



Carbon markets in transition

**Bilateral Agreements as Basis Towards Piloting
Sectoral Market Mechanisms**

Umwelt 
Bundesamt

DEHSt
Deutsche
Emissionshandelsstelle

Impressum

Publisher

German Emissions Trading Authority (DEHSt) at the Federal Environment Agency
Bismarckplatz 1
14193 Berlin
Telefon: +49 (0) 30 89 03-50 50
Telefax: +49 (0) 30 89 03-50 10
emissionstrading@dehst.de
Internet: www.dehst.de/EN

Subject Editor

ECOFYS Germany GmbH
Am Wassermann 36
50829 Köln
Telefon: +49 (0)221 27070-100
Telefax: +49 (0)221 27070-011
info@ecofys.com
Internet: www.ecofys.com

Autoren: Carsten Warnecke, Hanna Fekete

status: 30th November 2013

Project number: CLIDE12771

Disclaimer

This document has been prepared as part of the on-going research work for the German Emission Trading Authority in the framework of the “Umweltforschungsplan” (FKZ: 3712 41 507). This document is an interim deliverable and should be regarded as work in progress. This document reflects the researcher’s current understanding and incorporates the data available at the time of writing. As such, it does not necessarily reflect the final outcome of the study contract. The views expressed in this document represent only the views of the authors and not necessarily those of the German Emission Trading Authority.

Executive Summary

The international carbon market is characterised by an activity gap between existing and future market-based mechanisms. Project-based carbon market mechanisms - such as the Clean Development Mechanism (CDM) - no longer provide sufficient incentives for the initiation of greenhouse gas mitigation activities in developing countries. At the same time, procedures and modalities for new mechanisms are not yet defined. However, a certain level of activity in the international carbon market is required to maintain the expertise of various stakeholder groups, to test new mechanism approaches in practice and to support the final definition of new mechanism procedures. In this gap period bilateral agreements between countries provide a basis for piloting market-based approaches at the sectoral level.

In this respect, the Ecofys research work follows different steps, in assessing opportunities towards the implementation of credited pilot projects based on bilaterally agreed reference levels:

1. Country selection methodology

Prioritization of countries to host pilot activities considers criteria which reflect the countries' activity and ambition levels in the area of carbon markets and climate policy.

2. Approach to defining reference levels

The definition of accepted credited baselines is key to the success of pilots. Concepts to define reference levels based on benchmarking steps are tested for two different sectors.

3. Steps towards implementation

Recommendations for actions by policy-makers for the implementation of bilateral sector pilots will be developed taking into account the prevention of market fragmentation.

In the first part we develop a detailed and objective ranking methodology to identify the countries most suitable to start piloting activities. Within the context of the priorities for this research, Chile and South Africa qualify as good choice for further steps in which two structurally different sectors are selected. In the second part concepts for the development of reference levels are tested for the Chilean electricity sector and the low-income segment of the buildings sector in South Africa. The research uses a benchmarking approach to address the question of how reference levels in sectoral approaches can be designed to offer pathways from existing to new mechanisms. Country stakeholders and sector experts contribute to all parts of the research through a workshop and various interviews. Results for the third part will be available towards the end of the research.

The research results for the first two parts show that there is scope to adapt and adopt elements from the CDM to support the development of new market-based mechanisms. With the main focus on broad segments of the economy and on lowering implementation barriers, the research identifies significant differences between the sectors and the usability of the CDM methods. In the Chilean electricity sector the CDM approach mainly requires a few important modifications which increase pragmatism, ambition and suitability for sector coverage while sectoral approaches in the building sector can only build on CDM experiences to a limited extent. The proposed simplified approach for the building sector is combined with an ambitious reference level definition which ensures a high level of environmental integrity and allows for the next steps towards implementation.

Table of Content

List of Abbreviations	7
1 Introduction	9
2 Country and sector selection	12
2.1 Criteria development	13
2.1.1. Exclusion criteria.....	14
2.1.2. Ranking criteria.....	15
2.1.3. Criteria for individual country assessment.....	20
2.2 Country selection	22
2.2.1. Shortlisting process	24
2.2.2. Ranking process.....	25
2.2.3. Individual country assessment (Chile, South Africa, Mexico).....	26
2.3 Sector selection.....	30
2.3.1. Sector considerations for Chile	30
2.3.2. Sector considerations for South Africa	34
2.3.3. Actual choice of sectors.....	37
3 Benchmark concept development	38
3.1 The benchmarking approach in a nutshell	38
3.2 Existing experiences with benchmarks	44
3.2.1. Benchmarks in the Clean Development Mechanism	44
3.2.2. Benchmarks in the EU Emissions Trading System	48
3.2.3. Benchmarks in the context of a New Market-based Mechanism	48
3.3 Framework conditions for benchmarks in the selected pilot sectors	49
3.3.1. The Chilean electricity sector.....	50
3.3.2. South Africa’s low income housing sector.....	62
3.4 Concluding remarks on benchmark concept development opportunities.....	74
6 References	77
Annex 1: Overview of criteria and sources for selection process	82

