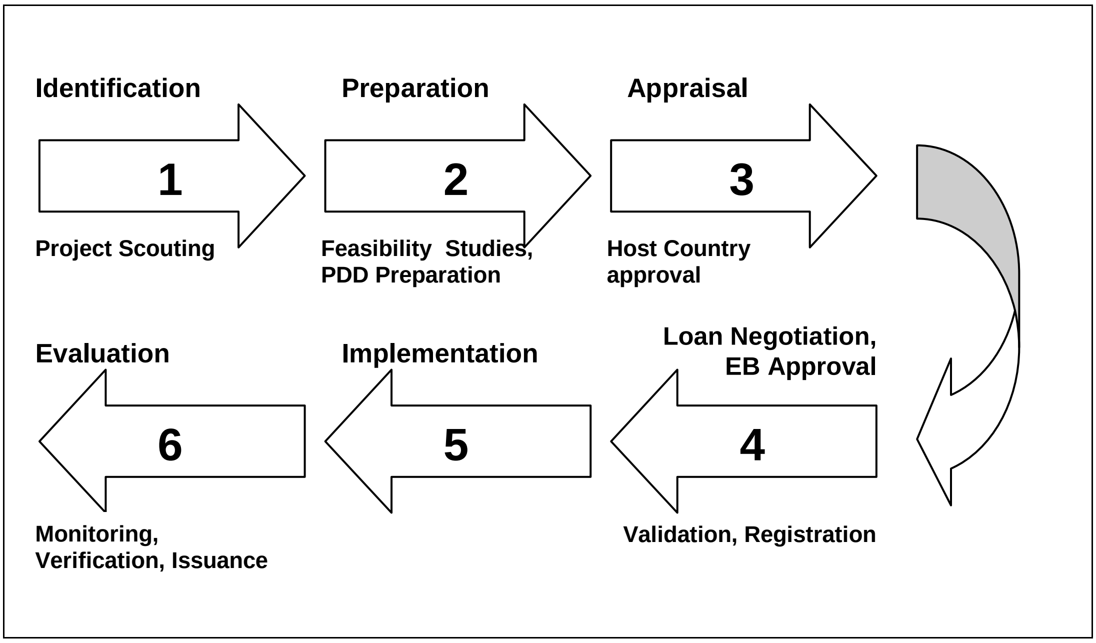

Fig. 1.1: CDM project cycle

Limits of the Flexible Mechanisms

Complexity of the project cycle is one of the problems of the current CDM scheme. This is widely recognized by several studies (Ellis and Kamel [14], Hargrave et al. [19], Broekhoff [6], etc.) and is part of UNFCCC discussions.

The project cycle is a complicated exercise, normally requiring a significant amount of time, with no direct control of the investor over the steps of host country and Executive Board approvals. Preparing a PDD can be a costly task, especially in the phase of collecting data and information for elaborating a baseline scenario and demonstrating additionality. In many cases, especially for small and medium enterprises, applicants do not have sufficient knowledge or relevant expertise to manage all the phases of the cycle. External consultancies are therefore hired to follow these aspects, with additional costs for the project.

Considering the uncertainty over the final CDM eligibility, in the case of small projects CERs revenues might not be sufficient to justify the investment risk.

In addition, a structural problem lies with the phases of validation and registration of a project, with DOEs and the Executive Board being overburdened with a huge number of applications. In fact, for each PDD a detailed and project-specific review is needed, especially over the determination of the baseline scenario and the demonstration of additionality.

Criticism on the current CDM structure is not limited to its project cycle. The CDM is often criticized for not having delivered on its sustainability objective. Some project types, such as HFC-23 and N_2O destruction projects, are considered “low hanging fruits” for industrialized countries, giving them the possibility to implement low cost projects generating huge volumes of credits. This results in a large portion of the overall volume of CERs being generated simply capturing and destroying gases with high global warming potential. Several authors (e.g. Sutter and Parreño [49], Schneider [45], etc.) have blamed these projects to merely shift the location at which emissions reductions are achieved, without delivering additional sustainable development benefits and without catalyzing any change in the host country's transition towards a low-carbon economy. In addition, the amounts of credits generated by these projects influence the market with excessive supply, thus decreasing the value of the single credit. This can limit the impact of the mechanism on other projects, generating smaller amount of credits but ensuring more environmental benefits. According to literature (Schneider [45], Ellis and Kamel [14], etc.) and project experience, CDM projects such as renewable energy plants are characterized by a low increase of their internal rate of return, which makes difficult investments to be justified only by the carbon market added value. These projects, despite being beneficial for the environment and sustainable development, find little advantage in the CDM architecture which does not monetize those benefits.

Looking at CDM statistics [64], an uneven distribution can be noted not only for project-types, but also for host countries and regions. Indeed, most projects have been located in advanced developing countries, where the level of industrial development has offered the biggest opportunities in terms of project feasibility and profitability. Also in terms of capacity, UNFCCC methodologies are often more easily applicable where data availability and technical capabilities are more developed. Out of more than 2700 registered projects, almost 1750 are located in China and India[3]. Therefore, it is questionable whether the mechanism has really fulfilled, until now, its original objective of facilitating technology transfer to developing countries: apparently, most projects have been implemented where technology already existed and opportunities for achieving emission reductions were easier.

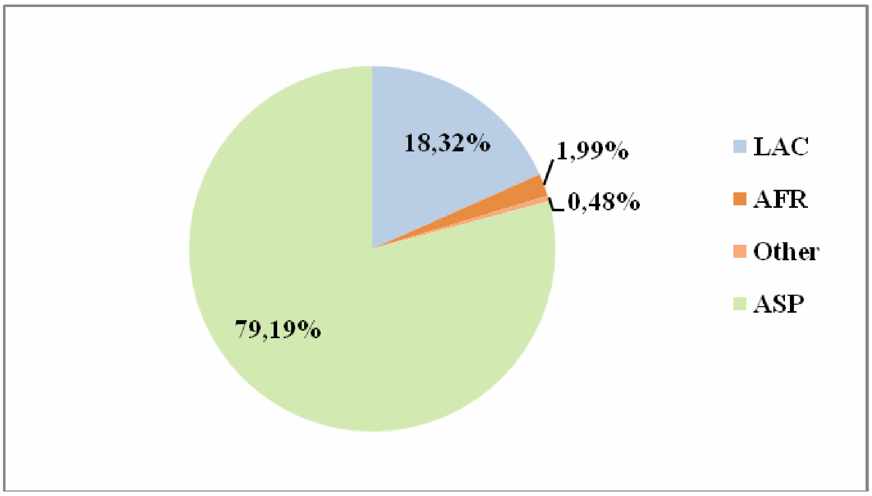

Fig.1.2: Regional distribution of registered projects (updated 1 January 2011)

Region	Number of projects
Africa	54
Asia and the Pacific	2143
Latin America and the Caribbean	496
Other	13

Table 1.1: Regional distribution of registered projects (updated 1 January 2011)

[3] UNFCCC data [64], updated 1 January 2011

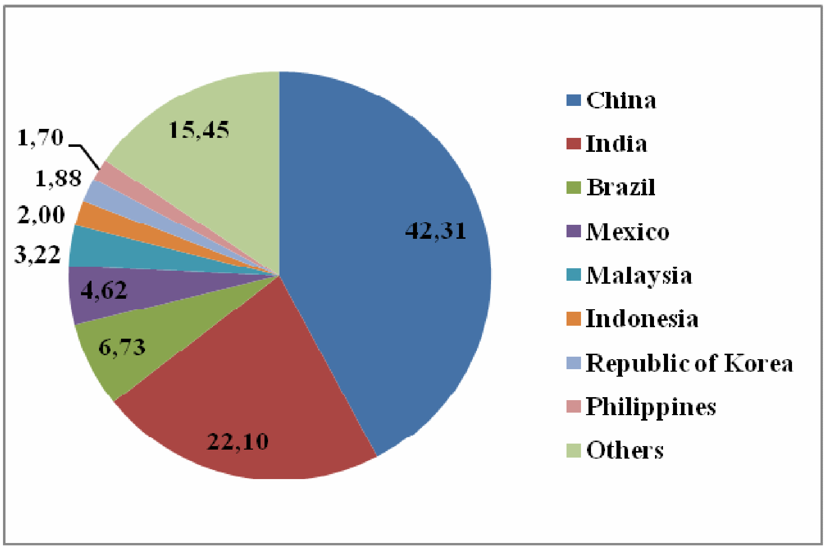

Fig. 1.3: Percentages of registered projects by host Party
(updated 1 January 2011)

Country	Number of projects
China	1145
India	598
Brazil	182
Mexico	125
Malaysia	87
Indonesia	54
Republic of Korea	51
Philippines	46
Others	418
Total	**2706**

Table 1.2: Number of registered projects by host Party
(updated 1 January 2011)

Other projects (such as large hydro plants) have raised concerns over their adverse environmental effects and their negative impacts on local communities. In this regard, host governments are responsible to evaluate if projects are in line with the country's sustainable development criteria. Yet, while some countries have set up proper criteria and procedures to examine project ideas, with the involvement of communities and stakeholders, in some other countries economic interests may represent the main driver for project approval. In fact, many projects have passed the approval phase based on their economic efficiency and potential in delivering emission reductions, without a proper sustainability evaluation. Some large hydro projects, regularly registered as CDM projects have raised concerns for their negative impacts on biodiversity, local communities and water management. Several examples can be found in literature in this regard (e.g. De Sepibus [11], Mc Cully [37], Haya [20]). Other projects on methane capture in oil facilities and coal mines, now regularly registered, are generating carbon credits whose revenues are subsidizing further oil and coal production (Schneider [45]). In other cases "carbon leakage" may occur: project emission reductions will result in emission increase elsewhere. Carbon leakage is normally taken into account by IPCC methodologies, but calculation tools may lead to some degree of uncertainty. Some research institutes (e.g. Oeko Insitute, [45]) have published numerous facts and figures in this regard.

A broadly discussed concept is the **"additionality"** of projects: the Kyoto Protocol requires emission reductions under the CDM to be additional to those that would have happened in the absence of the project. This criteria often involves a certain degree of subjective assessment, especially for some project types. According to several studies (Schneider [45], [46], Haya [20]) a large share of registered CDM projects would not be additional, meaning that projects would have been implemented even without the CDM. Annex I countries investing in project being not additional would endanger the principle itself of CDM, since industrialized countries would simply buy their way out of responsibility, causing increased pollution and harming efficiency of climate change policies.

Other studies indicate the existence of CDM projects co-located with very similar projects that are not registered under the mechanism. One example is the case of wind farms in China [16], where the registered projects are characterized by an internal rate of return very similar to non-CDM projects. The existence of such investments would be a clear indicator that those CDM projects should not have been considered additional. Yet, under the project specific approach, no certainty and predictability can be ensured.

The Negotiating Process for Mitigation Action

In the middle of the first "commitment period" of the Kyoto Protocol (2008-2012), governments are negotiating how best the implementation of the Convention should be enhanced for the post-2012 period, so as to ensure continuity of action to tackle climate change.

This negotiating process is being conducted on 2 different "tracks": future commitments for industrialized countries, beyond the Kyoto Protocol, and long term cooperative action to combat climate change, with the involvement of all Parties. In doing this exercise, there is a general attempt to improve efficiency of global mitigation action, setting the conditions to facilitate investments in clean technologies and keeping in track with the GhG stabilization objective.

The current "2 tracks" approach is the result of several steps in the international process.

First, the **AWG-KP** (Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol) was established during the first COP/MOP, held in Montreal in 2005. Based on the Kyoto Protocol 2012 timeline, this was an additional body tasked with considering future commitments for industrialized countries in the period post 2012. The work programme of this group, agreed at its second session, consisted of three tasks: the analysis of mitigation potentials and ranges of emission reduction objectives of Annex I Parties; the analysis of possible means to achieve mitigation objectives; and the consideration of further commitments by Annex I Parties.

Therefore, discussions included proposed amendments to the Kyoto Protocol (pursuant to its Article 3, paragraph 9 involving Annex I emission reductions), the aggregate scale of emission reductions by Annex I Parties, the contributions of Parties (individually or jointly) to the aggregate scale, issues relating to the flexible mechanisms, the use of LULUCF activities, consideration of greenhouse gases, sectors and sources, potential consequences of response measures, bunker fuels and legal matters.

Discussions have been fragmented across different agenda items and no outcome on further commitments – other than voluntary pledges – has been reached yet. Several interesting elements can be pointed out in the conclusions of the different sessions. Yet, the core itself of the process is still depending on many factors and a due balance over the 2 tracks is still the main obstacle. A significant outcome under the AWG-KP is not likely unless adequate mitigation instruments are also agreed under the other process, that is seeking action with the involvement of all Parties, including those who have not ratified the Protocol.

The process leading to the establishment of the "**AWG-LCA**" (Ad Hoc Working Group on Long Term Cooperative Action) was launched during COP11 (Montreal, 2005). This was initially an informal "dialogue on long-term cooperative action to address climate change by enhancing implementation of the Convention". The Dialogue was a process of non-binding exchange of views among Parties, facilitated by two "co-facilitators" nominated by the COP and with no intent to open negotiations leading to new commitments. The Dialogue was tasked by the COP to analyse strategic approaches for long-term cooperative action to address climate change that could advance development goals in a sustainable way, address action on adaptation and realize the full potential of technology and market-based opportunities. The last workshop of the Dialogue was held in Vienna, in August 2007, where most Parties expressed the view that a follow-up to the Dialogue, with a view to implementing actions to address climate change, would be needed. Therefore, the conclusions of the Vienna workshop were forwarded to COP 13 in Bali. The Bali Conference formalized this process, agreeing on the "Bali Action Plan", which established the AWG-LCA. This body was tasked with seeking agreement on a number of "building blocks" for combating global warming and its impacts: "mitigation", "adaptation", "technology" and "finance". This would be based on a "shared vision" (that some consider as the “fifth building block”) of the level of ambition in terms of maximum temperature increase and corresponding emission reduction ranges.

The two “AWGs” plus a number of further decisions, constituted the “Bali Roadmap”, a two-year process setting the milestones for reaching an effective climate agreement in 2009. The intention of a number of Parties was to merge the two tracks and reach a single final agreement. Yet, during the 15th Conference of the Parties, held in December 2009 in Copenhagen, this effort failed, with no single decision or agreement on the two tracks. No meaningful decisions were even reached on the two tracks separately. The “Copenhagen Accord”, a non-legally binding document which came out from the conference, was barely “taken note of” by the COP, while both AWGs were mandated to continue their work after the Conference. Negotiations on the two “tracks” continued through 2010, with a number of UNFCCC sessions held in preparation of COP16/CMP6 (Cancun, November – December 2010).

In Cancun, after two weeks of intense negotiations, a minimum objective was reached, i.e. re-building trust among Parties and agreeing through consensus on a number of items, set out in the COP16 decision “Outcome of the work of the Ad Hoc Working Group on long-term Cooperative Action under the Convention” and in the COP/MOP6 decision “Outcome of the work of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol”. Other COP and COPMOP decisions, negotiated within SBSTA and SBI, complemented the “Cancun Agreements”.

The Agreements reconfirmed the ultimate objective to limit global warming to not more than 2°C, with the possibility of reconsidering and strengthening the ambition; established an adaptation framework and a technology mechanism; set out a number of further steps towards the implementation of emission reduction activities by developed and developing country Parties, yet without any specific obligations or targets; advanced work on REDD+ implementation, as well as the implementation of other market and non market mitigation approaches; set the basis for the establishment of a “Green Climate Fund”.

In addition, Parties agreed to further extend the work of the two AWGs through 2011, in order to seek a more comprehensive result at next COP/CMP. In fact, on several agenda items, the “crunch” issues were simply postponed in order to reach consensus. The challenge, in 2011, will be to re-open these issues and reach an agreement, aiming at a satisfactory balance between the two tracks and an effective regime to limit global warming.

New mitigation approaches

Under the Bali Action Plan (COP decision 1.CP.13), mitigation is addressed in different ways for both developed and developing country Parties. In addition to the “quantified emission limitation or reduction objectives” of the Kyoto Protocol, the scope is enlarged and opened to new commitments, actions and other approaches, along with necessary reporting requirements.

In the COP decision Developed countries are mandated to implement “measurable, reportable and verifiable” (MRV) commitments or actions. Developing countries are also required to implement “Nationally Appropriate Mitigation Actions” (NAMAs), with the support of developed countries. Following the introduction of this language in the Bali Action Plan, negotiations are underway on the translation into practice of NAMAs and the MRV regime. In this framework, new proposals have been advanced, going beyond emission reduction targets and existing mechanisms. For instance, new crediting and trading mechanisms have been formulated, such as the sectoral crediting, the sectoral trading or the NAMA crediting; non market approaches as well, have complemented the picture (supported and unsupported NAMAs, technology based approaches, etc.). In response to the further language of the Bali Action Plan “cooperative sectoral approaches and sector-specific actions” and “various approaches, including opportunities for using markets, to enhance the cost-effectiveness of mitigation actions”, a very wide range of policy responses have been proposed.

Approaches may target developing countries and be domestic-oriented, with or without greenhouse gases emissions crediting or trading; non credited efforts may take the form of policies and measures or other NAMAs, supported or unsupported by developed countries. Credited efforts may take the form of sectoral crediting mechanisms, for instance “no lose targets” (where mitigation targets will generate credits if reached, but will not generate any penalties otherwise). Another option would be sectoral trading (through the establishment of sector wide emission commitments).

Technology oriented agreements or other transnational efforts may include: commitments on cooperative research and development; international protocols mandating the use of specific technologies; transnational technology goals, technology partnerships, agreements on practices and standards, etc.

The approaches described above have been widely investigated over several negotiating sessions and some of them could be co-existing or overlapping, with different advantages and disadvantages. The COP16 decision on the outcome of LCA negotiations left the room open for the new approaches to be established through the next sessions. In any case, it is likely that new mechanisms will not fully replace existing mechanisms, that will probably continue to play an important role in the future regime.