List of Figures

Figure 1:	Methodological approach to selection of countries	13
Figure 2:	Criteria application for country selection process.....	23
Figure 3:	Chile - distribution of emissions to sectors in 2008, excl. LULUCF.....	31
Figure 4:	Distribution of final energy consumption in the industry in Chile in 2010.....	32
Figure 5:	South Africa - distribution of emissions to sectors in 2008, excl. LULUCF	34
Figure 6:	Distribution of final energy consumption in the industry in South Africa in 2008	36
Figure 7:	Benchmarking and performance levels	38
Figure 8:	Key steps of benchmarking approaches.....	39
Figure 9:	Approaches to define the benchmark level	43
Figure 10:	Simplified scheme of emission sources in the electricity supply sector.....	51
Figure 11:	Distribution of plant size according to capacity installed in SIC and SING zone in December 2011. Data source: (Comision Nacional de Energía 2013)	55
Figure 12:	Range of variation in grid emission factors of Chilean CDM project activities (box plots based on data from IGES (2013))	59
Figure 13:	Overall CO ₂ intensity of electricity generation in Chile, 1990-2011. (IEA 2012a)	60
Figure 14:	Overview on available methodologies for “household & building energy efficiency” (UNFCCC 2012a)	63
Figure 15:	Simplified overview on energy related emission sources of the building sector.....	68
Figure 16:	Schematic representation of different emission levels for the determination of the benchmark stringency	73

List of Tables

Table 1:	Conversion of CDM participation into numerical scores	16
Table 2:	Conversion of submissions of National Communications and greenhouse gas inventories into numerical scores	18
Table 3:	Conversion of pledge ratings into numerical scores.....	18
Table 4:	Conversion of LEDS engagement into numerical score.....	19
Table 5:	Conversion of memberships in networks into numerical score	20
Table 6:	List of Upper-Middle-Income Countries, based on (OECD 2012)	23
Table 7:	Short list after criteria of exclusion	24
Table 8:	Ranking results of shortlisted countries.....	25
Table 9:	Comparison of capacities in Chile’s electricity system’s zones (CDEC-SIC 2012)	53
Table 10:	Grid Emission Factor use in Chilean CDM projects (own calculations based on IGES (2013))	59
Table 11:	Grid Emission Factor for Chilean electricity grids (Ministerio de Energía 2013)	59
Table 12:	Building CDM methodology overview.....	64
Table 13:	Climatic zones of South Africa (Republic of South Africa 2011)	71

Table 14: Annually avoided CO2 emissions per household in the Kuyasa CDM project (Reference number: 0079) 71

Table 15: Comparison of market mechanism related sector characteristics 74

Table 16: Overview of criteria and sources 82

List of Abbreviations

BAU	Business as usual
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
COP	Conference of the Parties
DNA	Designated National Authority
EB	Executive Board (of the CDM)
EDGAR	Emission Database for Global Atmospheric Research
ETS	Emissions Trading System
GEF	Global Environment Facility
GHG	Greenhouse Gases
IEA	International Energy Agency
JI	Joint Implementation
LDC	Least Developed Country
LEDS	Low Emissions Development Strategy
LULUCF	Land Use, Land-Use Change and Forestry
MAPS	Mitigation Action Plans and Scenarios
MRV	Monitoring, Reporting and Verification
NAMAs	Nationally Appropriate Mitigation Actions
NMM	New market-based Mechanism
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
PMR	Partnership for Market Readiness of the World Bank
PDD	Project Design Document
REDD	Reducing Emissions from Deforestation and Forest Degradation
SBL	Standardised baseline
SIC	Sistema Interconectado Central (=Central Interconnected System)
SING	Sistema Interconectado del Norte Grande (=Interconnected System of the Great North)
UNFCCC	United Nations Framework Convention on Climate Change

1 Introduction

This report presents interim results of the research project “The fragmentation of the carbon market and options for counteraction” tendered by the German Emission Trading Authority in the framework of the “Umweltforschungsplan” (FKZ: 3712 41 507) and conducted by Ecofys.

Background

The Clean Development Mechanism (CDM) was introduced by the Kyoto Protocol and has developed into one of the most important carbon market instruments. The CDM stimulated investments in greenhouse gas (GHG) reductions in developing countries that would not have occurred otherwise. Moreover, it raised awareness of climate change and the possibilities of carbon markets and led to a wide range of skills and knowledge available in developing countries. In this way the CDM played an important role in transferring the CO₂ price signal to almost all parts of the world and can be seen as a pioneer instrument which has paved the way for various emerging emission trading systems (ETS).

The continuous reform and development processes of the CDM also lead to different scaling up approaches. The introduction of Programme of Activities (PoA) and Standardised Baselines (SBL) aim for an increased scale of CDM activities and widens the CDM from a mechanism covering single projects to a mechanism with a sectoral scope. Furthermore, the CDM as a widely accepted offset standard with its links to different markets has the potential to indirectly link regional markets.

However, the success of the CDM relies on a stable demand for the supplied carbon credits and prices that are sufficient to incentivise investments in CDM projects. Due to unforeseen developments, such as the economic crisis, emissions in various countries and EU ETS installations dropped to unexpected low levels. In addition, further qualitative restrictions for the use of offsets from CDM and Joint Implementation (JI) projects in the EU ETS apply from 2013. This also includes offsets from CDM projects registered after 31 December 2012 and outside least developed countries (LDC) which are thus not eligible in the EU ETS anymore.

Against this background it is not surprising that the activity level in the CDM and especially in non-LDCs decreases to very low levels with the risk that structures and expertise established by the CDM get lost. Even if the CDM is discontinued on a larger scale and although future carbon market mechanisms do not intend to be a direct continuation of the CDM, this expertise might be required for the operation of new instruments. This includes, for example, the New Market-based Mechanism (NMM) under the guidance and authority of the Conference of the Parties (COP) which is defined as an instrument targeting larger emission reductions in broad sectors of developing country economies. The development of new market-based mechanisms and the ongoing evolution of the CDM might partly converge or might have overlapping applications. To what extent the mechanisms will interact, exist in parallel or even replace each other are still open questions.

Besides general uncertainty around the existing and future market mechanisms, further developments in the carbon markets additionally show fragmentation tendencies. On the one hand the Kyoto Protocol in its second commitment period regulates only a small part of the global greenhouse gas emissions and on the other hand various smaller, regional initiatives and emission trading schemes emerge. While direct or indirect linking through the CDM potentially leads to a larger global carbon market, various regional emission trading schemes remain hesitant to allow offsets generated under the CDM standards. In addition the potential creation of a “Framework for Various Approaches” might further increase the fragmentation of carbon markets since it is understood by some Parties to allow maximum flexibility to create individual crediting systems that could be counted towards targets.

Project objectives

Especially in non-LDCs the positive effect of the CDM in stimulating greenhouse gas reduction activities recently disappeared. It is therefore time to consider potential solutions to the related challenges and risks. A balanced CDM continuation and piloting activities towards new mechanisms could act as a stepping stone to pick up the existing skill base and selected approaches of the CDM. With the current supply and demand imbalance the required demand for credited pilot activities could be created based on bilateral agreements between Parties rather than by the markets themselves.

Against this background, this research project aims to develop theoretic approaches based on a potential bilateral crediting system. The methodological approaches of such a bilateral crediting system shall consider existing CDM structures while the potential transition to future mechanisms is a further key objective. Furthermore, the approach shall have a sectoral scope, facilitated through benchmarks, and shall ensure a high level of environmental integrity to maximise the potential international acceptance of generated reduction units. The specific conditions under which countries or regions with regional trading schemes and potential demand for offsets are willing to accept reduction units from the proposed bilateral crediting system shall in addition be assessed and considered.

Piloting activities for such a benchmark based bilateral crediting system can counteract the emerging fragmentation of the global carbon market by further enabling non-LDCs to finance and initiate mitigation activities, by involving regional trading schemes and by mostly building on existing CDM or ETS compatible methodological structures. A suitable legal framework for such a pilot-like approach provides Article 11a (5), (6) of the EU Emissions Trading Directive (European Parliament 2009). This article allows the use of credits from third countries in case bilateral agreements have been signed with these countries and in case by 31 December 2009 no international agreement on climate change has been agreed¹. Third countries in this respect are non-EU Member States. Article 11a (6) of the Directive specifies the eligible project types which are basically those which are eligible for use in the EU ETS during the second trading period. This includes renewable energy or energy efficiency technologies which promote technology transfer and sustainable development. Furthermore, also eligible are credits from projects which have a baseline below the benchmark used for the allocation in the third trading period of the EU ETS.

Bilateral agreements for piloting activities may regulate the processes and responsibilities and allow for learning-by-doing, as long as the further development of mechanisms under the United Nations Framework Convention on Climate Change (UNFCCC) is still pending. Examples from the past have shown that early activities positively affect the development of market-based mechanisms and have the potential to set standards. This project therefore aims towards proposing concrete structures which later can be expanded to other countries with the overall motivation of achieving a global carbon market. Since it is not yet predictable whether these pilots will fit into the future framework of an upscaled CDM or new market-based mechanisms, in the following we use the neutral term “reduction units” when referring to offset credits stemming from these pilot activities.

¹ The second commitment period of the Kyoto Protocol in its current form is not an international agreement as referred to in Article 11a(7) of the EU ETS Directive (cf. Questions & answers on use of international credits in the third trading phase of the EU ETS (January 2012) http://ec.europa.eu/clima/policies/ets/linking/faq_en.htm).

Project approach

The project follows a step-wise approach for the preparation of pilot projects on the basis of bilateral agreements. In the first part we develop sector proposals for bilateral agreements. At first potential target countries for pilot activities are identified out of the group of upper-middle-income countries. The actual selection process is based on a set of criteria which are developed to reflect the suitability of countries for bilateral agreements and sectoral mechanism approaches. Through assessing the countries' activity and ambition levels in the area of carbon markets and climate policy, we take into account that pilot activities in particular need endurance and long-term commitment from all participants. Furthermore, countries shall act as roles models for other countries in their region.

In the next step we identify for two selected countries suitable sectors for which the development of benchmarks seems possible. The preparations for benchmark developments in these countries address potential challenges such as methodological choices, definition of sector boundaries, differentiation of benchmarks to products or processes, data availability and more. The developed benchmark concept considers the application in an upscaled CDM or a new market-based mechanism. Developing benchmark concepts in the scope of this study does however not ultimately include the development of actual benchmark values.

To include both the supply and the demand side, the developed possible approaches are presented and discussed with suitable developing countries and countries which develop and operate an ETS. In particular, the project team reached out to various stakeholders and experts in the selected countries and the respective sectors in the course of 2013. On 5 June 2013, interim results were additionally presented and discussed during an expert workshop on "Reform efforts for the international carbon market: CDM, bilateral offsets and beyond" organized on behalf the German Emissions Trading Authority (DEHSt) at the Federal Environment Agency and the German Ministry for the Environment (BMU) in Bonn. For this purpose, an exposé was elaborated and distributed which included preliminary recommendations for the design of bilateral agreements and pilot project activities. The feedback received during the workshop was used to review and improve the proposed approaches.

In the third part of the project we develop practical recommendations for actions on the level of policy makers for the prevention of the fragmentation of the global carbon market. We consider recent changes to existing mechanisms and developments towards the definition of new market mechanisms for the implementation of pilot activities under the umbrella of bilateral agreements.