Improvement of the flexible mechanisms

The future role of flexible mechanisms in the climate change regime is not fully clear yet. Some negotiating groups, especially developing countries, are supporting the continuation of the present Kyoto regime with a strong role for flexible mechanisms. Others negotiating groups, as well as several authors (Houdhashelt et al. [23], Baron and Ellis [1],[2], Matsuo[33], etc.), in light of the difficulties and shortcomings of this approach, are calling for a deep reform of the mechanisms, including their structure, rules and scope. The discussion is obviously connected with the overall carbon market, also in light of new market approaches, such as the sectoral ones (Baron et al. [3],[4]). In the event that advanced developing countries could take some form of target, the market structure would be changed with impacts on supply and demand. The future of the flexible mechanisms is linked to this aspect as well. Yet, even if a country or a sector is covered by a target, this will not eliminate the possibility of continuing with project based mechanisms (such as for the JI). In addition, for countries such as LDCs, it is likely that the CDM will be continued anyway.

Furthermore, current mechanisms have been established by the Kyoto Protocol, which set a legal framework for an indefinite period, regardless of the commitment period. In case of a second commitment period following 2008-2012, the CDM will serve future commitments of Parties; yet, even in absence of a commitment period, CERs will be able to be generated. They could play a role in other markets and regional legal frameworks, such as the European Union Emissions Trading Scheme. This gives enough certainty for the carbon market and for offset mechanisms to continue.

In this context, countries are negotiating how to improve flexible mechanisms in order to overcome the problems and shortcomings described in the previous paragraphs. The existing structures and their decision making mechanisms (COP/MOP decisions, the Executive Board and its different panels, the JISC etc.) are already working in this direction, addressing different issues especially relating to baseline methodologies. Furthermore, the Kyoto Protocol offers additional instruments for revising and improving the system, i.e. its article 9, providing for a periodic review of the Protocol itself. Yet, the 2nd review under this article ended up in 2008 with no conclusions, because of lack of convergence on several negotiating issues.

The work of the AWG-KP and the AWG-LCA is trying to envision the mechanisms in the context of the future regime on a broader basis, in an attempt to build the future of the Kyoto Protocol and of a more comprehensive climate change regime. The role of flexible mechanisms has been examined in relation to discussions on efforts and achievement to date, transformation of current pledges into QELROs, LULUCF, legal matters arising from a possible gap between the 1st CP of the Kyoto Protocol and subsequent CPs, etc. Many issues are still on the table and next negotiating sessions are expected to bring clarity and wider consensus among Parties.

The issue of standardization is one of the many open topics in the agenda and its role in the context of the future regime has yet to be fully defined.

2. Standardized multi-project baselines

Approaches for determining baseline and additionality

The identification of the **baseline scenario** and the demonstration of **additionality** are two of the most crucial components of the CDM project cycle.
The baseline scenario is the scenario that represents GHG emissions that would occur in the absence of the proposed project activity. It is a theoretical "emission trajectory", from which real emissions have to be subtracted in order to obtain emission reductions. Mathematically, it is a function of time and can be a product of a given output (e.g. KWh) and a given intensity (e.g. ton CO_2/KWh/year). Output and intensity can be both time-dependent and a baseline methodology, as well, can be subject to revisions and vary over time.
During the CDM project cycle, baseline emissions are estimated twice, before and after project implementation (ex-ante and ex-post). Ex-ante calculation takes place when the project is proposed, while ex-post calculation takes place annually in order to verify, certify and issue emission reductions.

Demonstrating project additionality means proving that the planned reductions would not occur without the additional incentive provided by carbon credits; in other words, it means demonstrating that project implementation results in actual emission reductions with reference to the baseline scenario).

Under the current CDM structure, in most cases these steps imply a certain level of subjective judgment. Most CDM approved methodologies, in fact, follow a "**project specific**" approach, involving data and assumptions relating to the specific case study and proposed investment. Project-specific methods require consideration of a project's unique location and circumstances, often with site-

specific measurements or data collection. In light of project specificities, the baseline scenario is chosen as the most likely of the projects' plausible alternatives, estimating implementation barriers and benefits of each alternative, considering legal requirements and common practices.
This approach involves some level of subjectivity, thus implying less certainty and predictability, as well as transparency, both in project eligibility and in the quantification of the amount of CERs that will be generated. Furthermore, a project-specific assessment of the baseline scenario and additionality can be a costly exercise. Several authors (Brokhoff [6], Matsuo [35], Ellis and Kamel [14], etc.) stress the importance of this element as a major barrier in CDM project development.

Few CDM methodologies, as well as many methodologies used by other carbon offset schemes, are **standardized**. This means they make use of uniform methods and procedures applicable to multiple projects. Therefore, a standardized baseline is a baseline applicable to multiple projects (same methodology applicable to "similar" types of projects, falling under specific conditions).
Setting up a methodology applicable to multiple projects may be more costly in itself, whereas its application would simplify the phases of identification of the baseline scenario, demonstration of additionality and calculation of actual emission reductions. This would increase objectivity and reduce transaction costs.

There is not a clear borderline between the two approaches, as in some cases standardization may be limited to some parameters, within a "project specific method". In 2001, Bosi [5] proposed to classify methodologies in three categories: "project specific", "standardized" and "hybrid". This categorization is frequently used, but the level of accuracy and the general applicability of a methodology can differ widely within these areas. Methodologies generally recognized as "project specific" can still be "hybrid" to some extent, due to the use of few standardized parameters. The use of different approaches, with different levels of standardization, may lead to significant differences, both in terms of project eligibility and in the quantity of reductions recognized to the project activity.

Depending on many factors, there may be some project types more suitable to standardization than others.

The reason for the CDM to mostly adopt a project-specific approach was mainly historical: it was conceived, from the beginning, as a mechanism encompassing any possible emission reduction activity for the 6 gases of the Kyoto Protocol. In view of a quick start-up of the mechanism, it was decided to leave to project proponents the possibility to propose methodologies, that would be subject to approval by the CDM executive board. In fact, it was impossible to set up top-down methodologies for all possible activities, both financially and within a reasonable timeframe. In addition, the CDM has a global scope, with a huge diversity of data and conditions across different host countries.

Therefore, the tendency was inevitably project-specific (some authors, such as Broekhoff [6] have highlighted that none of the proponents had interest in developing methodologies applicable to other projects).

In other offset schemes, with a more limited geographical scope and with the involvement of few eligible project categories, the exercise of development of top-down methodologies was much easier. Some example of standardized approaches utilized outside the UNFCCC is described further on in this chapter.

Standardization scope and approaches

Most literature addresses standardized approaches simply in relation to the determination of the baseline scenario. Actually, standardization can apply also to the demonstration of additionality and the calculation of actual emission reductions after the implementation of the project. In particular, this last aspect is rarely taken into account (e.g. Carnahan [8]), although in most cases this is implied within the concept of baseline scenario. Some standardized methodologies may address, at the same time, the baseline scenario and additionality. In other cases, standardization may offer partial solutions (e.g. addressing only one of the “barrier tests” for additionality determination, where the other tests are not suitable for standardization). Some authors (Eichhorst [13], Broekhoff [6], Hayashi et al. [21]) have published interesting examples in this regard.

Standardization may be applicable under specific conditions and not for all project types. The applicability of standardization depends on various conditions, including project type, size, location, data availability, etc.

One of the most studied approaches is the development of **emissions intensity benchmarks**, relating to specific technologies. This method requires the identification of a "benchmark" emission level per unit of production (e.g. aluminum, nitric acid or cement production) or a "benchmark" performance standard (efficiency standards in appliances, vehicle emission intensities etc.). Benchmarks may be applied both to baseline determination and additionality demonstration. This approach is the most studied in literature and the DFID, for instance, has recently published a comprehensive study [21] in this regard.

Benchmarks can be set at different levels of the production and comsumption process. Hayashi et al. [21] have identified the main functional levels, from the energy consumption in extraction and processing of raw materials to the final consumption of products or services. Different options, in this respect, can be used in combination with one another.

Determining such benchmarks may be a difficult exercise, requiring extensive data collection (often facing the challenge of data availability) and adjustment over time (because of technology development and diffusion). Some studies (e.g. [13] for transportation offer some figures relating to the challenge of data collection. Hayashi et al. [21] have published some figures on the financial resources required for determining a benchmark, both in case of data available and in case of need of data collection. In the latter case the figures are significantly higher.

Despite the significant upfront costs, once determined, both baseline emissions and additionality can be very easy to calculate: baseline emissions will be obtained multiplying the project output by the benchmark emission rate. The emission rate can be either calculated (e.g. 20th percentile of a certain category)) or referred to a specific technology or practice. In the latter case, the benchmark could refer to the most conservative option (with lowest emissions), least cost option, technology/practice required by law or “best available technology”. Several proposals in this regard can be found in literature, yet the choice should be based on the project activity type.

Under this approach, projects with emission rates lower than the benchmark could be automatically considered additional. Some authors (e.g. Broekhoff [6]) also propose that additionality might use, in some cases, a different (less stringent) benchmark than the one used for the baseline scenario. Other criteria (e.g. exclusion of projects required by law) can complement the benchmark approach in order to minimize the risk of having “business as usual” projects qualify as additional (Broekhoff [6], Hayashi et al. [21], Lazarus et al. [30]).

In some methodology types, where actual data collection or measurements might be costly or not feasible, conservative **default values** may be used, obtained from existing data under similar conditions. This approach helps simplifying the process of data collection for some project activities and is already used in the UNFCCC in some cases.

The IPCC, in its 2006 Guidelines[4] [25], provided different approaches for estimating anthropogenic emissions by sources and removals by sinks of greenhouse gases. Different ways of calculating emissions are described as “tiers” (Tier 1, Tier 2 and Tier 3), with different levels of details and accuracy (Fig. 1.2). “Default emission factors” are provided for several fuels and activities. These factors are generally less accurate than country-specific and process-specific factors but may be used in case of unavailability of more detailed data.

[4] IPCC Guidelines for National Greenhouse Gas Inventories, 2006 (Recommended scientific guidance for the UNFCCC)

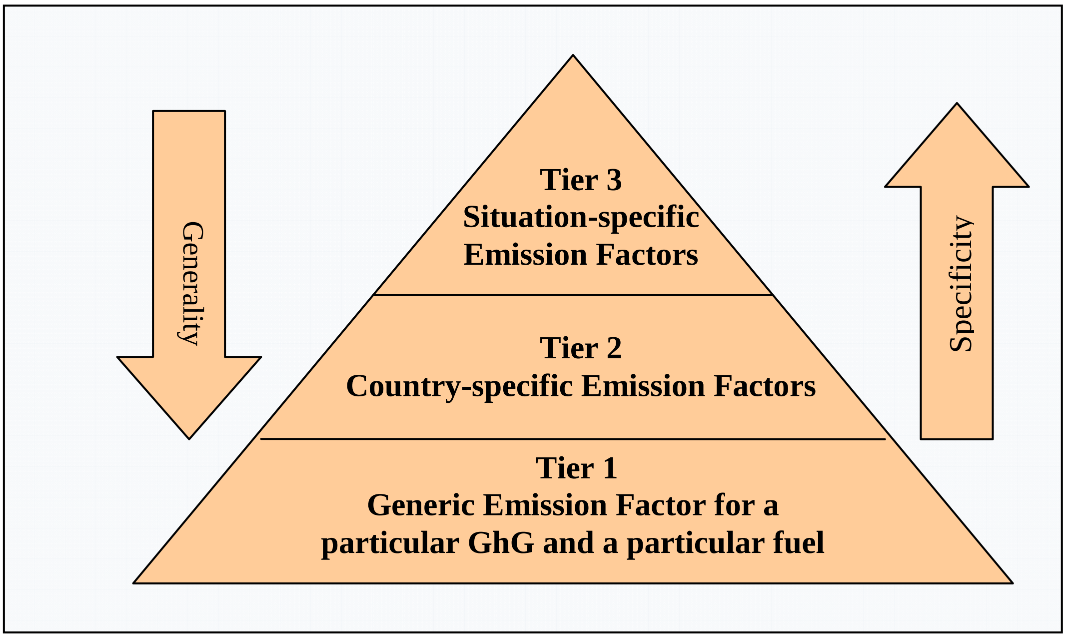

Fig. 2.1: IPCC Tier approaches

For instance, the CDM methodology ACM0010 (manure management systems) refers to default values for animal weight, biological oxygen demand, volatile solids, etc., from IPCC Guidelines. These default values can be used to replace actual measurements.

For project activities involving a large number of “units” (high efficiency light bulbs, high efficiency cook stoves, solar lamps, etc.), **deemed or per-unit values** may be used, helping determining emissions reductions by multiplying a conservative per-unit estimate by the number of units involved in the project activity. This approach, as suggested by Carnahan [8] may be particularly helpful in very “fragmented” activities, such as Programmes of Activities (PoAs), a new instrument recently introduced in the CDM. The scientific literature is still poor in studies and examples in this regard, yet a number of submissions to the UNFCCC [64] from the private sector and other stakeholders offer very interesting examples of proposed methodologies using this approach, especially in the energy efficiency sector.

Other approaches can somehow be re-conducted to the previous categories. “Positive lists”, for instance, are proposed in some studies (Broekhoff [6], Schneider [45]) and submissions of Parties to the UNFCCC [64], to offer a direct solution to additionality demonstration for some categories of projects agreed to by policymakers. Yet, a positive list is practically a binary benchmark, directly based on project type. This may apply to some projects clearly identified as target activities to be incentivized, facing high barriers to investment and, at the same time, difficult additionality demonstration.

An example of performance standard, quite well known, is the **grid emission factor**. This is an intensity factor used in renewable energy projects or, in general, in projects decreasing the carbon intensity of electricity generation. Several studies and proposed approaches for calculating this factor can be found in literature (Bosi [5], Kartha et al. [27], Sathaye et al. [43],[44], etc.).

UNFCCC methodologies contain a "*Tool to calculate the emission factor for an electricity system*", that can be used for any host country. A grid emission factor is normally grid-specific, therefore it can be established nationally, but also regionally or sub-nationally, depending on the characteristics of the grid. In some host countries this factor has been standardized, meaning that the country has officially approved it for a certain period of time. Some JI countries in Eastern Europe, for instance, have developed national emission factors within bilateral and multilateral programmes (e.g. in partnership with the World Bank).This facilitates project implementation by adding a significant degree of objectivity to project additionality and certainty over the EB approval.

In general, standardized baselines may be applicable under specific conditions and not for all project types. Summarizing literature indications and EB proceedings, standardized baselines can be considered most feasible in case of easy data availability, uniformity of technology and practices across a category and geographical area, stability over time and absence of leakage. Sectors like energy, industry, buildings and waste management have been identified, in literature, as more promising than others for standardized baselines development.

The concept of standardization in the UNFCCC

The concept of standardization is not new under the UNFCCC. In 2001, under COP7, a set of decisions called "Marrakech Accords" established the rules for meeting the targets set out in the Kyoto Protocol. Under such decisions, the concept of standardization already appeared as one of the possible choices for baseline establishment, both in JI and CDM.

Among the criteria for baseline setting and monitoring for Joint Implementation activities, the Marrakech decisions read as follows:

> *"A baseline shall be established:*
>
> *(a) On a project-specific basis and/or using* ***a multi-project emission factor****;*
>
> *(b) In a transparent manner with regard to the choice of approaches, assumptions, methodologies, parameters, data sources and key factors;*
>
> *(c) Taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector;*
>
> *(d) In such a way that ERUs cannot be earned for decreases in activity levels outside the project activity or due to force majeure;*
>
> *(e) Taking account of uncertainties and using conservative assumptions.*
>
> *Project participants shall justify their choice of baseline"*

In the "modalities and procedures for a Clean Development Mechanism" (Paragraph 48) the following text was agreed:

> *"In choosing a baseline methodology for a project activity, project participants shall select from among the following approaches the one deemed most appropriate for the project activity, taking into account any*

guidance by the executive board, and justify the appropriateness of their choice:

(a) Existing actual or historical emissions, as applicable; or

(b) Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment; or

(c) ***The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category".***

Under the terms of reference for establishing guidelines on baselines and monitoring methodologies for the CDM, the following text came out:

"[…] the appropriate level of standardization of methodologies to allow a reasonable estimation of what would have occurred in the absence of a project activity wherever possible and appropriate. Standardization should be conservative in order to prevent any overestimation of reductions in anthropogenic emissions"

As a matter of fact, while the multi-project approach was fully allowed in the Kyoto mechanisms, project-specific methodologies have prevailed for the reasons explained in the previous paragraph.

The option relating to "*average emissions of similar project activities undertaken in the previous five years, whose performance is among the top 20 per cent of their category*" has been adopted in some large scale methodologies only recently. In fact, it is generally easier for project proponents to develop methodologies that rely on project-specific data, rather than performance standards. These would require intensive data collection and would offer other investors the possibility to free-ride on the approved methodology.

Discussions under the UNFCCC have been referring especially to standardization of the baseline scenario. Yet, the possibility of applying standardized methods for the quantification of actual project or programme emissions after the implementation of the project (in order to allow credit issuance) and for the demonstration of additionality should be also kept in mind.

Table 2.1 summarizes approved CDM methodologies using standardized approaches for calculating baseline emissions (UNFCCC[64], Hayashi et al.[21]):

	Methodology	Type	Benchmark	Registered Projects	Notes
AM0037	Flare (or vent) reduction and utilization of gas from oil wells as a feedstock	48a	Top 20%	2	
AM0070	Manufacturing of energy efficient domestic refrigerators	48a	Top 20%	0	Benchmark approach for baseline scenario and additionality
ACM0005	Consolidated methodology for increasing the blend in cement production	48a		24	Includes “first of its kind” barrier test, requiring demonstration that the market share of is 5% or lower
AM0030	PFC emission reductions from anode effect mitigation at primary aluminium smelting facilities	48a		3	Refers to data published by the International Aluminium Institute
AM0059	Reduction in GHGs emissions from primary aluminium smelters	48a 48b	Top 20%	1	Refers to data published by the International Aluminium Institute
AM0063	Recovery of CO2 from tail gas in industrial facilities to substitute the use of fossil fuels for production of CO2	48a		0	
AM0067	Installation of energy efficient transformers in a power distribution grid	48b		0	
ACM0013	Consolidated baseline and monitoring methodology for new grid connected fossil fuel fired power plants using a less GHG intensive technology	48b 48c	Top 15%	2	Grid emission factor
AMS-I.D	Grid connected renewable electricity generation			812	Grid emission factor
ACM0002	Consolidated methodology for grid connected electricity generation from renewable sources	48a 48b		849	Grid emission factor
ACM0010	Consolidated methodology for GHG emission reductions from manure management systems	48b		3	Uses a number of default values from IPCC2006 or USEPA, whichever is lower

Table 2.1 CDM methodologies using standardized approaches. Source: UNFCCC, DFID Updated 1 January 2011

All methodologies in Table 2.1 use standardized approaches for the establishment of baseline scenario. AM0070 also uses a standardized approach for additionality (being the only methodology to adopt a standardized approach to both baseline and additionality). The adopted level of stringency is the same in both cases (top 20%). Yet, no projects have been registered under AM0070 yet, probably due to the significant amount of data necessary for the benchmark determination.

ACM 0005 adopts a partial standardization of the additionality, applied to a "barrier test". This is based on the market share of the technology, that should be 5% or lower in order for the project to qualify as "first of its kind".

Among methodologies adopting "performance standards" (or benchmarks), the most widely used timeframe corresponds to "the most recent 5 years", even if there are some cases referring to "the most recent 10 years" (AM0063) and "the most recent year" (AM0070).

As regards the geographical area, most methodologies adopt the country boundaries or the grid system. Yet, for products traded beyond national boundaries (e.g. aluminum), the geographical scope is expanded.

The benchmark stringency is usually defined as the average of the top 20% performers (as indicated by paragraph 48c of the Marrakech Accords). Benchmarks are typically updated only at the renewal of the crediting period.

Another methodology, under approval for cement projects (CSI cement benchmarking methodology) [57] adopts different benchmark levels for baseline emissions (top 45%) and additionality determination (top 20%).

ACM 0013 (methodology for new grid-connected fossil fuel-fired power plants) requires the use of an emissions intensity benchmark. This is calculated based on the performance of the top 15% power plants using the same fuel. The benchmark is then compared with the emission factor of the technology and fuel identified as the most likely baseline scenario; the lowest factor is taken as the crediting baseline.

ACM 0002 and AMS.I.D (methodologies for new grid-connected renewable power plants) rely on the "grid emission factor". Other methodologies refer to the grid emission factor when electricity is dispatched to the grid or utilized for on-site consumption.

Other standardization experiences (outside UNFCCC)

Standardized methodologies have found different applications also outside the UNFCCC, in a number of offset programmes and other initiatives.

An interesting application of a fully standardized approach can be found in Australia, in the framework of the "**New South Wales GHG Reduction Scheme**" (GGAS) [63]. This programme, launched in 2003, is aimed at decreasing the carbon intensity of the electricity production sector, through the establishment of mandatory targets for electricity suppliers.

These targets may be fulfilled through a number of specific emission reduction activities, entitled to generate "abatement certificates". These emission reduction activities are categorized very precisely and include efficiency improvement in electricity use and generation, electricity generation through low carbon technologies (e.g. renewables), methane capture and use, afforestation/reforestation and emission reductions in certain industrial processes.

The approach is fully standardized and makes large use of benchmarks and emission factors, whereas project-specific data are very limited (e.g. restricted to the historical generation and consumption rates at the project site). In some cases, baselines are very simplified. For instance, for afforestation/reforestation, the default assumption is that territories will remain un-forested in the baseline scenario.

Any activity resulting, according to predefined rules, to emission reductions below baseline is considered additional, with no need for further additionality tests.

This approach was generally successful, thanks to a number of factors, including the limited number of project categories, the limited geographical area, the full availability of historical data on generation and consumption, etc. All rules were developed directly by the authorities and not by project proponents.

Another system applying a top-down standardized approach is the **Chicago Climate Exchange** (CCX) [58]. This is a voluntary emissions trading scheme, whose participants can meet their emission reduction targets internally, purchasing allowances from other participants or purchasing offset credits. A number of specific categories, for which standardized parameters and emission factors have been established, are eligible for project implementation and generation of offset credits.

For instance, baseline emissions for methane capture projects in the agriculture sector use a standard "per animal" emission factor; likewise, renewable energies projects make use of a standard conservative emission factor. Parameters and emission factors are generally very conservative, in order to compensate for potential inaccuracies. For instance, renewable energy projects within the United States are credited at a rate of 0.4 tons of CO_2 per MWh, considerably lower than marginal emission rates in most parts of the country.

For some projects, in particular large scale projects, limited project-specific data are required. For example, large reforestation projects require measurement of site-specific carbon levels before project implementation.

Offset reductions may also be generated in a number of countries outside the United States and may be recognized for projects outside the identified categories, such as energy efficiency and fuel switch projects. Yet, in this case the approach is project-specific.

As regards additionality, this is largely based on standard eligibility criteria and is also reviewed by an "Offset Committee" established under the programme.

Likewise, in the North-East part of the US there is an ongoing initiative called "**Regional Greenhouse Gas Initiative**" (RGGI) [62]. This initiative establishes an emission cap for power plants, from 2009 to 2018. Each power plant is entitled to use a limited percentage of offset credits for compliance (initially 3.3%, which

will be increased if carbon credits will increase over certain levels (7 USD and 10 USD). Activities eligible for emission reductions are landfill and agriculture methane capture and destruction, SF_6 reduction in electricity utilities, afforestation projects and end-use thermal efficiency (oil, gas, propane reduction).
In these categories, approaches are largely standardized but also include numerous project-specific parameters (e.g. historical measurements for afforestation, SF_6, energy efficiency or agricultural methane projects). Project-specific parameters are meant to ensure accuracy across different locations and different types of projects. Standardization also applies to additionality testing: projects must meet specific performance standards in order to be eligible and no site-specific additionality test is required.

In Canada, the **Alberta Offset system** [53] is in place since 2007. This is a system requiring high emissions industries (over 100,000 tons CO_2 eq per year) to reduce their carbon intensity by a specific percentage. Reductions may be achieved internally (trough efficiency improvement), by contributing into a climate change technology fund or through the purchase of offset credits.
The local government has been collaborating with the industry in order to develop a number of offset project protocols, specifying baseline estimation and emissions reduction calculation.
These protocols include projects in the agriculture sector (e.g. livestock methane emissions, methane reductions from organic waste, biofuels, etc.), enhanced oil recovery, waste heat recovery, energy efficiency and afforestation.
Protocols are highly standardized but also require a significant use of project specific data. In comparison with the RGGI, the use of project specific data is generally more extensive, due to the relative difficulty in standardizing parameters in the target sectors of the Alberta offset system (e.g. energy efficiency, agriculture).
No specific additionality test is applied in this system (all projects started after 2001 and not required by law are automatically eligible).

In California, a voluntary GHG registry (**California Climate Action Registry**, CCAR [54]) has been designed. Besides GHG emissions reporting, the system is developing protocols for the calculation of project based emission reductions, even if no offset programme is in place. Offset protocols have been published in the forestry sector and for agricultural methane. Standardized approaches are adopted in these protocols, but with inclusion of project specific elements.

For instance, for the agricultural methane sector, the baseline is fixed as the “continuation of current practice”, but baseline emissions are calculated using project specific data and information.

Standardized additionality criteria have also been developed for additionality (e.g. agricultural methane projects are considered additional as long as they are not required by law). This simple criteria is based on the assumption that biogas capture systems are not “common practice” in the United States.

Standardized approaches have also been developed under the **US EPA Climate Leaders Program** [59]. This is a government-industry partnership designed to facilitate the development of long term comprehensive climate strategies. Climate leaders applies a top-down approach and refers to projects within the United States, thereby allowing standardization.

A corporate-wide emission reduction goal is set and all partners are required to inventory their emissions to monitor progress. This is a programme based on accounting and reporting, but the USEPA is also in the process of developing rules and criteria for including offset projects in the programme. A set of project accounting methodologies is being tested by EPA in several categories (afforestation, commercial boilers, industrial boilers, landfill methane, manure management (agricultural methane), reforestation, SF6, bus fleet upgrades).

EPA’s methodologies are mainly based on a “performance standard” approach, both for baseline and additionality determinations. For instance, baseline emissions for new commercial boilers or new bus fleets are based on a standard emission rate, corresponding to “better than average” performance in the US. Project-specific data (e.g. historical measurements) are still required to some extend, depending on project type. For example, for methane capture projects, continuation of prior practices is assumed as the baseline and project specific data are used to calculate baseline emissions.

Within the "**Cement Sustainability Initiative** (CSI)" [57], an international effort has been undertaken to develop performance standards for baseline calculation in the cement sector. This is an example of interaction between the UNFCCC and other international bodies. In fact, a specific methodology based on performance standards has been submitted to the Executive Board and is in the phase of approval. As highlighted by Hayashi et al. [21], a key challenge of CSI benchmarking is limited data availability in some regions, while in others there is comprehensive data coverage.

Likewise, the "**International Aluminium Institute** (IAI)" is an important source of data for both chemical emissions (perfluorocarbons) and emissions related to electricity consumption, with yearly updates. This institute offers an interesting benchmarking with a high degree of process disaggregation, identified by some authors (Chase [9]) as one of its major strengths. Data from this institute are used in a UNFCCC methodology.

Non-Kyoto programmes offer a good stock of knowledge on the suitability of different sectors and projects to standardization. Yet, as explained above, under these programs the scope of eligible project activities and the geographical scope are often limited. This is one of the main reasons for the success of top down standardized approaches. In addition, most schemes have significant differences compared to the CDM. For instance, nearly all described programs identify a single baseline option, with no necessity to choose a "baseline scenario" from among different alternatives. In addition, the level of standardization, the necessity of including project specific data and the conservativeness of approaches varies considerably among different schemes.

In some cases, the effectiveness of offset schemes is not fully clear, neither comparable to UNFCCC projects. This is a concern especially regarding project additionality. In some offset schemes, rewarding non-additional projects does not seem to be a worry for policymakers, given that those projects belong to specific "environmentally friendly" categories.

Nevertheless, despite differences between the CDM and other offset schemes, interesting indications can be drawn from non-UNFCCC experiences.

Benefits of standardization

The use of standardization has a number of advantages for carbon offset schemes. Several authors (Broekhoff [6], Carnahan [8], Hayashi et al. [21], etc.) recognize these benefits to different extents. As already explained, greater use of standardization would reduce the level of subjective judgment, both in recognizing project eligibility for credit generation and in calculating the amount of credits that will be generated. This would add transparency and objectivity to the whole process, giving more confidence to project developers and simplifying the work of the Executive Board and other entities involved in the process of validation and verification. Some authors (Matsuo, [35]) assign to the objectivity of the project cycle a paramount importance for the CDM credibility.
This can also safeguard the environmental integrity of the projects, reducing the risk of overcrediting and granting eligibility to non-additional projects.
In addition, higher predictability would encourage investment and improve market certainty. Projects with higher predictability will obtain funding more easily, thus potentially increasing the overall scale of funds raised by the CDM.

Standardization will also reduce transaction costs. While a considerable amount of resources is necessary to develop a baseline, once developed its application will be much less costly compared to the project specific approach. In addition, the process itself would be simplified avoiding the situations of distrust among project participants, DOEs and the Executive Board, where questions and requests of clarification often arise massively and delay the process.
A simpler and less costly project cycle can directly affect the commercial viability of projects and may be decisive for small projects, where transaction costs are a significant barrier. As some authors highlight (Capoor and Ambrosi [7], Fischer [15], Ellis and Kamel [14], etc.) lower transaction costs, in some categories, may allow development of some projects that were not profitable under the project

specific approach, thus also expanding the potential of emission reductions under the CDM. Some of these assessments are sector-specific (e.g. Michaelowa and Umamaheswaran, [38] for the energy efficiency sector, Schneider [46] for renewable energies, etc.).

Standardization may also help improve regional distribution of the CDM. In fact, especially in under-represented host countries, where investment conditions are particularly difficult, both lower transaction costs and higher certainty can be key in encouraging investment. This benefit of standardization is particularly stressed in several submissions from Parties and other stakeholders to the UNFCCC secretariat [64], as well as by some authors (Broekhoff [6], Carnahan [8]).
The same consideration can be made for under-represented sectors: setting appropriate baseline levels, jointly with lower transaction costs and higher certainty can be crucial to improve project-type distribution in the CDM (Broekhoff [6], Carnahan [8], Hayashi et al. [21], etc.).

In addition, setting performance standards for a specific activity may be a key driver for technology development. Technologies with higher emission intensities would be gradually excluded from the market, leading to a general effort of performance improvement. Some authors (e.g. Broekhoff [6]) suggest that technology development may be itself included in the determination of the performance standard, so that requirements would become more stringent over time.

Finally, more simplicity into the project cycle will generally improve accessibility to the CDM to both project developers and other stakeholders. Even if some authors (Matsuo, [35]) highlight that there is no automatic connection between standardization and the simplicity of a methodology, project experience and non-UNFCCC schemes, as well as most literature, clearly indicate that this happens in most cases.

Disadvantages and challenges of standardization

Besides benefits, there is wide recognition in literature of limits and disadvantages of standardization (e.g. Baron and Ellis [1], Broekhoff [6], Hayashi et al. [21], Fischer [15]). Standardized approaches, while providing more objectivity to the project cycle, generally provides less accuracy over single project activities. A standardized baseline, as rigorous as it can be, provides accuracy over a "family" of projects, with overestimations or underestimations potentially occurring over single project activities.

On the contrary, the project-specific approach remains the most precise way to quantify and credit emission reductions, as it takes into account specificities and unique characteristics of a single project activity.

Stringency of a baseline is a delicate matter. A baseline that is not stringent enough may hamper environmental integrity, by over crediting projects and granting approval to non-additional projects. The risk of recognizing unfair reductions through standardized baselines was assessed, *inter alia*, by Fischer [15], highlighting the necessity of conservativeness in standardized methods.

On the other hand, excessive stringency levels would exclude good emission reduction projects from the list of eligible activities and could discourage investment in some sectors or countries. Single projects having baselines higher than the standardized one, in fact, would be penalized.

A small enterprise with low efficiency levels can be an example. Interventions bringing more efficiency could deliver real and significant emission reductions; yet, if the final efficiency level is still under the benchmark, this activity will not be recognized, regardless the big gain in efficiency, even without the most up-to-date technologies.

Standardized baselines should be set in such a way that these two effects counterbalance each other. This would ensure, in aggregate, an acceptable level of environmental integrity while encouraging investments.

An important element is the tradeoff between level of aggregation and accuracy. In fact, standardization works best when projects and their baseline alternatives are sufficiently homogeneous. Even within one sector there might be a huge variance in terms of size and type of a certain technology, with a single baseline failing to capture such variation. The more a methodology is standardized and widely applicable, the more it can lead to inaccuracies of calculation in the single project. Conservativeness will help avoid overcrediting but may penalize some projects that would have been eligible in the project-specific case. This is true, in particular, for large scale projects, where small inaccuracies can lead to big differences in the calculation of emission reductions. Some studies (e.g. [52], outlining some specificities of CDM projects in China) highlight the inadequacy of standardized methods for some categories of large scale projects.

Data availability is also a frequent challenge. Adopting standardized baselines only for countries and sectors where data are promptly available would lead to exclusion of the developing world from this exercise. On the contrary, including all countries and facing data collection challenges will result in a very costly exercise. Some figures on the financial challenges of data collection are given by Hayashi et al. [21]. The larger the applicability of a methodology, the biggest this challenge.

Finally, standardization can be applicable under specific conditions and not for all project types. For a given project type, standardization may not be applicable to different geographical areas. An example is the emission factor of an electricity grid, that may vary within a single country (e.g. Bosi [5], Kartha, Lazarus and Bosi [27]).

The large scope of the CDM (both in project categories and geographical terms) can make standardization much more difficult than in other carbon offset schemes. Therefore, while it can help solve some of the concerns of the CDM in some project activity types, standardization cannot be considered as a general solution for all emission reduction categories.

Negotiations on standardization: the AWG-KP process

The "Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP)" was established in the 2005 Conference of the Parties to the UNFCCC in Montreal. The AWG-KP was an additional body tasked with considering future commitments for industrialized countries under the Kyoto Protocol for the period post 2012. The work programme of this group, agreed at its second session, consisted of three tasks: the analysis of mitigation potentials and ranges of emission reduction objectives of Annex I Parties; the analysis of possible means to achieve mitigation objectives; and the consideration of further commitments by Annex I Parties.

The discussion on means to achieve mitigation objectives includes future rules for project based mechanisms and standardized rules and criteria are part of this discussion.

The negotiating text proposed by the AWG-KP co-facilitators in preparation of COP16/CMP6 negotiations read, *inter alia*, as follows:

> *The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol,*
>
> *[…]*
>
> *"Decides that, where appropriate, in order to enhance the environmental integrity, efficiency and regional distribution of the clean development mechanism, standardized baselines shall be used on a national or subnational level for specific project activity types in the determination of additionality and the calculation of emission reductions and removals;*
>
> *Requests the Subsidiary Body for Scientific and Technological Advice to recommend modalities and procedures for the definition, periodic adjustment and use of standardized baselines […], with a view to forwarding a draft decision on this matter to the Conference of the Parties*

serving as the meeting of the Parties to the Kyoto Protocol for adoption at its seventh session;

Such text is an evolution of previous formulations. In a previous UNFCCC session (Barcelona - November 2009, preceding the Copenhagen Conference), the text read as follows:

In relation to encouraging the development of standardized, multi-project baselines under the clean development mechanism:

[…]

Decides that the Executive Board of the clean development mechanism, drawing on expert input from its support structure and other relevant institutions, shall, where appropriate, to enhance the environmental integrity, efficiency and regional distribution of the clean development mechanism, define standardized baselines for specific project activity types [and specific sectors or subsectors] by establishing parameters, including benchmarks, and procedures and making them available for [mandatory] [optional] use in the determination of additionality and the calculation of emission reductions;

[…]

Decides that the parameters and procedures used to facilitate standardized baselines shall:
(a) Be established on the basis of [similar project activities undertaken in the previous five years] [installations or processes in the relevant sector] [in similar social, economic, environmental and technological circumstances] whose [performance] [emissions intensity] is in the top [53] [29] [x] per cent for their category;
(b) Be regional, national or subnational in nature;
(c) Be periodically adjusted;

In this previous version, some key issues are more evident and some of the key questions appear as bracketed: mandatory vs. optional use, project activity types vs. sectors, ranges of performance (or emission intensity), etc. and various implications are connected to the choice of different options. Accuracy, as already mentioned, is seen as a delicate matter and the possibility that some project activities would be penalized has generated a lack of confidence from some Parties.