This report describes interim results of the first and second part of the project including the incorporation of workshop feedback while results for the third part will be available towards the end of the research only. The remainder of this report is organized as follows:

In section 2 we at first describe the developed methodology and the catalogue of criteria used to rank and identify suitable countries and sectors. Thereafter, the actual selection process conducted for this project is separately described in subsections 2.2 and 2.3.

Section 3 describes the methodological choices for the development of reference levels based on benchmark approaches. Further subsections in section 3 describe the conceptual proposals for the determination of reference levels in the selected target sectors incorporating the feedback received during expert interviews and the workshop.

2 Country and sector selection

In accordance with the project approach, we develop in the first part of the project sector proposals for bilateral agreements. This includes the selection of target countries out of the group of upper-middle-income countries, and within these countries the selection of suitable sectors. For these sectors we develop a concept for a sectoral benchmark which can provide the basis for credited pilot activities. The methodology for the selection of countries includes the application of specific criteria and follows a stepwise approach which is described in the following paragraphs.

Approach to selection of countries and sectors

The **starting point** for the selection of target countries is the group of upper-middle-income countries since non-Annex-I countries in this group are especially affected by the EU decision to abandon Certified Emission Reduction (CER) credits from CDM projects registered in non-LCDs after 2012. At the same time this group includes various countries that have shown leadership and commitment in the UNFCCC process and have global and regional importance. Especially pilot activities need endurance and ownership from all participants. Innovative pilot initiatives should also have up-scaling potential or characteristics that are replicable. Harvesting this replication potential is facilitated by role model status of countries hosting pilots. Host countries should therefore be actual or potential leaders for a regional group to have the potential to successfully promote and multiply credited pilot activities based on sectoral benchmarks.

While the starting point for the identification of suitable target countries is the group of upper-middle-income countries, this does not imply that all countries in this group qualify to host activities in the scope of this project. Various definitions from different organisations (e.g. World Bank) exist that classify this group of countries with minor differences. The list and definition provided by the OECD DAC² includes all countries and territories eligible to receive official development assistance (ODA). The categorisation of the OECD DAC follows the following principles: income classification according to the World Bank and exclusion of G8 and EU members and countries with a firm accession date for entry into the EU (OECD 2012). LDCs are listed separately and thus do not appear in the list of “upper middle income countries and territories”. Furthermore, all countries listed have ratified the Kyoto Protocol. Mainly the overseas territories in the list vary in terms of their status under the Kyoto Protocol. Since the territories also have a very limited potential for sectoral approaches they are excluded from the country selection. The OECD DAC list therefore provides the most suitable starting point for our country selection.

The methodological selection process of countries and sectors aims to consider efficiency and objectivity principles. We combine quantitative information with expert knowledge to achieve, in a transparent way, the best choice for the objectives of this study. To facilitate the detailed evaluation of promising countries, we apply a stepped approach which includes a “shortlisting process” followed by a “rating process”. The individual steps of the country selection process are visualised in Figure 1.

2 The DAC is the Development Assistance Committee of the Organisation for Economic Co-operation and Development (OECD).

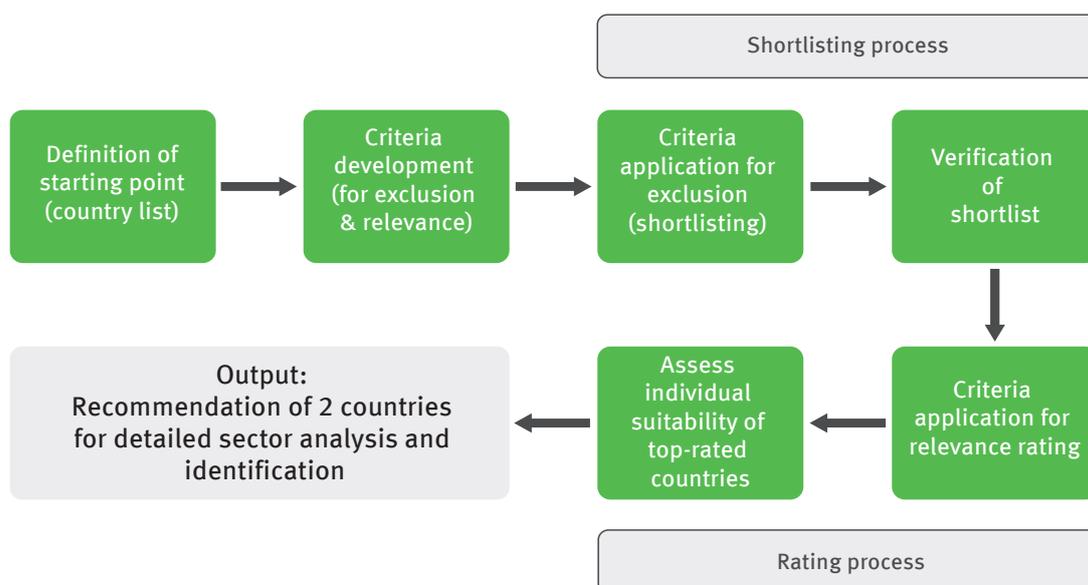


Figure 1: Methodological approach to selection of countries

In the **shortlisting process** we apply criteria for exclusion to countries that will evidently not meet the requirements for the purpose of this study. The preliminary list of selected countries will in a next step be verified to ensure that no promising country is accidentally excluded.