Options of percentages of performance and/or emission intensity is also a key issue, as literature review, while giving broad indications across different categories and sectors, does not offer a clear picture in terms of the overall effect on the carbon market. Comparability and interactions with project-specific methods and institutional questions are additional open issues.

Some opposition to standardized baselines was also made with reference to emission intensity benchmarks. In fact, at different instances during the negotiations, these have been perceived as an attempt to direct countries towards common emission intensity goals, as a first step towards binding emission targets.

After COP16/CMP6, the AWG-KP has seen its mandate renewed for another year. Discussions on the inclusion of standardized approaches in post-2012 mechanisms will continue in 2011.

Negotiations on standardization under SBSTA

Standardization is also part of SBSTA negotiations, as a methodological issue under the Kyoto Protocol. During its thirty-second session (31 may – 9 June 2010), this item was discussed with special regard to the possibility to prepare a recommendation on “modalities and procedures for the development of standardized baselines under the clean development mechanism (CDM)”.

This followed a specific mandate given by decision 2.CMP5, taken during the Climate Change Conference held in Copenhagen in 2009. The decision reads as follows:

Requests the Subsidiary Body for Scientific and Technological Advice to recommend modalities and procedures for the development of standardized baselines that are broadly applicable, while providing for a high level of environmental integrity and taking into account specific national circumstances, and to forward a draft decision on this matter to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its sixth session;

On the occasion of SBSTA32, Parties had the possibility to widely discuss the issue. Many countries expressed support for the general idea of advancing work on standardized baselines, yet a number of outstanding issues were pointed out where further work would be necessary.

Some concerns were raised over levels and ranges of the benchmarks and their applicability to different project scale and technologies.

Others pointed out the necessity to follow a country-driven process and to take into account specificities of single countries and sectors/sub-sectors. Many Parties highlighted the importance of the issue of regional distribution. Some developing countries expressed serious concerns around availability of data, as well as issues of confidentiality of information (especially in the energy sector); costs were highlighted by other developing countries, pointing out the limited capacity of their DNAs (a possible exercise of collection and update of information would represent an important challenge).

At the same time, Parties emphasized that a high level of involvement of countries should be envisaged in this matter (highlighting that some EB decisions are very well elaborated but not feasible in some countries).

Specific issues identified for further clarifications were the following:

- the scope of the development of standardized baselines (e.g., baseline setting or baseline setting and additionality demonstration; in this regard, parties had different views, with some countries proposing to start from baselines only);

- The mandatory or optional nature of the use of standardized baselines (what would be the relation between these baselines and current methodologies? and would the use of standardized baselines be mandatory when established?)

- The procedural requirements for the development of standardized baselines, including the involvement of designated national authorities (Who will develop - top down and/or bottom up - the standardized baselines and who will approve them? What should be the role of the designated national authorities (DNAs) and the role of the CDM Executive Board? What level of interaction with stakeholders would be required?)

- The priorities for developing standardized baselines;

- Access by under-represented regions, sub-regions, sectors and least developed countries to the CDM;

- The level of aggregation and the boundaries (e.g. should the standardized baselines be developed at global, national or sub-national level? should the standardized baselines be developed at sectoral or sub-sectoral level?);

- Data quality, availability, collection and confidentiality issues (who will collect the necessary data? How could data availability and quality be ensured? How will confidential data be treated? What are the possible financing mechanisms for data collection for a bottom-up approach in regions underrepresented in the CDM?);

- The financing of the development of standardized baselines, including capacity building and data collection;

- Accounting for developments over time, including past efforts (what will be the criteria for determining the frequency for updating the standardized baselines? How will past efforts made by developing countries to improve sectoral or sub-sectoral efficiency be considered in the development of standardized baselines?).

These questions were taken note of for a specific submission to the UNFCCC from Parties and other stakeholders. Other interesting views also emerged during discussions. For instance, some developing countries highlighted the possible relation between benchmarks and future sectoral mechanisms. Others pointed out that standardized baselines and benchmarking are different issues. Some specific sectors were also addressed, for instance wastewater: some parties highlighted the necessity to clarify the possible scope of standardized baselines (e.g. pig farms, urban wastewater or industrial wastewater are different in many aspects, including data availability). Finally, some Parties specified the need to avoid moving away from the Marrakech Accords.

On the basis of Parties' submissions, discussions continued during COP16, where several text proposals were presented and textual negotiations started.
Despite some initial lack of confidence over the possibility of reaching an agreed outcome, a COP/MOP decision on "*Further guidance relating to the clean development mechanism*", containing a section on standardization, was eventually adopted.
This was also due to the final good negotiation atmosphere and to the willingness of Parties to agree on an overall compromise package. In fact, the final text did not solve all issues raised during SBSTA32, simply avoiding and postponing some of them. The text of the adopted COP/MOP decision is the following:

"Further guidance relating to the clean development Mechanism"

The Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol,

Recalling the provisions of Articles 3 and 12 of the Kyoto Protocol,
Noting that standardization is being used in some approved baseline and monitoring methodologies under the clean development mechanism,

Recognizing that baseline and monitoring methodologies using standardized baselines can be developed, proposed by project participants and approved by the Executive Board of the clean development mechanism under the modalities and procedures adopted by decisions 3/CMP.1 and 5/CMP.1,

Recalling that standardized baselines under the clean development mechanism should be broadly applicable, provide a high level of environmental integrity and take into account specific national, subnational or international circumstances, as appropriate,

Noting that the use of standardized baselines could reduce transaction costs, enhance transparency, objectivity and predictability, facilitate access to the clean development mechanism, particularly with regard to underrepresented project types and regions, and scale up the abatement of greenhouse gas emissions, while ensuring environmental integrity,

Also noting the issues identified by the Subsidiary Body for Scientific and Technological Advice at its thirty-second session,

Cognizant of decisions 7/CMP.1, 1/CMP.2, 2/CMP.3, 2/CMP.4 and 2/CMP.5,

[…]

44. Defines "standardized baseline" as a baseline established for a Party or a group of Parties to facilitate the calculation of emission reduction and removals and/or the determination of additionality for clean development mechanism project activities, while providing assistance for assuring environmental integrity;

45. Decides that Parties, project participants, as well as international industry organizations or admitted observer organizations through the host country's designated national authority, may submit proposals for standardized baselines applicable to new or existing methodologies, for consideration by the Executive Board;

46. Requests the Executive Board to develop standardized baselines, as appropriate, in consultation with relevant designated national authorities, prioritizing methodologies that are applicable to least developed countries, small island developing States, Parties with 10 or less registered clean development mechanism project activities as of December 31 2010 and underrepresented project activity types or regions, inter alia, for energy generation in isolate systems, transport and agriculture, taking into account the workshop referred to in paragraph 51 below.

47. Decides that the application of the standardized baselines as defined in paragraph 44 above, shall be at the discretion of the host country's designated national authorities;

48. Requests the Executive Board to periodically review, as appropriate, the standardized baselines used in the methodologies;

49. Requests the Executive Board to explore different financial sources to cover the costs of developing and establishing standardized baselines, according to the needs identified in paragraph 46 above, including direct resources from the annual budget of the clean development mechanism.

50. Encourages Parties included in Annex I to the Convention and Parties not included in Annex I to the Convention with relevant experience to provide capacity-building and/or support for developing standardized baselines;

51. Requests the secretariat to organize a workshop in one of the Parties referred to in paragraph 46 above not later than the thirty-fifth session of the Subsidiary Body for Scientific and Technological Advice on the issue of standardized baselines for facilitating the access to the clean development mechanism;

52. Requests the Executive Board to report to the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its seventh session on its work on standardized baselines.

A first consideration on the adopted decision can be made on the initial paragraph, whereby a definition of standardized baseline has been introduced. This definition is not comprehensive of all possible standardized approaches as described in this chapter and appears to be Party-specific. Indeed, a standardized parameter such as a national or multi-national grid emission factor could fit well in this definition, while other approaches might fit less appropriately.

Yet, the introduction of a definition – as narrow as it could be – was the only possible way to overcome opposition of some Parties, not at ease with an excessive openness of the CDM to any form of standardization. The issue itself of additionality was at the centre of discussion. In fact, during the negotiations, it was proposed to adopt a more general language, with “standardized approaches” replacing “standardized baselines”. This was refused by some countries, but finally additionality was included in the definition, as long as it contained also a strong reference to host countries. In fact, throughout the whole decision, a very central role is given to DNAs, including an “optional clause” for the use of standardized baselines in host countries. This element was key in reaching final consensus.

Another positive element of the decision is the specific request to the Executive Board to undertake a “top down” work on standardized methodologies. In fact, following the encouragement to Parties and other stakeholders to submit standardized methodologies for EB approval, there is a specific mandate for the EB to “develop” standardized baselines, including the indication of the priorities. This will be a challenge, because of limited availability of financial resources (the only specified resources are those from the annual budget of the CDM). Yet, it is a first step to undertake efforts in this direction and the clear priority given to under-represented regions is a positive accomplishment.

During the negotiations, other textual proposals had been tabled, referring – for instance – to periodical review at the renewal of the crediting period, or to the specifications of different standardization approaches (performance standards, technology penetration rates, pre-designed algorithms to determine emission reductions and additionality). Yet, the necessity of closing the package of decisions and reaching consensus forced to drop these elements from the decision text and to defer them to the next sessions of the negotiations. In this regard, the decision convenes an ad-hoc workshop, meant to clarify many of the aspects emerged during the discussions and excluded from the final text, including many of the issues emerged from SBSTA32.

Indeed, the COP/MOP decision is not an enormous step forward in work on standardization. Yet, it was a first move, that will hopefully be complemented, during next sessions, with further guidance and a stronger mandate to the Executive Board.

3. Case study: Methane Capture and Use in the Northern African Region

Introduction

Standardized baselines can be a means to streamline the project cycle and achieve a better penetration of the CDM in some regions and for some project types. A number of case studies are available in literature and in some offset schemes, in particular in some sectors (e.g. the power sector and some industrial sectors [5], [6], [21], [27], [38], [43], [44]), demonstrating the benefits of standardization. For other regions and sectors more research is necessary, in order to fully test the implications of standardized approaches and their application to CDM methodologies. In the present study, a target area and a target sector were identified, in order to test the suitability of UNFCCC methodologies and assess their possible improvement through standardization.

The **Northern African region** was chosen as the target area. While this area has been attracting a significant interest for possible low carbon investments, a big discrepancy remains between its huge potential and the actual status of project development. As of January 2011, in fact, the overall number of CDM projects registered in Northern African countries was only 14 (7 in Egypt, 5 in Morocco and 2 in Tunisia, see Tab 3.1). Furthermore, some of these projects have not been able, until now, to issue any credits.

These figures do not reflect the level of development of these countries (compared, for instance, to LDCs) and their project development potential. While in some countries slow CDM development can be re-conducted to lack of institutional capacity and knowledge, in others (where DNAs are well established and trained) different types of barriers are playing a decisive role.

Country	Projects in DNA Portfolio	Registered Projects
EGYPT	24	7
MOROCCO	61	5
TUNISIA	35	2
TOTAL	120	14

Table 3.1 Project Activities in Northern African Countries[5]
(Updated 1 January 2010)

A CDM project scouting activity was carried out in Morocco [47], in order to identify new opportunities for possible CDM investments. Within this activity, data and information were collected in a few sectors and UNFCCC methodologies were used to calculate emission reductions. This has given the possibility to test such methodologies and identify some elements for improvement, in view of a possible future work of the EB on development of standardized approaches.

In Morocco the DNA is well established and functioning. It was one of the first DNAs, established the same year of the Protocol's ratification. The DNA has been working actively in the identification and follow up of numerous projects ideas, especially in the framework of programmes of international assistance.

Several Project Idea Notes have entered the CDM pipeline, populating the country's portfolio. Yet, many of these projects were not able to enter the other phases of the CDM cycle, due to different barriers. Some activities, especially those with a public project proponent, encountered difficulties related to the tendering process, with delays in timelines and decision making. In other sectors, regulatory frameworks did not ensure the right conditions for project implementation. Other barriers were directly related to the internal rate of return of projects. In many cases in fact, CDM revenues represented a small incentive

[5] Source: websites of the countries' DNAs

for the private sector, unable to justify a number of investment risks. Other activities faced different obstacles and proved to be not technically feasible.

Nevertheless, it is widely recognized that this country has a huge emission reduction potential. For instance, big opportunities exist in the power sector, including an enormous renewable energy potential. Energy efficiency as well, is a largely untapped sector with a strong political commitment and a new legislation. In addition, the rate of growth of the national economy is significant, the regulatory environment is changing and investments are also favored by the proximity of consumers (especially the European market). In fact, Morocco is characterized by one of the highest investment climate indexes in Africa.

In light of these factors, host country's barriers are not sufficient to justify limited project development. Some obstacles need to be examined within the CDM structure itself, which is not properly designed to achieve a satisfactory project penetration in this geographical area. The heavy structure of the project cycle and the issues of limited certainty, predictability and high transaction costs are very tough in a region where others barriers to investment exist. These aspects can be decisive for investments in small scale projects, especially in rural areas.
The ongoing process of improvement of the CDM is looking at this issue, seeking more geographical balance and attempting to make methodologies more appropriate for some project types. Standardization, as one of the elements of this challenge, may represent an interesting step forward.

Methane capture and use was chosen as the target sector. The project scouting activity highlighted interesting opportunities in methane capture activities, thus offering the possibility to practically test UNFCCC methodologies. Indeed, this sector lacks a sufficient amount of knowledge and case studies in literature with reference to possible methodology evolutions (technical and scientific publications on standardization have addressed mostly other sectors, especially the power sector and other industrial sectors).

Methane is second only to carbon dioxide as a greenhouse gas resulting from human activities. Due to its high global warming potential[6] and its short atmospheric lifetime (12 years), it is particularly effective for global warming mitigation in the near term. Methane reduction activities are mostly connected with projects in the sectors of waste management, oil and gas activities, coal mines, agriculture and wastewater. Generally, methane is not considered a pollutant, therefore its emissions are not regulated in these sectors. In addition, there is not sufficient financial return for methane recovery and use (in absence of other incentives), unless it is generated in very large quantities. Therefore, the CDM can provide the proper added value for implementing capture projects and avoid methane emissions in the atmosphere.

Methane capture and standardization

Methane capture is considered in literature (e.g. Broekhoff [6]) a sector with good potential for standardization. Good experiences of development of standardized baselines exist, for methane projects, in some offset schemes (e.g. [53], [54], [59]). However, different project types within the same sector can be differently conducive to standardization. In addition, changes in characteristics, practices and combustion efficiency throughout different regions suggest that project specific data should integrate standardized approaches, where possible.

In some cases, the project specific approach appears to be more appropriate. For instance, for projects implemented on existing facilities (assuming that the facility will be in operation for the full crediting period of the project), the baseline can be based on historical data of that facility. Yet, small facilities in developing countries do not always have all necessary data and information for calculating baseline emissions.

For greenfield projects, the common approach is to consider data from similar facilities in a given geographical area. This is not feasible for all project types, because of the objective difficulty of defining a “similar” activity (as technologies

[6] According to UNFCCC reference values, based on IPCC SAR, 1 ton CH_4 = 21 tons CO_2eq. According to more recent estimates (IPCC TAR), methane’s GWP appears to be higher (23).

and layouts can vary considerably within the same area) and of obtaining data from other projects. In addition, for some greenfield activities, many other factors can affect the baseline scenario. For instance, in the case of gas flaring, a number of elements will enter into the decision to flare or not (gas quality, distance to markets, local conditions, etc.).

In case of unavailability of historical data and unfeasibility of data collection, baselines can be developed using standard values. The IPCC's Guidelines for National Greenhouse Gas Inventories [25] provides a number of default values for different methane capture activities, while other institutions have also useful databases in the methane sector. For instance, in the natural gas sector, institutions such as the International Gas Union [60] and the Canadian Association of Petroleum Producers [55] provide a number of default values for various technologies.

In the sector of landfill biogas capture, the potential for standardization may be good for simple flaring projects, while the situation might be more complicated in case of methane utilization for energy production, because of changing grid characteristics from region to region. In this sector, the literature (e.g. Broekhoff [6]) suggests that standardization in the additionality demonstration may be done on the basis of the "common practice", "least cost", or "technology" tests. The "common practice" test refers to verifying whether the project utilizes commonly used or well established technologies; the "least cost" test verifies whether the technology represents a least cost option; the "technology" test verifies, for instance, whether a technology has no other purpose besides the CDM. This last option can be considered only for simple capture projects and the approach can be referred to as a "binary benchmark" (positive list). On the contrary, for projects where methane utilization for energy is involved, it may be difficult to distinguish whether projects are "business as usual" without a project specific approach.

Standardized methodologies for landfill biogas are already used under some regional offset schemes. For instance, schemes like the CCX [58], the RGGI [62], the CCAR [54] or USEPA's Climate Leaders [59] use project protocols with a number of standard eligibility rules, default factors for the efficiencies of combustion devices, uncertainty discounts for less accurate measurement methods, etc.

Concerning additionality, some protocols recognize as additional all projects not required by law and implemented in landfills without a previous LFG collection system. Others (e.g. Climate Leaders [59], CCX [58]) reach more or less the same conclusion, but based on a performance standard approach. Some protocols (RGGI [62]) add a “financial” requirement (projects should not benefit from other incentives, including those connected to electricity production or to renewable portfolios). The CDM is actually the only scheme to use a project specific additionality test, with requirements on investment and barrier analysis.

In the agricultural sector (methane capture from livestock activities) there is also some potential for standardization, possibly with the inclusion of project specific parameters. Yet, uncertainties due to changing manure management practices, livestock feeding, etc. may complicate setting reliable multi-projects baselines. Differences in layouts and management practices, in this field, are very frequent in developing countries.

Outside the UNFCCC some interesting examples of standardized parameters and emission factors exist. For instance, the Chicago Climate Exchange programme [58] has introduced “per animal” emission factors. Additionality, in many programmes, is assessed against regulatory requirements or performance standard approaches, with possible further requirements on financial criteria. In general, additionality tests may be standardized on the basis of “common practice” or “least cost” tests. Some propose to use, where possible, the “binary benchmark” of “no revenues other than the CDM”. As in the previous case, the CDM is the only scheme to use a project specific additionality test with requirements on investment and barrier analysis.

In the sector of wastewater treatment, regions with uniform practices and reliable data may be more conducive to standardization. This is not often the case, as technologies can be different in the same region. Options for additionality demonstration may include the common practice, least-cost or technology tests.

Non-UNFCCC schemes utilize a range of approaches similar to the agricultural case, while the CDM uses a project specific approach.

In general, standardization in the methane capture sector is more diffused in non-UNFCCC carbon offset programmes. The UNFCCC itself has introduced some elements of standardization within few methodologies, making use of factors (using IPCC values [25]) and even the benchmark approach (e.g. for greenfield projects in the wastewater treatment sector), while additionality tests remain project specific. Yet, present methodologies are still unpractical for some project activity types and more efforts are needed in order to enhance their application in some regions.

Project scouting experience in Morocco

Within the project scouting exercise carried out in Morocco [47], methane capture and use was targeted as a sector possibly conducive to new CDM opportunities. In particular, the sectors of **waste management, agriculture and wastewater** were identified as possible promising sectors for new CDM projects.

As regards the **waste management** sector, neither methane recovery and flaring nor methane use for energy production are common practice in Morocco. Legislation requiring compulsory collection of landfill gas (LFG) from waste sites does not exist, therefore in principle projects could be additional.
Landfilling is the only existing method of Municipal Solid Waste (MSW) disposal in Morocco. The country is facing a continuous increase in waste production, resulting from the regular growth of urban population and industrial activities, as well as the evolution of consumption modes and living standards. Estimates on the total amount of MSW production at the national level reach 5 million tons per year, with a ratio of 0,76 kg per capita per day. Lack of financial resources and ineffective management practices have led many municipalities to engage the private sector in waste management activities. This has induced a general improvement in management practices, but often limited to waste collection and not including waste treatment.

Within other programmes of international assistance, few projects had already targeted some interesting landfills. Beyond these projects, some other opportunities were identified within the project scouting activity. Yet, no projects were finally selected for PDD preparation, due to a number of practical difficulties:

- Management practices did not include dumping by sections, nor leachate collection and treatment. Furthermore, waste was disposed of without compacting and daily coverage with inert material, with aeration higher than expected on properly managed landfills.

- In some cases, with landfills located over clayey soils, water logging had occurred. This had not been managed with proper draining, but only covered with soil and inert material, with waste continued to be disposed of afterwards.

- Landfill management did not include weight measurement. Estimates on the total amounts of incoming waste were made on the basis of truck load volumes (multiplied by the number of incoming trucks and some average density).

- There were no reliable data on the composition of waste, due to the absence of appropriate laboratory measures.

- In few dumpsites, dangerous or inert waste was disposed of together with municipal solid waste. In these cases, the overall reliability of emission calculations was compromised.

- In few cases, due to local management conditions, there existed danger from explosions from “pockets of methane” located within existing waste dumps.

In general, change of management practices to allow methane recovery or improvement of other aspects (laboratory measures, weight measurement, leachate collection, etc.) entailed excessive investment costs and were not sufficiently justified by CERs revenues. In some cases, administrative issues added a further barrier. Land ownership, for instance, was a decisive barrier for a specific project. The selected dumpsite was not a direct ownership of the municipality and this posed a number of procedural barriers on a possible tender for the landfill management.

In the **agricultural sector**, an interesting category of projects regards manure management systems. Anaerobic lagoons are largely used as treatment systems in Morocco, with consequent methane emissions in the atmosphere. Sometimes, local practice includes a first stage of treatment, consisting of shallow basins, where bigger solid particles can settle, while "cleaned" wastewater will overflow to the lagoon. Wastewater overflowing to the proper lagoon system is still in the conditions to decompose anaerobically.

Fig. 3.1 pre-treatment shallow lagoon

This does not match perfectly with existing methodologies, where the definition of lagoon system does not specifically contemplate "batteries" of different lagoons.

In addition, in some farms it can be observed that animal waste is not transported directly from the barns to the lagoons, but there is a pit for the collection of the daily amount of waste. This is transferred to lagoons at different intervals of time.

All these elements bring some degree of uncertainty into emission reduction calculations. Considering further difficulties related to project locations (usually rural areas) and site owners' availability, no project opportunities were finally selected in this sector.

In the **municipal wastewater sector**, Morocco has a predominance of public sewage systems, covering around 80% of settlements and 97% of total population. The rest is covered by individual sewage systems, not served by a network. Annual volumes of urban wastewater discharges have undergone a notable increase over the last years. Several treatment facilities are present throughout the country, especially around the biggest urban centers. The common technology practice for wastewater treatment is represented by anaerobic lagoons. These are used both in biggest municipalities and in smaller urban centers, where wastewater treatment is managed by the National Office of Drinking Water (ONEP). Technology choices are based on the National Framework Scheme for Liquids and Sanitation (SDNAL), which includes:

- anaerobic lagoons as a first treatment stage with depth of 3 – 5 m;
- anaerobic shallow lagoons as a second treatment stage with depth between 1,2 and 2 m;
- maturation lagoons as a third treatment stage with depth between 1 and 1,2 m.

A first project opportunity was taken into consideration in a treatment plant near Meknes, managed by the entity responsible for electricity and water distribution for a group of municipalities. The WWTP was not operational yet at the time of project scouting. Assumptions for 2010 were that the plant would serve a population of 631,000 inhabitants, in addition to industrial effluents of 215,000 inhabitants equivalent.

The system consisted of 3 batteries with 3 anaerobic lagoons per battery (9 lagoons in total) and an area for drying sludge. The lagoons covered a surface area of 11.7 ha and the maximum lagoon depth reached more than 5 meters. The

lagoon capacity allowed retention of waste water for about 3-5 days, after which the water would be discharged into the nearby river with the level of BOD_5 reduced by 40 – 70%. Sludge would be periodically removed from the lagoons and transported to a treatment area, where it would be left to aerobic decay. Dehydrated sludge was supposed to be disposed of in a landfill.
The implementation of one additional battery is planned beyond 2020, leading to 12 lagoons in total, with a resulting total surface area of 15,6 ha.

Fig. 3.2 Meknes treatment plant

The project idea was to implement equipment that would collect and utilise biogas generated from decaying of organic matter under anaerobic conditions. High endurance plastic material would be used to cover lagoons and prevent biogas to be released into the atmosphere. Collected biogas with high percentage of methane would be flared and emission reductions would occur by transformation of CH_4 into CO_2.

Also, the estimated amount of energy generated in the process of transformation of biogas was enough for running an electricity generator with installed power capacity of 1,5 MW. This would result in annual electricity production of 11,76 GWh and additional emission reductions through electricity production from renewable energy sources.

The following small scale methodologies were used for preliminary calculations of emission reductions:

- AMS.III.H. – "Methane recovery in Waste Water treatment"
- AMS.I.A. – "Electricity generation by the user"

Technical information was collected trough questionnaires, site visits and a feasibility study. A first application of these methodologies indicated that the project had a capacity to reduce GHG emission by around 42,300 tCO_{2eq} per year (34,300 tCO_{2eq} per year from biogas flaring and 8,000 tCO_{2eq} per year from electricity production).

A second project opportunity was selected near Agadir, in a wastewater treatment facility operated by the local water distribution entity.

The facility had a capacity of 50,000 m^3/day and consisted of two different treatment stages. The primary stage consisted of anaerobic treatment in 9 lagoons. One of the lagoons was always out of function due to cleaning of sludge and maintenance, thus leaving 8 lagoons always operational. The average depth of the lagoons was 4.25 meters and the average surface area was around 4,000 m^2. The average reduction of COD in the lagoon system was 40-60%.

The secondary stage consisted of a sand filtration system. After the secondary stage, the effluent was discharged into the sea, with an overall rate of COD removal of 98%.

Fig. 3.3 Wastewater treatment plant near Agadir

Temporary equipment for collection of biogas in some areas of lagoons was already implemented, due to some research activities. According to available measurements, 77% of the biogas was composed of methane, thus justifying possible use for energy production.

The proposed project activity would consist of covering lagoons and collecting biogas generated under anaerobic conditions. The primary emission reductions would be achieved by the transformation of CH_4 into CO_2 through combustion of collected biogas.
Also, the amount of energy generated through gas flaring could provide enough thermal energy to run an electricity generator of 1 MW, thus generating about 7,800 MWh/year.

The following 2 methodologies were used to calculate emission reductions:

- AMS III.H. - “Methane recovery in Waste Water treatment”
- AMS I.A. – “Electricity generation by the user”

Technical information was collected trough questionnaires and site visits. A first application of these methodologies indicated that the project had a capacity to reduce GHG emission by around 44,000 tCO_{2eq} per year (38,200 tCO_{2eq} from flaring and 5.800 tCO_{2eq} from electricity production).

Unfortunately, projects located in Meknes and Agadir did not enter the final portfolio, because of lack of agreement with the site owners on a number of administrative and procedural steps. Nevertheless, even in absence of follow up and PDD preparation, a number of interesting indications were collected on the technical feasibility of these projects and the applicability of the mentioned methodologies.

Another project opportunity was selected in consultation with the national water utility (ONEP). A number of wastewater treatment facilities (8 in total) managed by ONEP were identified for potential CDM development. All plants adopted the technology practice of lagoons and in all of them basins deeper than 2 meters were present (with consequent anaerobic conditions conducive to methane formation).
The proposed CDM activity was to cover anaerobic lagoons in order to capture and collect biogas. The recovered biogas, containing high percentage of methane, would eventually be flared or used for energy production. The emission reduction would be achieved by the transformation of CH_4 into CO_2 (occurring during biogas combustion) and by displacement of fossil fuel use (due to energy production). The choice whether to flare or utilize the recovered biogas depended on each single treatment plant.

Preliminary calculations confirmed potential CDM feasibility. Specific technical information was collected through questionnaires, completed by the site owner. A feasibility study was carried out to further investigate the project potential, with more detailed emission projections and economic analyses. Predicted flow rates for 2010 were done on the assumption of 2% of annual population's growth.

Site	Served population [inhabitants]	Total surface area [m^2]	Flow rate [m3/jour]	COD Delta [mg/l]
Guelmim	95 749	8 840	2977	567
Ouarzazate	56 616	5 896	9600	390
Berkane	80 012	4 343	9180	272
Berrechid	89 724	4 692	N.A.*	N.A.*
Bni Bouayach Imzouren	15 497	2 208	2512	680
Taourirt	80 012	4 250	4919	650
Tiznit	53 682	2 065	2331	498
Essaouira	69 493	8 400	7992	125

*Not Available

Table 3.2 – Data and characteristics of anaerobic lagoons

Since estimated reductions in single WWTPs were not large individually, in order to achieve a significant level of emission reductions and thereby reasonable transaction costs per unit of reduction, the 8 locations were grouped in a single "bundled" activity. Bundling different "similar" project activities is a possibility given by the CDM, based on the principles agreed by the EB at its 21st meeting. Bundling small scale projects offers the opportunity of undertaking a "single project cycle" for a group of projects (a single PDD, a single validating entity, etc.)

Different technology options (bio-digester, rigid geomembrane, floating geomembrane) were taken into consideration. Bio-digester is the most advanced technology option, allowing most effective performances in emission capture, odor control and production of biogas for energy purposes. Yet, it is also the most expensive option, also in terms of operation and maintenance. Rigid geomembrane, while being a much simpler solution, requires significant investment costs as well. Floating geomembrane is the simplest option and was chosen on the basis of the constraints and request posed by the site owner: simplicity, low maintenance, low energy consuming process, low investment costs and avoidance of any changes in the water treatment process.

Two different hypotheses were taken into consideration: biogas flaring and biogas utilization for energy production. Tab. 3.3 shows estimations of carbon credits generation in the two cases.

Site	Baseline emissions [tCO_2e]	Project emissions 1 [tCO_2e]	CERs 1	Project emissions 2 [tCO_2e]	CERs 2
Guelmim	3 022	511,24	2 511	401,2	1 896
Ouarzazate	4 532	913,09	3 619	912,4	4 256
Berkane	2 068	511,93	1 556	619,1	2 803
Bni Bouayach Imzouren	1 209	329,13	880	426,2	1 899
Taourirt	3 870	779,38	3 091	780,2	3 633
Tiznit	1 405	282,67	1 122	282,2	1 286
Essaouira	2 043	327,88	1 715	234,4	1 116
TOTAL	18 150	3657,32	14 493	3 647,3	16 898

Tab. 3.3: estimation of carbon credit generation

In light of investment costs for the 2 options, considering CERs value at 10 Euros, simple gas flaring appeared to be the best option in some sites, while gas capture and energy production seemed the best option in the others. Yet, the decision was not only driven by technical circumstances and economic reasons, but also by the site owner's preferences.

Economic estimates were carried out in order to assess the feasibility of the project in the different sites, with different assumptions on the percentage of borrowed capital. According to the economic calculations, not all sites were suitable for project implementation and some of them were characterized by an interesting IRR only if the project encompassed the energy production component. Nevertheless, a bundled project with the promising sites was economically feasible. Yet, in this kind of assessment, a potential investor will have to take into account the project risks, including the uncertain value of the CERs, the future recognition of carbon credits (since this project would begin at the end of the first commitment period of the Kyoto Protocol) and all risks connected with the phase of implementation, monitoring and issuance (failure or delays in credit issuance would impact the calculated IRR). In consideration of these aspects and of the scale of the project, transaction costs and lack of certainty and predictability may play a major role in an investment decision.

Considerations on methodology application

AMS.III.H was the methodology applied for the determination of the baseline scenario for the selected project opportunities. It was applied both on its own and in combination with other methodologies (in order to account for energy production), depending on the site under consideration.

AMS.III.H was approved for the first time in 2006 and is currently in its 16th version[7], valid from 10 December 2010. It covers the sectoral scope "13" (waste handling and disposal) as defined by the UNFCCC.
As of 1 January 2011, 88 projects had been registered under this methodology. Most project activities had been registered in Asian countries, as shown figure 3.4. No projects had been registered, under this methodology, in African countries.

[7] On 1 January 2011

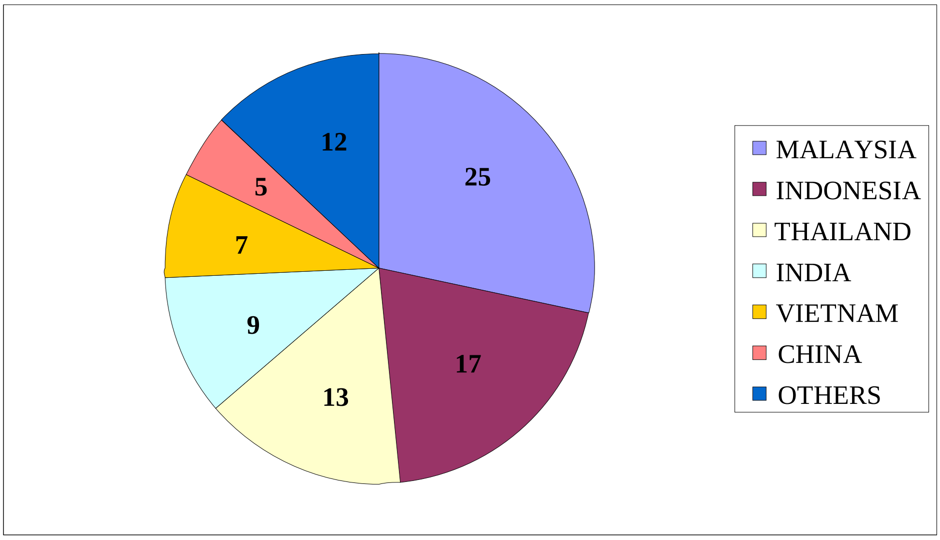

Fig. 3.4: Geographical distribution of AMS.III.H projects
(Source: UNFCCC, updated 1 January 2011)

Most projects belong to specific industrial activities, including palm oil production, tapioca and starch processing, alcohol industry, paper manufacturing, etc., as shown in fig. 3.5. Only 2 projects have been registered in the field of municipal wastewater.