In the **ranking process** we apply additional and more detailed criteria to the shortlist of countries. These criteria facilitate the ranking of countries according to their activity and ambition levels concerning carbon market readiness and greenhouse gas mitigation. This is seen as essential for sectoral benchmark based pilot activities enabled by bilateral agreements. The ranking process results in a specific ranking order for the shortlisted countries.

In a final step we consider the individual suitability of countries starting from the top of the list of countries. For the assessment of the individual suitability of top-rated countries we consider detailed information which describes conditions such as the general attractiveness of countries for further global cooperation, the integrity level of relevant activities or plans as well as the existence of agreements in other areas. This assessment results in a recommendation of two countries for a detailed sector analysis.

The developed criteria are described in section 2.1 while the actual country selection process is documented in section 2.2. The selection of sectors within the recommended countries follows criteria as described in section 2.1.4, and is documented in section 2.3.

2.1 Criteria development

In this section we describe the methodological choices for the development of criteria which are applied in the shortlisting and the ranking process. The justification for all criteria is described including the data sources and the application methodology. Furthermore, an overview in tabular form can be found in **Annex 1** with detailed information on each data source used for the specific indicators. The actual application in the country selection process is documented in section 2.2.

2.1.1. Exclusion criteria

Criteria for exclusion are developed and applied to obtain a shortlist of countries for further detailed considerations.

Criteria: Global importance / emission level

Countries' total greenhouse gas emission levels are one first criterion of orientation for their global importance. Since this project aims to prepare pilot activities based on benchmarks, initial project activities should be applicable to a significant amount of emissions or project cases to ensure a substantial level of impact and a multiplication potential. It is assumed that small countries or countries with small total emission levels do not provide the required opportunities and are less suitable with regards to the piloting character of the envisaged activities.

We additionally look into emission levels of sectors within selected countries. This is to address the situation that countries might have outstanding high ambition and activity levels but the total emission level does not reflect their suitability. In these cases single sectors might exist that are suitable for benchmark-based pilot activities (cf. section 2.1.4). Sectors with large point sources such as the electricity and heat production and industry sectors are more suitable for the development of single benchmarks while sectors with smaller and dispersed emission sources are less promising, such as the agricultural, transport and buildings sectors. In this step we apply a rough categorisation of sector emissions which distinguishes into some parent categories (e.g. electricity and heat production, industry, transport, households and services, agriculture, forestry and land use, waste). For the detailed sector selection in section 2.2, we use more specific sector distinctions and data.

Data sources:

- ▶ Emission Database for Global Atmospheric Research (EDGAR): greenhouse gas emission database for the years 1990, 2000, 2005 and 2008, including the gases CO₂, CH₄, N₂O, HFCs, PFCs and SF₆. The data includes all sectors, including land use, land use change and forestry (LULUCF), but excludes short-cycle biomass burning (e.g. burning of agricultural waste or Savannah burning). At the time of analysis data was available on a total level only, while for future updates a sectoral split will be considered (European Commission 2011).
- ▶ Data compiled for “Factors Underpinning Future Actions Factsheets”: The data set provides emissions data by sector and country and is based on a variety of sources, such as National Communications or greenhouse gas inventories submitted to the UNFCCC, the International Energy Agency (IEA) or World Bank. The data is aggregated using a “hierarchy of sources”, preferring official and revised data and filling lacks of data with additional sources (Hagemann et al. 2011).

Application methodology:

Countries that do not meet a minimum emission level of 50 MtCO₂e/a in 2008 will be excluded in the first step. Since this rather simple approach might exclude smaller countries which could have potential for bilateral agreements (e.g. in specific sectors), we manually analyse the list of initially excluded countries in a second step with regards to their preliminary status for the ranking criteria “activity” and “ambition”. After this verification step initially excluded countries might be further considered despite the fact that they are below the minimum emission level.

Criteria: Regional importance

Countries which have emission levels and sectors that qualify for the development and application of benchmarks might still not be suitable to host a pilot project activity. The aim of the project is to prepare activities in countries which display commitment and drive to climate policy and which may act as role models for other countries in their region. Most likely actual or potential leaders of a regional group have the potential to successfully promote and multiply credited pilot activities based on sectoral benchmarks. We therefore judge to what extent regional role model status exists.

Data sources:

- ▶ Expert judgement

Application methodology:

Countries that meet the requirements for minimum emission levels - possibly in sectors only - will be judged with regards to their regional role model status. In order to ensure that the selection process is efficient and objective, we exclude at this stage only those countries that do not provide a minimum level of role model potential.

2.1.2. Ranking criteria

Based on the general objectives of the project we describe in the following the criteria and their indicators developed for the ranking of the shortlisted countries. Our ranking is basically characterised by the two main criteria “activity” and “ambition”. Both criteria are described by different indicators which are listed below.

Indicators for criterion “level of activity”:

- ▶ Participation in the Clean Development Mechanisms
- ▶ Activities under the Partnership for Market Readiness (PMR) of the World Bank
- ▶ Activities around Nationally Appropriate Mitigation Actions (NAMAs)
- ▶ Activities around Monitoring, Reporting and Verification (MRV) of greenhouse gases; further described with the following sub-indicators:
 - ▶ Submission of National Communications to the UNFCCC; existence of greenhouse gas inventories
 - ▶ Activities under the Global Environment Facility (GEF) and the MRV partnership

Indicators for criterion “level of ambition”:

- ▶ Emission reduction pledges on an international level
- ▶ Further targets: National energy efficiency or renewable targets
- ▶ Engagement in Low Emission Development Strategies (LEDS)
- ▶ Participation in regional or global networks

Each indicator results in a grade for the countries on a scale of 0 to 2, with 2 being the best score. For each of the criteria “activity” and “ambition”, we weigh the indicators and summarise them to an overall criterion score. We then combine the two categories again to an overall rating for all countries, according to which those are then ranked. The two main criteria are of equal weight.

Criterion: Level of activity

Indicator: Participation in the Clean Development Mechanisms

Participation in the CDM is considered as one aspect which describes the “carbon market readiness” status of individual countries. The existence of registered CDM projects shows that national institutions are operational and that first experiences with carbon market mechanisms exist. A larger amount of registered projects allows the assumption that the host country actively provides supporting conditions for carbon market participation since the current unequal distribution of the CDM is, beside other reasons, considerably influenced through national conditions such as institutional capacity (see for example Shishlov and Bellassen 2012). The importance of this factor might even increase. An upscaled CDM (with benchmarks) or an NMM will impose even higher requirements on host countries. For example, the DNA (Designated National Authority) capacity may turn out to be a bottle neck for the development of SBLs under the CDM.

Data sources:

- ▶ UNFCCC project database: The UNFCCC database includes all CDM and JI activities including the most recent registrations of projects.
- ▶ Voluntary project registries: Includes registered project activities listed in the project database of Gold Standard Foundation and the Verified Carbon Standard.

Application methodology:

To rate CDM participation, we look at the number of registered CDM projects. We score countries as listed in Table 1.

Table 1: Conversion of CDM participation into numerical scores

CDM participation in host countries	Score
less than 10 registered projects	0
> 10 but </= 50 registered projects	1
more than 50 registered projects	2

We chose comparative low thresholds to at least partly compensate the fact that large countries with high emission levels have more CDM project opportunities and reach a high number of registered projects with less relative effort. Countries with very small emission levels and respective CDM opportunities are already excluded in the shortlisting process. We use proxy data from JI or voluntary offset generation activities in case countries do not qualify as CDM host countries. Experiences with voluntary emission reduction projects receive, however, a maximum score of 1 even if more than 50 projects are registered (e.g. Turkey). This is because voluntary activities are not counted for in other countries and due to the fact that voluntary activities involve different institutions and cannot ensure the same level of “carbon market readiness”. The grade of this indicator affects the overall grade for the criterion level of activity with a weight of 25%.

Indicator: Activities under the PMR

Under the PMR, countries receive support in the form of finance and capacity building for exploring innovative emissions reduction approaches including carbon market instruments. These approaches cover, for example, domestic emission trading, carbon tax measures and crediting mechanisms. As part of the process, countries prepare detailed road maps for market-based instruments. We use activities under this programme as an indicator because it expresses substantial proactive behaviour in this area.

Data sources:

- ▶ The PMR’s list of participants shows all “implementing country participants”, which receive support under the programme. It additionally provides documents which show the objectives and activities under the PMR for each member country.

Application methodology:

The grading for PMR activities is a “0” for countries who do not participate. Those countries which participate are rated according to their objectives and activities. Participants in the programme are graded with a “2”, if they show at least initial activities with regards to domestic emission trading schemes. Activities towards domestic ETS are generally seen as positive because this also confirms the ambition level of countries. Activities which mainly aim for crediting mechanisms receive a “1”. The PMR activities impact the overall grade for the criterion level of activity with a weight of 25%.

Indicator: Activities around NAMAs

NAMAs are policies, programmes and projects that are undertaken by developing countries to contribute to the global effort to reduce greenhouse gas emissions.

The policy framework around NAMAs is still being developed but they are set to become a building block for a future climate agreement. Activities around NAMAs can serve both as an indicator of activity as well as of ambition. The concept of NAMAs is relatively new and mostly implemented by countries dedicated to climate change mitigation. Furthermore, many NAMAs are economy wide emission targets. On the other hand, going ahead with NAMAs triggers additional activities in the countries. We decided to include this criterion under the activities section, because the number of NAMAs in place does not lead to conclusions in terms of real ambition. This would require additional analysis on the content of the NAMAs. Furthermore, those NAMAs which contain economy wide emission reduction targets are covered by the criterion “pledges on an international level”.

Data sources:

- ▶ NAMA database: an online wiki platform maintained by Ecofys and including NAMA activities around the world. It is updated regularly and includes official NAMAs submitted to the UNFCCC as well as NAMA ideas which are developed elsewhere.

Application methodology:

We rate NAMA activities according to the number of NAMAs in the countries on a scale of “0” to “2” with “2” as the highest score. Because NAMAs are still a new concept, we acknowledge even little activities. According to this consideration, a score of “0” only reflects 0 NAMA activities. 1 or 2 NAMA ideas or concepts are rated “1”, and anything above this is rated “2”. The NAMA activities impact the overall grade for the criterion level of activity with a weight of 25%.

Indicator: Activities around MRV of greenhouse gases

Precondition for activities and programmes to reduce greenhouse gas emissions in developing countries supported by the private or public sector is that their performance is determined. The impact measurement of carbon market-based activities is mostly based on the quantification of actual greenhouse gas reductions. In case of traditional CDM projects the MRV of emission reductions covers single project sites, whereas for market-based activities with a larger scale (e.g. sector-wide) the need evolves to MRV those actions on a country level. The existence of a greenhouse gas inventory or structures and institutions that enable the establishment of MRV processes and greenhouse gas data over time reflects the activity level of countries towards readiness for future market-based mechanisms.