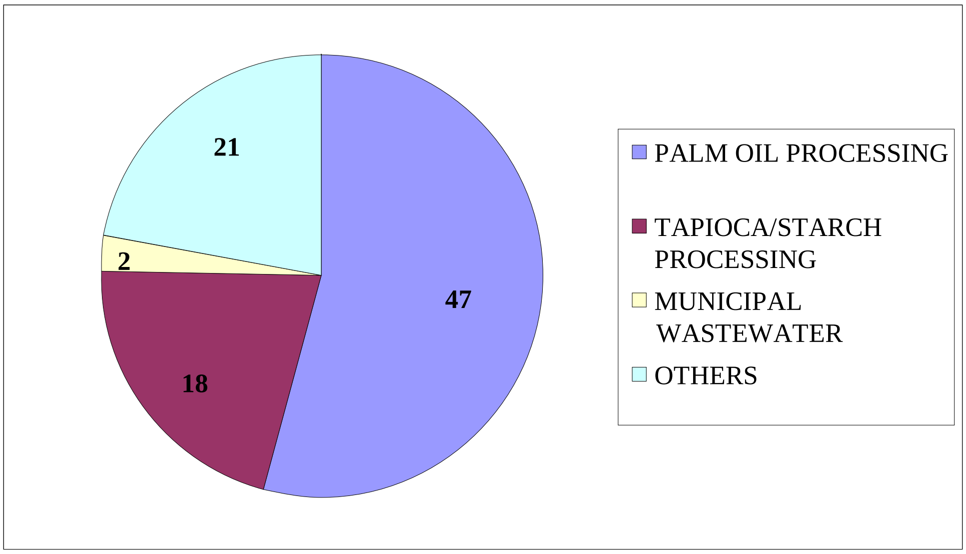

Fig. 3.5: Project type distribution of Projects registered under methodology AMS.III.H (Source: UNFCCC, updated 1 January 2011)

As a project specific methodology, AMS.III.H was conceived by project developers themselves, therefore constructed "around a specific project". Once approved by the EB, the methodology was used for other projects within the same sectoral scope.

In its first versions, the methodology was much simpler than today. In fact, throughout its different versions, several changes were made, with latest versions getting generally more complex, in the interest of accuracy and environmental integrity.

Yet, the prevalence of projects of wastewater treatment connected to industrial activities and the absence of projects in African countries clearly suggests that this methodology was unsuccessful in attracting investments for municipal wastewater projects and in least developed regions.

Application of the methodology in the case studies was quite challenging, with a number of difficulties connected to several aspects. Examination of past case studies (not limited to municipal wastewater) and exchanges of views with project developers, engaged on similar projects in other regions, confirmed these challenges. In the case under consideration, the following specific issues can be highlighted:

- Lagoon definition

The lagoon systems, as encountered in the case studies, were not completely described by the CDM methodology. In fact in most cases, wastewater treatment through anaerobic lagoons included "batteries" of lagoons, some of them "shallow" (below 2 meters, used for the purpose of wastewater settling).

Fig. 3.6: Shallow lagoons for wastewater settling

At the time of project scouting, methodology AMS.III.H was in its 9th version. In such version, valid from 28 March 2008 to 09 October 2008, there was no definition of anaerobic lagoons nor any indications on wastewater retention time.

The only definition of the lagoon related to UNFCCC methodologies could be found in AMS.III.D (at that time in its version 14), related to animal waste management systems and very similar to AMS.III.H:

[…]

b) Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. rivers or estuaries), otherwise AMS.III.H shall be applied;

c) The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C;

d) In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than 1 month, and in case of anaerobic lagoons in the baseline, their depths are at least 1 m;

Such methodology included a reference to the “retention time” of lagoons. In the sites under consideration, retention time reached 1 month if both stages (shallow lagoon and deep lagoon) were considered. Otherwise, the retention time in “deep” lagoons was slightly less than 1 month. This aspect was not given, initially, the right importance as a potential barrier, since AMS.III.H did not make specific requirements.

In AMS.III.H version 10 (valid from 10 October 2008 to 07 April 2009), following a “request of clarification” from a private company, a definition of lagoon was introduced:

> *“Under this methodology anaerobic lagoons are considered ponds deeper than 2 meters, without aeration, ambient temperature above 15 °C, at east during part of the year, on a monthly average basis, a volumetric loading rate of Chemical Oxygen Demand above 0.1 kg COD.m-3.day-1. The residence time of the non-soluble part of the organic matter in anaerobic lagoons shall be at least 30 days”.*

The aim was to introduce the parameters of “ambient temperature” and “residence time”, in order to establish whether baseline conditions were conducive to methane formation. These specifications clarified the definition of lagoon while leaving ambiguous, for unusual lagoon configurations, issues such as the retention time. This could pose a problem in the development of a PDD, reducing certainty and confidence on the project approval.

In AMS.III.H version 14 (valid from 8 April 2010 to 12 August 2010), the definition was changed:

> *"Under this methodology anaerobic lagoons are considered ponds deeper than 2 meters, without aeration, ambient temperature above 15°C, at least during part of the year, on a monthly average basis, and with a volumetric loading rate of Chemical Oxygen Demand above 0.1 kg COD.m-3.day-1. The minimum interval between two consecutives sludge removal events shall be 30 days".*

Finally, from its 15th version (valid from 13 August to 9 December 2010), the definition became as follows:

> *(a) The lagoons are ponds with a depth greater than two meters, without aeration.*
> *The value for depth is obtained from engineering design documents, or through direct measurement, or by dividing the surface area by the total volume. If the lagoon filling level varies seasonally, the average of the highest and lowest levels may be taken;*
> *(b) Ambient temperature above 15°C, at least during part of the year, on a monthly average basis;*
> *(c) The minimum interval between two consecutive sludge removal events shall be 30 days.*

This definition is still valid in the last version of methodology. In this definition, the reference to the COD volumetric loading rate was taken out, as it was very problematic and unpractical for many potential CDM projects.

In fact, as in the cases under consideration, treatment systems may consist of several lagoons with different areas and depths; historical information would be needed on COD concentration and volume of the wastewater of every lagoon, making calculations very difficult.

In addition, COD loads in a lagoon may fluctuate, due to fluctuations in incoming wastewater composition, dilution with rainwater and other factors.

Finally, depth is influenced by sedimentation of solids at the bottom of the lagoon.

➢ Historical data

For the calculation of baseline emissions, AMS.III.H requires historical records of at least one year prior to the project implementation, including the following parameters:

- COD removal efficiency;
- amount of dry matter in sludge;
- power and electricity consumption per m^3 of wastewater treated;
- amount of final sludge generated per tonne of COD treated.

In the cases under consideration, historical records were present for wastewater flow rates (m^3/day) and COD in/out (mg/l), yet such data lacked external validation. Therefore, additional costs would be needed to carry out an ad-hoc measurement campaign, as requested by the methodology in absence of historical records.

> *"The parameters shall be determined by a measurement campaign in the baseline wastewater systems for at least 10 days. The measurements should be undertaken during a period that is representative for the typical operation conditions of the systems and ambient conditions of the site (temperature, etc). Average values from the measurement campaign shall be used and the result shall be multiplied by 0.89 to account for the uncertainty range (30% to 50%) associated with this approach as compared to one-year of historical data"*

This is very often the case in developing countries and especially in the African region for this kind of projects. While for other projects (of industrial type) these parameters are monitored and validated regularly, in case of municipal wastewater treatment an additional measurement campaign (with related additional costs) is very likely to be necessary. In presence of data without an external validation, a PDD could even be produced and reach EB registration, yet with limited attractiveness for potential investors.

- Other data

Data relating to **quantity and composition of biogas** generated in lagoons were not available for the sites under consideration. In absence of measurements, the only way to make calculations was to base them on available literature. Yet, no comprehensive studies of this kind are present in the region, thus bringing uncertainty over project calculations.

In addition, data relating to the project components of capture and flaring/energy production (supply of materials, construction of cover systems, civil works, biogas transport, desulphurisation systems, safety torches, connection to the electricity grid, etc.), as well as other economic data (financed capital, interest rate) are not easily obtainable from similar case studies in the region. Calculations of IRRs, based on these data, are therefore uncertain.

- Application in conjunction with other methodologies

AMS.III.H can be applied in conjunction with different other methodologies relating to “Type I” projects, according to the UNFCCC definition, namely:

- AMS.I.A (electricity generation by the user)
- AMS.I.B (mechanical energy for the user with or without electrical energy)
- AMS.I.C (thermal energy production with or without electricity)
- AMS.I.D (grid connected renewable energy generation)

While for AMS.I.B historical data are required, for AMS.I.A, AMS.I.C and AMS.I.D the “tool to calculate the emission factor for an electricity system” must be used, which is quite difficult in many developing countries, because of very limited data available.

As regards Morocco, no standardized emission factor has been approved to date. Data from the International Energy Agency or from other sources may be sufficiently reliable, yet clear indications from the local electricity utility, based on updated data, would be more appropriate to reflect the country's real conditions. Also in view of using the UNFCCC "tool to calculate the emission factor for an electricity system", updated data are necessary and not easily available to calculate the "build margin" and "operating margin" as defined in the tool, with information on existing and planned electricity power plants, including renewables (construction year, installed power, net generated energy, power plant performance efficiency). A degree of uncertainty is brought in project calculations if the data used in the tool are not updated and from an official source.

In addition, in developing countries it is often the case that several diesel generators are onsite, with consequent poor grid delivery and difficulty in "claiming" the diesel component. UNFCCC methodologies are not well adapted to these "uncommon" grid delivery layouts.

- Uncertainty over different bundled components

In order to carry out a pre-feasibility study within reasonable costs, detailed analyses and data collection were not carried out in all sites, but only in some of them, whose conditions were considered representative of the 8 projects. Yet, in view of PDD completion, due consideration of related uncertainty needs to be taken into account.

This is a common problem for bundled CDM project activities, where per-unit costs might be very high and not worth the investment in case of need of extensive data collection. This situation would not hold in presence of reliable and readily available data, which is hardly the case in the African region.

- Benchmark approach for Greenfield projects

It is interesting to point out that methodology AMS.III.H contains an element of standardization for Greenfield projects. The methodology, in its 16th version, reads as follows:

> *For Greenfield and capacity addition projects, one of the following procedures shall be used:*
>
> *(a) Value obtained from a measurement campaign in a comparable existing wastewater treatment plant i.e. having similar environmental and technological circumstances for example treating similar type of wastewater. Average values from the measurement campaign shall be used and the result shall be multiplied by 0.89 to account for the uncertainty range (30% to 50%) associated with this approach. The treatment plant and wastewater source can be considered as similar as the baseline plant, whereby the measurement campaign can be implemented when following conditions can be fulfilled:*
>
> *(i) The two sources of wastewater (wastewater treated in the selected plant and from the project activity) are of the same type, e.g. either domestic or industrial wastewater;*
>
> *(ii) The selected plant and the baseline plants employ the same treatment technology (e.g. anaerobic lagoons or activated sludge), and the hydraulic retention times in their biological and physical treatment systems do not vary by more than 20%; and*
>
> *(iii) For project activity treating industrial wastewater, both industries have the same raw material and final products, and apply the same industrial technology. Alternatively, different industrial*

wastewaters may be considered as similar if the following requirements are fulfilled:

• The ratio COD/BOD (related to the proportion of biodegradable organic matter) does not differ by more than 20%; and

• The ratio total COD / soluble COD (related to the proportion of suspended organic matter, and therefore to the sludge generation capacity) does not differ by more than 20%.

(b) Value provided by the manufacturer/designer of a Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative, e.g. average values from the top 20 percent plants with lowest emission rate per ton COD removed among the plants installed in the last five years designed for the same country/region to treat the same type of wastewaters as the project activity.

The (b) procedure uses the "top 20 per cent approach in the previous five years", as indicated in the Marrakech Accords.

This approach might be applicable for some industrial activities, but not for the wastewater sector in African countries. In these countries, but also in many other developing countries, the sector is two small and assorted (different technologies, configurations etc.) that it is impossible to come out with a representative and applicable benchmark. Therefore, in those cases where new facilities are planned in the coming months or years, this approach is not applicable.

➢ Additionality Demonstration

AMS.III.H, along with similar methodologies referring to biogas capture (AMS.III.C, AMS.III.D) pose a general problem regarding additionality. In fact, proving barriers by means of UNFCCC tools is quite difficult in relation to financial flows and possible CER revenues, when those methodology are coupled with an energy use component. Calculations of the IRR present different elements of uncertainty, to be added to other factors relating to historical data and energy data. In the cases under consideration, elements of uncertainty were manifold and included the estimation of the construction costs, due to the absence of similar projects in the same region. Therefore, the value of the IRR could be very changing depending on the initial estimated costs.

Some efforts are being done by the Executive Board in order to streamline methodologies and make them more applicable in under-represented sectors and regions. Yet, more needs to be done in order to fully face this challenge and encourage investments. The studied methodology, for instance, was not fully suitable and efficient for the project conditions. Standardization, along with other approaches, can be part of the overall work for the improvement of methodology application.

Proposals for methodology improvement and standardization

In light of the observations above and in consideration of other evidence across projects studied in different geographical areas, methodology AMS.III.H needs to be further streamlined – and possibly standardized – in order to enhance its applicability over different geographical regions and sectors. While some of the barriers encountered in Morocco are specific of the project locations, others are common to project proposals in different areas, especially Eastern Asia.

Furthermore, the feasibility barriers were discussed with possible private investors, confirming some limitations of the existing approaches and some room for improvement.

For the studied methodology, standardization could be recommended in the following areas:

- Calculation of emissions and monitoring for the energy use component of the biogas projects.

Projects that use AMS.III.H usually correspond to “type I” project, according to the UNFCCC definition (mostly type I.A – electricity generation by the user, type I.C – thermal energy production with or without electricity and type I.D - grid connected renewable energy generation).

As observed in the case studies, but also from other evidence in LDCs and SIDS, it was very difficult to apply the exact requirements for biogas projects coupled to “type I” situations. One of the main reasons, especially for I.C projects, is the need to provide historical data. In addition, taking into account experience from similar project activities, having to measure thermal energy (TJ) might be quite complicated.

Small scale methodologies for I.A and I.D projects (AMS.I.A and AMS.I.C) have undergone several changes throughout their different versions, becoming more accurate but also more complicated. They refer to the emission factor tool, which for some developing countries is very difficult to apply because of issues of data availability. There are also common situations with poor grid delivery, with several onsite diesel generators complicating layout and calculations. Many biogas sites have also onsite biomass generators, which makes it difficult to apply the tool.

For underrepresented regions, therefore, it would be advisable that a methodology like AMS.III.H specify directly how the energy baselines/monitoring would be applied (not referring them to other type I methodologies). Some methodologies (like AM0022, for avoided wastewater and on-site energy use emissions in the industrial sector) use this kind of approach.

For example, if the biogas plant is associated to thermal energy production (i.e. I.C projects), the baseline could be set as the TJ of energy equivalent delivered to the burner from the biogas multiplied by a coefficient of the fuel.

This would mean monitoring the quantity of biogas (Nm^3) and convert that to energy (TJ) and then to emissions (tCO_2). This would simplify monitoring, as biogas flows (Nm^3) are already monitored as part of AMS.III.H, thus avoiding the complication of monitoring energy (TJ), historical fuel use etc.

For projects of type I.A (electricity generation by the user) and I.D (grid connected renewable energy generation) as well, the procedure to calculate baseline emissions and monitoring requirements should be set within AMS.III.H. The requirement could be simplified to simple monitoring of the energy output (MWh), to be multiplied by a default emissions factor. In alternative, an ex-ante weighted average grid emissions factor could be calculated, thus avoiding calculations via the tool. In view of possible concerns about environmental integrity, an uncertainty factor could be applied, as it is the case in other methodologies (using a 0.89 correction factor).

Environmental integrity is not the first driver of such approach, but in under-represented regions a right tradeoff should be found between environmental integrity and the need to facilitate project implementation, recognizing that monitoring and baseline setting is an extremely difficult exercise. Therefore, sustainable development benefits and technology deployment and diffusion should remain the first goal.

- Methane monitoring requirements.

Currently, the phases of monitoring, verification and issuance for biogas projects are very complicated, with many investors preferring not to engage on such a difficult process, even in advanced developing countries.

Because of the very high number of parameters requested in AMS.III.H, as well as in other “biogas” methodologies, it is extremely likely that a problem arises with at least one meter, thus complicating the whole issuance process. In some rural areas, where facilities are quite remote from larger cities, if a methane analyzer brakes it could be very difficult and costly to reach it. In particular, meters placed at the flare system are the most complex and costly.

Currently, AMS.III.H requires monitoring methane content at the locations of flow-rate monitoring, meaning up to three times. For under-represented developing countries, this methodology should recover the original goals of being simple and practical.

First, the amount of biogas generated and combusted already represents, to an acceptable extent, emission reductions with respect to the baseline. Adopting this approach would simplify PDD calculations and increase certainty on project eligibility and credit generation; in addition, it would significantly simplify the monitoring phase, thus increasing certainty of delivery and issuance of CERs.

Secondly, measurement of methane content should be at just 1 location, as the level of accuracy gained through multiple measurements is limited, considering investment costs – and potential problems – due to installation of new measurement systems.

With these two suggestions, simply 5 parameters would be monitored in order to verify emission reductions: flow-rate of biogas combusted at the flare, the engine and the burner, methane content and energy output.

In addition, the presence of meters at the flares systems could be avoided very simply where automatic ignition flares are present. In fact, such meters ensure that biogas is actually burning and not venting in the air. In presence of automatic ignition (which is the case for most flare systems), absence of flare meters should be deemed acceptable (possibly with discount factors ensuring conservativeness).

The issue of environmental integrity and delivery of real emission reductions could be raised, as this approach would decrease accuracy in baseline determination. Yet, differences in accuracy are sometimes very small, compared with the benefits of a streamlined methodology.

As regard flow meters, many installations in developing countries are equipped with cheap ones, with frequent problems in calibration or other errors in calculations, impacting measurement of biogas flow rates. Errors of this kind are generally in the order of 1-5%. Yet, even with a 10% error in flow rate data, the impact on the overall calculation of emission reductions might be less than 1%.

For small scale CDM projects in under-represented regions, these small errors should not undermine the project cycle and a general rule should apply, stating for instance that "any error in accuracy which does not impact the overall calculation for more than 5% should be neglected".
This concept has sometimes been discussed in the UNFCCC context, under the name of "materiality". Some attempts were also made to have the EB adopt this approach in some methodologies, without success. On the contrary, the JISC has given more consideration to this issue for JI projects.

Of course, this rule should apply only to small scale projects, since 5% could be a significant CERs amount for a large scale project.

- Calculation of COD removal efficiency.

In its first versions, and until version 9, AMS.III.H applied the IPCC guidelines [25] to determine the lagoon efficiency (*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5: Waste, Chapter 6: Wastewater treatment and Discharge*).
The IPCC model was based only on the lagoon depth and ambient temperature without the need for historical data to determine the lagoon efficiency, COD volumetric loading rate or residence time of organic matter in the lagoons.
Then, the EB judged that the IPCC approach was too generic and a historical component started to be included in the methodology. Yet, in Northern Africa and many other developing countries, most biogas projects refer to rural industry and very few of them are managed in such a professional way

to have historical data available. The IPCC approach, in terms of practical viability, remains the best method and for this kind of project could be restored. Actually, this approach is successfully used in other emission reduction programmes, such as the USEPA Climate Leaders [59]. USEPA decided to adopt it because of the high costs and technical difficulty of direct methane measurements. Furthermore, there are even some studies (e.g. Lory et al. [32]) questioning such approach as too conservative.

AMS.III.H offers the alternative of making "ad hoc" measuring campaigns of at least 10 days, which indeed adds a further cost component in the overall balance. This was also the case for the Moroccan projects.

In general, there is a lack of recognition and consideration of developing countries' conditions when developing CDM methodologies. The suggestions above are ways to "streamline" the methodology, based on its current structure. Further hypotheses could be made and more elements of standardization brought in (e.g. emission factors such as livestock animal factors). Yet, it is unlikely that a project proponent will propose this kind of approach on its own, because of the upfront costs to develop a standardized methodology. Therefore, some degree of "top down" work will be necessary.

In this exercise, due consideration to past experience and comprehensive analyses of investment conditions need to be carried out. All stakeholders (including investors and site owners) need to be consulted, in order to make realistic project assumptions. In doing this exercise, geographical distribution of the CDM should be the main priority, along with the objectives of technology transfer and sustainable development.

A further exercise should target the harmonization of different methodologies. For instance, AMS.III.D – differently from AMS.III.H – does not require COD measurements for determining the baseline. Its approach could be extended to AMS.III.H, in the interest of simplifying calculations. In general consistency should be brought across different methodologies for similar project activities, in order to allow easier preparation of PDDs.

Consistency could be also enhanced across different programmes. For instance, the concept of “project boundary” (boundary including all sources of emissions to be reasonably included in the baseline) has slightly different definitions in the UNFCCC or in other offset programmes. Harmonization of these concepts, with due contributions from the scientific community, would facilitate project development.

4. The way forward

Towards a future climate agreement

The adoption of the Kyoto Protocol in 1997 was a significant accomplishment for international environmental policy. Despite the Protocol's weaknesses and shortcomings, a major result has been the creation of a global market based on a new carbon economy. Yet, the Protocol is not sufficient to ensure effective mitigation results for the future, and new instruments will be necessary to guarantee GhG stabilization at safe levels, as required by the Convention. Enhanced participation from all Parties is crucial, with commitments by all developed countries, participation of advanced developing countries, improved market mechanisms, efficient measuring, reporting and verification, improved rules for LULUCF and the introduction of the "REDD+" mechanism. Furthermore, mitigation action is not the only objective of climate change negotiations. Enhanced action on adaptation, development and transfer of technologies and the provision of adequate and predictable financial resources are also essential part of the future agreement. These elements were recognized as the "building blocks" of the future climate regime in the "Bali Action Plan" and are being deeply discussed in the framework of the AWG-LCA.

A global legally binding agreement, encompassing all these elements, is still the preferred option for tackling climate change. Yet, Parties are also exploring alternative approaches, such as the achievement of shorter term COP decisions, in order to foster action in those negotiating items that are more mature than others. Whatever the legal form, balance will be necessary in order to achieve results and a number of political issues and trade-offs (addressing the potential impacts of response measures, including CCS in mitigation policies, defining the role of REDD+ etc.) will need to be considered.

The role of standardization within the future agreement

Whatever the outcome of international climate change negotiations, it is very likely that project based mechanism will continue to be part of the game. Even in case of new mitigation approaches and different mechanisms being established, there is wide agreement that the implementation of mechanisms such as the JI and CDM will be continued to some extent. It is very likely, for instance, that geographical areas such as LDCs and SIDS will continue to host CDM projects anyway; this will be very important to give a signal of market certainty, as well as to meet the requests of developing countries. Furthermore, project based mechanisms were established by the Kyoto Protocol regardless of its commitment periods. A possible failure in achieving a second commitment period will not affect the legal existence of the CDM; its carbon credits, if not used for compliance with Kyoto targets, could continue to play a role in mitigation policy, either in regional markets (such as the EU emissions trading scheme) or within voluntary schemes. Therefore, negotiating the future rules of project based mechanisms remains of crucial importance for the future regime.

A broader use of standardized approaches can be part of the process of improvement of the mechanisms. Compared to non-UNFCCC experiences, the applicability of standardization is more difficult due to the wider technical and geographical scope of the projects. Yet, across the diversity of existing approaches, some may be suitable under the UNFCCC and improve the existing scheme. This has been under discussion for a long time in UNFCCC talks.

Even before COP/MOP6, the Executive Board was already working on the improvement of existing methodologies, including through the introduction of standardized approaches. Standardization, in fact, is fully allowed under the Marrakech Accords. Yet, the Executive Board lacked a strong mandate to exploit the full potential of standardized baselines. The recent COP/MOP6 decision on "further guidance relating to the clean development mechanism" has made an attempt in this direction. The decision was agreed in the framework of a compromise package and several elements will need further work over the next sessions. Some available reviews (e.g. Heimdal [61]) criticize its limited scope and the lack of a stronger mandate to the Executive Board. Yet, agreement on a more "ambitious" text was not realistic in this session, due to the worries from some Parties over the possible disadvantages of standardization. Some lack of confidence also originated from the intrinsic vagueness of the concept itself of "standardized baselines" that, as such, may imply a wide diversity of approaches with different consequences. Therefore, the tendency in Cancun was to circumscribe this concept within a clear definition, closely linked to the geographical scope of baselines and giving a strong role to national authorities. Nevertheless, the positive elements of such decision should be pointed out. For instance, the inclusion of additionality within the definition, the mandate to the EB for a top-down work on standardized baselines, the priority given to under-represented regions and the commitment to work – this year – on the refinement of many aspects not addressed by the decision. In this respect, an ad-hoc workshop has been convened and will hopefully be a good occasion for new steps forward.

The role of standardization within the overall package should not be underestimated. In fact, while representing a signal of continuity with the existing mechanisms, it can also represent an important link with new mechanisms and carbon market approaches. In addition, it can be given a strong role in the effort to include developing countries in mitigation actions and it can represent a driver, for these countries, to attract financial resources. Nonetheless, interesting linkages could be created with the new mitigation policies discussed under the AWG-LCA. In fact, standardization can be linked to the new sectoral mechanisms, to Low Carbon Development Strategies/Plans (LCDS/LCDP) and to the NAMA exercise.

LCDS/LCDP have been introduced through the COP16 AWG-LCA overarching decision. Their modalities of development and implementation has yet to be defined. Yet, they can represent a very interesting opportunity for developing countries in terms of contribution to mitigation policies and identification of financing needs. The identification of CDM barriers and possible solutions through standardization could enter the exercise of development of strategies, plans or NAMAs. Financing this kind of actions can represent an occasion to mobilize further financial resources through increased investment. In addition, integration of the standardization process with NAMAs and LCDS/LCDP will also ensure a link to the overall discussions on technology transfer and financing.

Therefore, while being simply a technical matter related to the project based mechanisms, standardization could assume a very important role in relation to many other topics of the negotiations.

Technical and geographical scope

The recent COP/MOP6 decision followed a mandate given by COP/MOP5, referring to standardized baselines for "specific project activity types". Before adopting this wording, wide discussion had taken place over the possibility of developing standardized baseline for "sectors" or "sub-sectors".

In the COP/MOP6 decision, the wording "project activity types" was not used, while the text referred more generically to "CDM project activities". While this wording might seem more general and inclusive, it has been framed within an article defining the baselines as "established for a Party or a group of Parties", which might give less flexibility to the EB to design widely inclusive sector specific baselines. Framing the work on baselines within a country driven process was very important, during COP/MOP6, for gaining final consensus.

The issue of applicability and technical scope, as a matter of fact, remains open and discussion will continue during next sessions. While the Executive Board can take some initiative on this aspect, a stronger mandate would be necessary from Parties.

In general, standardization can be applicable under specific conditions and not for all project types. The large diversity of projects and regions in fact, makes the

CDM more challenging than other carbon offset schemes in establishing multi-project methodologies. Standardization, while being an interesting approach for specific project activity types, cannot be considered as a general solution for all emission reduction categories.

Depending on the standardization approach, there are some attempts, in literature, to categorize activities more "conducive" to standardization (Hayashi et al. [21] as regards benchmarks, Broekhoff [6] for benchmarks and default values, etc.). According to project experience, standardization works best when projects and their baseline alternatives are sufficiently homogeneous. Yet, defining a project category may not be straightforward. According to the WRI-WBCSD Project Protocol [65], projects providing the same "product" or "service" could be assessed, in principle, against the same standardized baseline. Yet, such requirement raises the issue of defining a "product" or "service", which also leaves room for many options, especially in the energy sector. For instance, some industrial projects may be assessed against the energy used for unit of product, as well as against the final product itself. Depending on the choice, a standardized baseline could apply to fuel switch alternatives or end-product alternatives, both influencing the production cycle efficiency.

In general, determining the appropriate level of aggregation is not easy and will vary depending on the technology under consideration. Within a single sector there might be a huge variance in terms of size and type of a certain technology, with a single baseline failing to capture such variation. Furthermore, the more a methodology is standardized and widely applicable, the more it can lead to inaccuracies of calculations over single projects. For instance, small industries with low efficiency levels could be penalized by ambitious technology benchmarks. In fact, they might host projects resulting in considerable emission reductions, although not beyond the benchmark. In addition, applying a baseline to a large "family" of projects will require more conservativeness, in order to avoid overcrediting. Yet, excessive conservativeness will penalize some projects that would have been eligible in the project-specific case. This is particularly sensitive for large scale projects, where small inaccuracies can lead to big differences in the calculation of emission reductions.

Baselines should be determined on a case by case basis, based on the technical literature available in each sector. In addition, host countries, the industry and other stakeholders should be duly involved in this exercise. Project cases may be very different. For instance, in the power sector, the common "service" to be considered in developing a standardized baseline is traditionally the unit of electricity delivered. Yet, according to some studies (Lazarus, Kartha, and Bernow [30], Various Authors [52]), the Megawatthours of electricity should be further characterized in some occasions. For instance, projects providing electricity during peak hours are distinguished by different emission characteristics than base load power projects. This approach has been followed also by the WRI-WBCSD Project Protocol [65]. Lazarus, Kartha, and Bernow [30] also propose to differentiate retrofit projects and new facilities, as well as grid connected and stand alone projects.

Some authors make the attempt of establishing single baselines for sector-wide categories. For instance, Esparta and Martins [12] propose a unique baseline for any renewable electricity generation project, identifying natural gas as the single reference. These approaches are interesting in terms of simplicity and for the attempt of reaching a sector-wide tradeoff between over-crediting and under-crediting. Yet, in terms of general applicability, their endorsement would be difficult, as they would strongly penalize some project activity types while favoring others. In general, a due balance should be sought between over-crediting and under-crediting single project activities, keeping in mind the overall goals and priorities set out by Parties.

During next negotiating sessions, further language should be adopted in order to facilitate and speed-up the work of the Executive Board. In this regard, the wording "project-activity types", already agreed to during COP/MOP5, appears to be a reasonable playing field. In fact, it does not limit the potential of standardization, while not opening too widely its scope (and being therefore a “practicable” negotiating solution. At the same time, some further priorities should be given to the Executive Board.

The question of the geographical scope (or boundaries) as well, has been raised several times by different Parties. The COP/MOP6 decision generically refers, in its definition, to baselines established for a Party or a group of Parties. Whether a specific baseline will apply at a national, sub-national or international level will depend on a case by case assessment, with no possibility of single solution.

For instance, in case of grid emission factors, the common-wise approach would be to determine them country by country. Yet, in some cases sub-national approaches should be used, due to different grid characteristics within a single country. In other cases, with different countries with similar grid characteristics, regional approaches could be applied (e.g. Bosi [5], Kartha, Lazarus and Bosi [27], Sathaye [44]). Bilateral and multilateral programmes, such as those implemented for some Eastern European Countries, should be encouraged, in order to select the best solution based on cooperative approaches. Other parameters might be even standardized globally. Lazarus [29] outlined the benefits of making the geographical scope as large as possible (e.g. to create a level-playing field among countries). Neelis et al. [41] argued that benchmarks should provide incentives to select the most cost-effective emission reduction options available, and such incentives are weaker if benchmarks are disaggregated too much. Taking these views into account, it should be noted that the best approach is not automatically the most widely inclusive. The approach suggested by Esparta and Martins [12], already discussed above, can be questioned for the same reasons at a geographical level. In fact, consensus would be impossible for a single global baseline favoring some countries and penalizing others. In addition, with such a baseline many good projects and investment opportunities would be left out of the scheme. On the contrary, the level and scope of standardization should be realistic and based on the best literature and project experience. For instance, in the WRI/WBCSD GHG Protocol for Project Accounting [65], reasonable boundaries (jurisdictional, physical or biophysical) are identified for different categories. In addition, national and regional institutions should be duly involved in defining the best approach for different projects. In some cases, participation of local authorities should be sought when a sub-national approach may apply. While the Executive Board should do its best to reach out to appropriate institutions, a pro-active approach of local DNAs should also be encouraged. In this regard, the COP/MOP decision is an interesting step forward in encouraging a process of larger involvement of industry and DNAs in the elaboration and approval of baselines. With this decision adopted and the Executive Board having a stronger mandate on standardized baselines, this process will be facilitated and hopefully lead to technical progress.

Standardization and additionality determination

Defining the technical scope of standardization includes defining its “domain of application” (baselines determination, demonstration of additionality or both). This aspect has been highlighted in various instances, by Parties, as an element that needs to be clarified in order to proceed with negotiations.

The recent COP/MOP decision opened the way, for the Executive Board, to fully address additionality under its work. In fact, the text clearly includes additionality in the definition of standardized baselines. Initially, there was some discussion on the wording “standardized approaches” rather than “standardized baselines”, in order to have a more inclusive definition comprising additionality. This was not accepted, but finally a clear reference to additionality was included in the definition itself of standardized baselines, as long as the definition also included a strong reference to host Parties.

Including additionality in the scope of the work of the Executive Board was a good accomplishment of COP/MOP6 negotiations. In fact, several studies have highlighted the significant burden posed by additionality demonstration to the project cycle (Broekhoff [6], Matsuo [35]), as well as the danger to have non-additional project qualify as eligible under the project specific approach (Schneider [45], [46], Haya [20]). Yet, standardized additionality tests are not practicable for all project types and a case-by-case consideration is needed, by project activity type and by geographical area. Furthermore, limited research is available looking directly at the definition of standardized additionality tests. Most literature, in fact (Lazarus [29], Lazarus Kartha and Bernow [30], Sathaye [43], Houdashelt [23]), links this issue to the definition of performance standards, which can potentially be used also as benchmarks for additionality. In this regard, some authors (Trexler, Broekhoff, and Kosloff, [50]) suggest the adoption of statistical approaches in order to reduce as much as possible the risk of granting additionality to non-additional projects or excluding from eligibility good project proposals. The WRI/WBCSD Project Protocol [65] as well, suggests this approach as a suitable option to determine additionality. Indeed, the demonstration of additionality represents one of the most uncertain factors in the current CDM scheme and approaches to overcome this difficulty and give more certainty to the investors should be sought as much as possible. In absence of standardized methodologies offering a full solution for additionality, partial approaches should be also taken into account (e.g. addressing only one of the "barrier tests" required by UNFCCC methodologies). As suggested by the WRI/WBCSD Project Protocol [65], project specific considerations (e.g. exclusion of projects required by law) can also complement standardized approaches, in order to reduce as much as possible the risk of granting additionality to "business as usual" projects. Other authors (Eichhorst [13], Broekhoff [6], Hayashi et al. [21]) also embrace this approach.

Considering existing literature, and taking into account pros and contras of project specific and standardized additionality tests, it can be recommended to look, as much as possible, at "mixed" approaches. While "benchmark" approaches to additionality represent the simplest option, integration with project specific considerations represents, in most cases, the most sensible approach in order to balance the advantages of standardization with the need for accuracy, especially in the case of large scale projects.

Mandatory or optional nature

According to CDM rules and procedures, a new or revised methodology will be applied to all new projects falling under its scope, or to existing projects at the renewal of their crediting period. Therefore, the most natural approach would be to continue following CDM rules and to have new methodologies (even those fully standardized) mandatory and replacing existing methodologies.

Yet, where the introduction of a standardized approach (e.g. a benchmark) leads to significant changes in a methodology, a wise approach could be to leave it optional (and continue allowing the project specific method, based on the applicant's preference). In case of successful results, this could eventually change in a "regime" phase, where standardized baselines might become mandatory.

As already remarked, in some cases standardization may penalise some "good" project activities (especially large scale) due to its conservativeness, making them non-additional or decreasing their profitability. In other cases, a standardized parameter (e.g. emission factor) may not be applicable under specific project conditions. Keeping the option of the project specific approach, in these cases, will allow the development of emission reduction activities that would not be carried out otherwise.

The recent COP/MOP decision states that "*the application of the standardized baselines as defined in paragraph 44 above, shall be at the discretion of the host country's designated national authorities*". This refers to standardized baselines as defined in the decision. For instance, a newly introduced grid emission factor will need approval by the host country before being utilized, which fully makes sense. Yet, discussions had gone further during SBSTA32 and other sessions, specifically addressing a possible optional clause for the applicants, having the right to choose the project specific or standardized approach. The workshop on standardized baselines, to be organized in 2011 as required by the decision, is expected to bring more views and clarity in this regard. While the "optional clause" would not be common practice in the CDM modalities and procedure, some openness in this regard could be important in gaining consensus of host countries and investors themselves.