We measure the level of MRV activities by counting the number of National Communications and greenhouse gas inventories submitted to the UNFCCC and looking at projects related to MRV financed via the GEF. Additionally, we consider the membership in the MRV partnership as an indicator for an active MRV. The MRV partnership, founded by South Africa, South Korea and Germany has the objective to support exchange between developed and developing countries on mitigation activities and MRV.

Data sources:

- ▶ UNCCCC database: Under “National reports”, the UNFCCC publishes submitted National Communications and greenhouse gas inventories online, both for Annex I and for non-Annex I countries.
- ▶ GEF project database: GEF is the largest funder of environmental programmes worldwide and serves as a financial mechanism for various multilateral agreements, such as the UNFCCC.
- ▶ MRV partnership member list, including all partnering countries.

Application methodology:

The sub indicators are used to gain four ratings, each on a scale from 0 to 0.5. We sum these ratings, which results in an overall rating for MRV activities on a scale of 0 to 2, with 2 being the highest score. The individual sub indicator ratings are developed as follows:

The number of submitted National Communications and greenhouse gas inventories is scored as listed in Table 2:

Table 2: Conversion of submissions of National Communications and greenhouse gas inventories into numerical scores

Submitted National Communications	Score	No of years for which greenhouse gas inventories was submitted	Score
no submission	0	Submissions for ≥ 0 years but ≤ 3 years	0
> 0 but ≤ 3 submissions	0.25	Submissions for > 3 years but ≤ 6 years	0.25
> 3 submissions	0.5	Submissions for > 6 years	0.5

Additionally, we give the countries each 0.5 points for having projects related to MRV in the GEF and for being member in the MRV partnership. This score is then used directly to calculate the overall rating for activity levels. The MRV activities impact the overall grade for the criterion level of activity with a weight of 25%.

Criteria: Level of ambition

Indicator: Emission reduction pledges on an international level

Under the UNFCCC, various countries have pledged emissions reduction targets for 2020 after the COP in Copenhagen in 2009. According to the Kyoto Protocol, developed countries included in the Annex I of the document are required to reduce emissions. Non-Annex I countries, on the other hand, do not have an obligation to do so. We therefore see economy wide reduction pledges as an indicator for ambition. A comparison between the pledged emission level in 2020 and necessary efforts according to a variety of effort sharing approaches can, furthermore, distinguish the level of ambition of different pledges.

Data sources:

- ▶ Climate Action Tracker: an independent, regularly updated assessment, tracking and evaluating emission pledges tool of different countries. It includes all countries which have a pledge and classifies them in the categories “Role model”, “Sufficient”, “Medium” and “Inadequate”.

Application methodology:

For the rating, we use the categories from the Climate Action Tracker and give them each a score as listed in Table 3.

Table 3: Conversion of pledge ratings into numerical scores

Pledge rating in Climate Action Tracker	Score
no pledge	0
inadequate pledge	0.5
medium pledge	1
sufficient pledge	1.5
role model pledge	2

Although inadequate pledges in some cases result in even higher emission levels than a business as usual (BAU) development, we give credit to the fact that the country at least has put forward a target. The impact of the pledge on the overall rating for the criterion level of ambition is 40%. The pledge is the most important indicator because it expresses the countries attitude towards future greenhouse gas reduction efforts.

Indicator: National energy efficiency or renewable targets

in addition to emission reduction targets, we consider national policies for energy efficiency or renewables as an indicator for ambition. As a first approximation, we check if energy efficiency or renewable targets are in place. This allows conclusions on the commitment of countries to reducing emissions and also on general openness to climate legislation. We do not focus on assessing policies for individual sectors as a priority but may use the results from this indicator for the choice of sectors as well.

Data sources:

- ▶ REN21³: Most recent global status report on renewable energy including a comprehensive overview on renewable targets and supporting policies (REN 21 2012).
- ▶ World Energy Council energy efficiency policies database: The online database includes different types of policies and programmes related to energy efficiency from all over the world.

Application methodology:

We give each one point if the country has a renewable or an energy efficiency target in place. Again, this results in a scale of 0 to 2 with 2 being the highest score. This score is then used directly to calculate the overall rating for activity levels. The impact of the targets on the overall rating for the criterion level of ambition is 20%. We underweight this indicator since the existence of policies is assessed rather than their actual ambition levels.

Indicator: Engagement in Low Emission Development Strategies

LEDS aim to combine conventional development goals such as poverty eradication with mitigation of climate change. This way, LEDS do not focus on the reduction of emissions but are more comprehensive, including the concept of a long term sustainable development. We see the engagement of countries in LEDS as an indicator for ambition because participating countries voluntarily go beyond the fulfilment of their basic development needs.

Data sources:

- ▶ LEDS Global Partnership Activity Inventory: Includes most recent information on activities and programmes related to LEDS.

Application methodology:

To score the engagement of countries in LEDS, we count the number of projects they are involved in. Each project from the database, in which the word “LEDS”, “Low emission development strategy” or “Low emission development planning” occurs, counts as one point. We then add up the points and score them according to Table 4.

Table 4: Conversion of LEDS engagement into numerical score

Number of projects in which country is engaged	Score
No projects	0
>/= 1 project	1
>/= 3 projects	2

The impact of the targets on the overall rating for the criterion level of ambition is 20%.

3 Renewable Energy Policy Network for the 21st Century (<http://www.ren21.net/>)

Indicator: Participation in regional or global networks

There are various regional or global groups of countries which have committed to climate change mitigation. Membership in such a network is an indicator for ambition because it expresses high interest and willingness to lead the way in a certain area, together with other countries as partners.