Actually, some degree of “optionality” is already present, to some extent, across existing methodologies. In the case study, it was observed that a benchmark approach is proposed in the methodology AMS.III.H as a possible method for greenfield installations. Yet, its use is not obligatory and is proposed, in the methodology, as a possible option. In this specific case, the benchmark approach was not successful (for the reasons explained in chapter 4) and no use of this option has been done to date. Updating such methodology with the standardized method without leaving a choice to applicants would not have been wise. In the same manner, new elements of standardization could be included within existing methodologies, as optional choices for applicants.

In order to achieve progress over the next sessions, some language in the negotiation texts referring to this approach could be key in gaining confidence and progress. At the same time, this could be the wisest approach in the process of update of existing methodologies.

Possibility of “hybrid” approaches

The CDM, by nature, is a global mechanism, covering unlimited areas and sectors. Standardization may be possible to a limited extent and project specific approaches might be often necessary anyway. Hybrid approaches, already successful in some experiences outside the UNFCCC (RGGI [62], Alberta Offset System [53], etc.) might be a solution in some cases, where a certain degree of standardization still needs to be adapted to project specific circumstances. Hybrid approaches combine project-specific methods with standardized elements and can be applicable to both the determination of the baseline scenario and the demonstration of additionality. As pointed out by some authors (e.g. Broekhoff [6]), this is often the most feasible approach, as it strikes a balance between the benefits and shortcomings of project specific and standardized methods. Some examples, in literature, address this aspect in relation to specific sectors. For instance, Lazarus, Kartha, and Bernow [30] or Kartha, Lazarus, and Bosi [27] highlight the advantages and disadvantages in demonstrating additionality of small scale renewable energy projects and large scale renewable energy projects, concluding that at least a barriers/benefits analysis is required in the latter case, to complement the standardized approach.

Some methodologies are adopting hybrid approaches also within the UNFCCC. For instance, AM0037 (flare reductions and gas utilization in oil and gas facilities) is a project specific methodology, but allows use of standard factors for leakage rates from pipelines. Other methane projects may be an interesting area of development of hybrid approaches. In this field and especially in rural areas and least developed countries, projects of the same type could have different characteristics and configurations, thus difficult to capture with a fully standardized approach.

Furthermore, as shown in the case study, the introduction of emission factors or default factors within project specific methodologies could simplify calculations and streamline the project cycle. Per-unit values could also be able to simplify calculations is disaggregated projects, including PoAs. In view of possible concerns on the environmental integrity using those values, conservativeness and further research could be the response. In fact, an increased use of emission factors in offset methodologies would stimulate scientific research for their accurate estimation, especially in those areas and activities with scarce literature. In addition, this should not be a primary concern in under-represented regions, where a more successful penetration of the CDM should be the main goal.

The COP/MOP6 decision does not refer, specifically, to hybrid approaches. This would have been an excessively specific level of detail, not agreeable by Parties in Cancun. At the same time, the decision is an interesting step forward, as it endows the EB with a stronger mandate on standardized baselines.
Therefore, the EB itself, in the short term, has the possibility to address hybrid approaches as a field of immediate work. If next sessions of the COP/MOP reach an adequate level of detail and priority setting, hybrid approaches – especially those favoring under-represented regions (e.g. the elaboration of emission factors

and default values to be included in existing methodologies) – should be clearly set as a priority.

Priority areas

Setting priority areas for the development of standardized baselines is one of the most difficult issues. Considering the potential impacts on carbon market dynamics, this is not only a technical issue, but also a sensitive political subject.

Some parties have been proposing "**environmental integrity**" as the most important objective of standardized baselines. Yet, the concept of environmental integrity is often confused with, or limited to "**conservativeness**" of the baselines. Conservativeness is a widely discussed concept, also referred to as "stringency" of a baseline (e.g. Broekhoff [6], Lazarus, Kartha nd Bernow [30]). In general, standardized approaches are less precise by nature and this requires a higher degree of conservativeness to avoid over-crediting. This can be achieved, for instance, through correction of the baseline with uncertainty factors, as well as through the choice of the baseline itself. Most approaches, in literature, refer to baselines reflecting a "better than average" technology. This is proposed, *inter alia*, by Sathaye [43],[44] and is utilized also in the WRI/WBCSD GHG Protocol for Project Accounting [65]. The reason behind this approach is linked to both environmental integrity (under-crediting is preferable to over-crediting) and the improvement of the emitting performance of technologies over time.

On the other hand, approaches should not be too conservative, especially for CDM project activities facing barriers of implementation. As shown in the case study, small scale projects in under-represented regions belong to this category. In these cases, methodologies should not become too "selective" in generating credits, otherwise they would not incentivize development of those projects that are intended to be encouraged through standardized approaches.

In consideration of possible concerns over environmental integrity, it should be noted that for small scale projects in under-represented regions, a relative level of over-crediting might be acceptable. In fact, if the overall result is a higher penetration of a certain technology, the net benefit in terms of emission reductions and sustainable development would justify the “non additional” credits.

Despite these considerations, conservativeness in credit generation remains an important political driver for those interested in decreasing the volume of credits and increasing prices (e.g. suppliers of credits). Wide use of stringent benchmarks, rather than other standardized approaches, could work in this direction. In some examples of literature on standardized baselines (e.g. Hayashi et al. [21]), benchmarks are studied much more than other approaches. In addition, prioritization seems to be given to those project categories endowed with comprehensive existing databases on performance standards (in other words, to those benchmarks that can be implemented more quickly).

Furthermore, adequate standardized rules could also downsize the credit generation of some project categories, that are currently overflowing the market (e.g. gas destruction projects). This would also have the effect to limit the overall CERs generation potential, influencing the market at the advantage of other projects types. This approach is also taken as a priority in some cases.

Yet, market dynamics should not be themselves the first driver in standardized baselines development. Project categories with ready data availability, for instance, should not take the lead over project development in under-represented regions, as standardization should not be a priority itself. Conservativeness, while remaining one of the most important elements in standardized baselines development, should not be the first priority when dealing with small scale projects and under-represented regions. Furthermore, environmental integrity should be considered in all its aspects, including other benefits on the environment, society and sustainable development.

Priority should be clearly given to standardized baselines that are likely to contribute to improve **geographical distribution** of the CDM. This was reflected in the recently adopted COP/MOP decision and was a significant negotiating success. In fact, the COP/MOP decision clearly defined priority for “*methodologies that are applicable to least developed countries, small island* *developing States and Parties with 10 or less registered clean development mechanism project activities as of December 31 2010 and underrepresented project activity types or regions, inter alia, for energy generation in isolate systems, transport and agriculture*”.

Besides geographical distribution, this wording also makes an attempt to improve **project type distribution**. In such respect, few specific categories, proposed by some Parties, were included in the text. The workshop on standardized baselines to be held in 2011 is expected to bring more clarity in this regard.

Prioritizing under-represented areas or project types can be a conflicting guiding principle, considering the limited financial resources available. Yet, keeping geographical distribution as the main objective, selection of priority project types could be functional to this objective, through selection of project types that would benefit particularly those under-represented regions. This concept emerged during the Cancun discussions and could be further elaborated in the next sessions. In this regard, a clear link between under-represented regions and project type lies in the scale of project activities. In fact, most of the unexploited CDM potential for these regions is represented by small scale project activities. As Hayashi et al. [21] point out, most registered projects are found in the range of 20,000 to 100,000 CERs per year. In particular, micro-scale projects (less than 5,000 CERs per year) are significantly under-represented. While one of the specific tasks of the Executive Board is its work for streamlining small scale methodologies, this task should be clearly linked to the task on standardization, as the rationale behind this tasks, to some extent, can be very similar.

Having set these first priorities, environmental integrity should not be neglected.

Yet, this should be set as a principle, rather than a priority and the recently adopted decision text well captures this consideration. In fact, environmental integrity is included within the definition itself of standardized baselines.

In this respect, standardization should aim at reduce the risk of inflated baselines, project gaming and other elements that could jeopardize the effectiveness of offset schemes. Emission reductions should become, to the extent possible, objective and verifiable. As explained above, the concept of environmental integrity should not be restricted to the accurate estimation of emission reductions (or conservativeness). Other benefits on the environment, society and sustainable development should also be considered. For example, in different instances throughout the climate change discussions, the “co-benefits approach” [39] has been proposed. This is a new project-based approach, aiming to address climate change concerns while also improving the local environment. The approach is based on the idea that those projects having additional benefits, other than emission reductions, should be recognized with some added value. For instance, projects associating methane emissions reduction with improvement of water quality, reduction of odors, generation of energy for local communities and job creation should somehow be rewarded in all these additional aspects. While studies are being conducted to establish measurable, reportable and verifiable methodologies to assess these co-benefits, preferential treatment and financial schemes in the interest of promoting this approach are also being discussed.

This concept could be easily included in the CDM and in the definition of priorities for standardized baselines, thus contributing to fully address the concept of environmental integrity. This specific relation is not addressed by existing literature and is worth to be explored.

In order to achieve progress on standardization, it will be necessary to go further than the COP/MOP6 decision. Based on the priorities set out in the decision, the Executive Board should undertake a clear work programme, with detailed objectives. Developing standardized baselines for under-represented regions and project types is a very wide task in itself and more specific priorities should be set. For instance, the work of the Executive Board could start from those areas where standardization can significantly help streamlining the CDM project cycle. Based also on the indications of the case study, some items for immediate work of the Executive Board could be, *inter alia*, the following:

- Selection of default values where possible, in order to simplify requirements on historical data;

- Removal of specific requirements adding unnecessary complexity to the methodologies, with reference to the project categories identified in the COP/MOP decision.

Institutional and financial issues

Institutional issues have been extensively discussed during UNFCCC talks and “who should develop the baselines” has been a recurring question. Many existing offset programmes have been using top-down approaches, with a central authority in charge of setting the rules. Yet, as many authors recognize (Broekhoff [6], Hayashi et al. [21]), this option has been successful mostly within limited geographical areas and with a limited number of project categories. On the contrary, the CDM faces a wide scope of project activities and a huge diversity of countries, thereby posing additional challenges. Developing standardized baselines would imply a considerable amount of upfront data and analyses, as well as significant financial resources.

Yet, a top-down approach is necessary to some extent. The way the CDM has worked until now (individual project participants proposing new methodologies) would not work for a standardized methodology obtained through a costly exercise. In fact, this would offer other investors the possibility to “free-ride” on such methodology. Therefore, institutions established under the UNFCCC should undertake – to the extent possible – this additional task.

As regards the CDM, the Executive Board has been given a clear indication through the recent COP/MOP decision. The decision, besides encouraging Parties, project participants, international industry organizations and observer organizations to submit proposals for standardized baselines through the host countries’ DNAs, also request the Executive Board to undertake a work on development of baselines.

This mandate is a very important step forward in work on standardized baselines, also thanks to the priorities set out in the decision. The workshop on standardized baselines to be held in 2011should further refine these priorities, so that a more focused mandate can be given to the EB and, in particular, its methodology panel. A clear work programme should include both an enlarged process of review of existing methodologies – to include options for standardization – and a plan on new methodologies or standardized tools and algorithms.

Yet, additional expertise and funding are necessary for this exercise. Comprehensive involvement of national governments is crucial, especially for nationally or regionally standardized parameters. Even local institutions could play a very important role for some methodologies. These institutions should be given the financial and technical capability to provide and regularly update emission factors or other parameters.

Local DNAs will have a very important role, both in the issue of data collection and in the issue of confidentiality, which might be a barrier – in some cases – to standardized baseline development. DNAs could be entrusted with processing sensitive data (e.g. for individual installations) and issue aggregate parameters, to be checked and verified by the UNFCCC. In this regard, a major challenge is developing sufficient human and technical capacities to deal with this effort.

On the other hand, too much flexibility given to governments could mean a tendency to allow overcrediting, in order to attract more investment. Therefore, a central institution should oversee the development of baselines, ensuring coordination, transparency and balance.

The international community should be ready to support these efforts (relevant international organizations and industry associations will have to be involved). Even universities and research institutes are increasingly entering into climate policy research. Given a strong international policy direction, it is likely and advisable that the academic bodies will strongly contribute to the scientific debate, providing important inputs to the development of reliable baselines. The aim should be to build a globally robust network where CDM administrative and technical bodies, national governments, the private sector, the academic sector and other institutions and stakeholders could contribute in a coordinated effort.

A good example has already been carried out in some countries, where standard emission factors for grid connected electricity projects have been approved and endorsed by the Executive Board. This is important to improve certainty and predictability for projects in those countries. It should be possible to develop standardized emission factors or default parameters for other project types as well, using existing methodologies.

Institutional issues need to be considered concurrently with the issue of financial resources. Development of standardized baselines can result in a very costly exercise and due consideration needs to be given to an adequate management of existing funds. The COP/MOP6 decision refers only to the CDM annual budget, which is limited and cannot accommodate all needs and will not allow an ambitious work on standardization. At the same time, the decision requests the EB to explore other financial resources.

Different standardized approaches have different financial requirements for their development. Hayashi et al. [21], for instance, make some estimates on the financial needs for developing benchmarks. These are quite different in the case of available data or need for data collection. Other authors make specific assessments in some sectors. For example, Eichhorst et al. [13] explain how costly and data intensive would be the development of the baseline with reference to the transport sector.

Working with clear priorities – as outlined above – will help optimizing limited resources through directing them towards immediate needs. In this regard, technology transfer and sustainable development of least developed countries are commonly recognized as urgent needs. Therefore, efforts should be concentrated on the priorities identified above.

Secondly, the establishment of adequate synergies needs to be ensured across existing sources of funding, as well as the new financial provisions for the future climate change regime. According to the Copenhagen Accord and to the AWG-LCA COP16 decision, a new "Green fund" will govern Parties' contributions to developing countries' mitigation and adaptation actions. This fund will complement existing resources and approaches and will cover most activities under the convention, including, *inter alia*, supported NAMAs. New and existing public funds will have to be used sensibly, in order to complement and leverage resources coming from the private sector, remaining the most significant source of finance for mitigation actions.

UNFCCC funds, used to strengthen the activities of the Executive Board and its methodology Panel, will not be sufficient to ensure a comprehensive work on standardized baselines. Strong inputs will still be necessary from the industry, host countries and other relevant organizations.

Existing multilateral programmes (e.g. through the World Bank and the Regional Banks) can contribute to the effort, while host countries will be requested to identify their needs and priorities. The NAMA cycle can contribute to this exercise, by integrating, as appropriate, data collection and baseline development into activities eligible for support. This synergy has not been studied, until now, due to the early-stage development of the concept of NAMA. Yet, it is recognized that one of the biggest challenges for financing mitigation will be achieving maximum results with limited financial resources. Financing these activities may result in attracting more investment into developing countries, thereby leveraging additional financial resources from the private sector.

Conclusion

Negotiations on Climate Change are in a critical moment. Science provides clear figures on the necessity of immediate action and Parties are engaged in a difficult process for setting up the future mitigation regime. Whatever the outcome of the negotiations, it is very likely that flexible mechanism, especially the CDM, will have a role in future mitigation policies, at least in LDCs. In addition, new regional markets are in expansion and will be increasingly linked to offset mechanisms.

In this regard, it is important that the work on the flexible mechanism continues, in order to give a signal of market certainty to investors. While some parties call for a "reform" of offset mechanism, the right term would be "improvement", with new rules aimed at improving regional distribution, efficiency and environmental integrity. Standardization, although not applicable to all categories of projects, can be part of this exercise and contribute to a more balanced offset scheme.

Standardization has advantages and shortcomings and is not applicable in all cases. Standardized baselines can be an appropriate driver for development of small scale projects in under-represented regions, where the high transaction costs associated with producing a baseline scenario may discourage potential investors. In other cases (e.g. projects with a large magnitude of emission reductions), project specific baselines may be more appropriate, because of the need of accurate calculation of emission reductions. In some cases hybrid approaches, integrating standardization with project specific elements, can be the best choice.

For under-represented regions, efforts should focus more on project benefits and sustainable development aspects for the host country, rather than on the impacts of the baseline on the carbon market. For small scale projects in these countries, conservativeness should be a second priority, while investments should not be hampered by too stringent baselines and complicated methodologies. A small degree of overcrediting in poorest countries could bring, in a wider perspective, a much larger amount of emission reductions through the effects of technology diffusion and transfer.

As shown in the case studies in Morocco, some methodologies were conceived for industrial projects and are not well suited or practical for simple technologies in rural areas. The CDM Executive Board and its methodology panel should increase efforts in the direction of streamlining methodologies. Within single methodologies, less prescriptive requirements should be set for certain technologies and conditions, removing unnecessary complexity and making them suitable to attract investments.

The term "standardization" should not be limited to the concept of performance standards or benchmarks. Despite this is a priority for some countries, small scale projects and underrepresented regions should be taken into account and a comprehensive work should also be launched on "default values" and "per unit values". Technology development should be fully taken into account and be part itself of baseline determination, so that requirements would adjust over time.

The recent COP/MOP decision, although limited in its scope, is a good first move concerning work on standardization. The decision has the merit of having set some first priorities (especially for under-represented regions), having included additionality within the scope of the baselines, having given a mandate to the EB for a top-down work and having planned work for the refinement of other aspects not addressed by the decision. This decision should be fully implemented and further focused during next sessions, in order to concentrate top-down efforts in the most significant areas.

At the negotiation level, success will be ensured by flexibility and by a step-wise approach, giving priority to developing countries' needs and engaging in a comprehensive "country driven" process. The role of standardized baselines, in this perspective, should not be underestimated. Interesting links could be established with NAMAs and LCDS/LCDP, within the "mitigation building block", and further links established with technology transfer and finance issues. The identification of areas of standardization could help in the overall effort to match country needs and limited funding, being a potential driver for leveraging additional financial resources from the private sector.

Finally, given the current status of negotiations and future perspectives of the CDM, the “non-Kyoto” hypothesis cannot be neglected. The carbon market may evolve towards multiple approaches and the setting up of links between the different markets. New mitigation approaches (sectoral, voluntary, bottom-up etc.) are also likely to emerge across different markets. The development of standardized rules and criteria for baseline and additionality may be a means to facilitate this process.

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