We consider the following groups:

- ▶ **LEDS Global Partnership:** The aim is to advance low emission development through coordination, information exchange, and cooperation amongst members and partners. Membership in this network demonstrates a willingness to take a leading role in this process and is therefore a step further than the engagement in LEDS, as described in the previous indicator.
- ▶ **Mitigation Action Plans and Scenarios (MAPS):** Collaboration amongst developing countries to work towards carbon efficient, robust economies
- ▶ **Measurement and Performance Tracking (MAPT):** Project by the World Resource Institute to build capacities on measurement of greenhouse gas emissions and tracking efforts towards low-carbon development goals.
- ▶ **Mitigation Action Implementation Network (MAIN):** Initiative led by CCAP (the Center for Clean Air Policy) to support of dialogues between developing countries on NAMAs and LEDS, by organising regional meetings and workshops and web-based exchange of information.

Data sources:

- ▶ Member lists from the networks' websites.

Application methodology:

We count the number of memberships in the networks mentioned above for each country. This number is then scored according to Table 5.

Table 5: Conversion of memberships in networks into numerical score

Number of memberships	Score
No membership	0
>/= 1 membership	1
>/= 2 memberships	2

The impact of the targets on the overall rating for the criterion level of ambition is 20%.

2.1.3. Criteria for individual country assessment

The preceding methodological steps result in a specific ranking order of shortlisted countries. This output facilitates the identification of a small number of countries with a high general potential and allows for a more detailed assessment which focuses on the specific suitability for the purpose of this study. The specific suitability can be described by conditions such as the general attractiveness of countries for further global cooperation, the integrity level of relevant activities or plans as well as the existence of agreements in other areas. The evaluation of these topics for selected countries is, to the extent possible, based on publically available information. Criteria and indicators are rather used in a qualitative than quantitative way. The following main indicators are used to derive information for the evaluation of the individual suitability of countries.

Criterion: General and carbon market specific attractiveness of countries for cooperation

Under this criterion we understand topics that are not yet covered by other criteria and describe the general political situation, existing links between countries and regions, regional attractiveness and cooperation experiences in other areas. A minimum level of political stability seems desirable for piloting innovative new market approaches.

Related processes need long-term vision and commitment from all participants. Furthermore, established general and carbon market related cooperation and trading relations are seen as a suitable indicator for the potential acceptance of bilateral agreements as a basis for pilots, and regional proximity potentially increases the acceptance of reduction units in emission trading systems or other demand generating mechanisms. Since a further objective of the piloting process is to trigger additional interest, also from countries or regions outside the EU that operate emission trading schemes and have a potential demand for credits stemming from those pilots, we also consider specific relationships between potential target and partner countries, whilst relationships to Germany and the EU have the main priority.

Criterion: Possibility for global role model status with regards to the environmental integrity of generated reduction units

The objective of pilot activities is to pave the way for others that might take up the idea behind the pilot and multiply its application. Alignment with own ambition levels and acceptance by other ambitious partner countries requires a high level of environmental integrity of the pilot activities. Role model status can be reached by going beyond pure offsetting approaches and by seriously addressing sustainable development. Pure offsetting describes the approach followed by the current CDM and other offsetting schemes in which exactly the same amount of emission rights are issued as emissions are avoided. In this way no direct reduction of global emission levels is achieved. Approaches that go beyond reduce more emissions with project activities as they allow emitting in demanding schemes. Contributions to sustainable development are already addressed by the CDM. However, the absence of common metrics and procedures to measure the actual contributions lead to substantial underperformance for this objective. The establishment of additional quality criteria is therefore essential to reach role model status of pilot activities.

However, it is impossible to determine upfront if target countries will, in the case that a bilateral agreement is negotiated, agree on objectives for co-benefits. Information on previous positions and activities can however be used as an indication on the general openness for approaches beyond pure offsetting. We assess in this respect how DNAs consider sustainable development during the approval process of CDM projects. Additionally a position, if available, with regards to new mechanisms and the general level of visibility at climate negotiations, will be assessed.

Other issues

During the individual country assessment, further issues with relevance for bilateral agreements and sectoral emission reductions based on benchmarks are assessed. These are potential interactions with national plans for emission trading schemes and potential overlap with ongoing sectoral activities. Initial activities for the development of an ETS in the target countries are generally seen as positive, because they confirm ambition. Most countries are still in an early conceptional stage where the development of pilots can contribute to their ambitious plans. However, in the case that countries are already close to bringing their system into operation, this is rather considered as a ground for exclusion. Potentially ongoing activities with regards to sectoral benchmarks, or activities involving opportunities under Article 11a(5) ETS Directive in the target countries, are assessed with regards to their overlap with the activities of this project. This might lead to exclusions, or might be considered as positive, if activities are supplementary rather than overlapping to this project.

Once final recommendations for two countries are made we will check the interest of target countries in contributing to activities for bilateral agreements and sectoral emission reductions based on benchmarks.

Criteria for selection of sectors

The approach for the selection of sectors mainly considers the general importance and the individual suitability of sectors for the development of benchmarks and for the pilot character of the targeted mitigation activities. Generally, sectors with large point sources such as the electricity and heat production and certain industry sectors are more suitable for the development of single benchmarks. Sectors with diverse products, for example the chemical industry, would however require a whole package of benchmarks to consider the different conditions under which their various products are produced. Examples provide the allocation benchmarks for the EU ETS. Even more challenging is the benchmark development for sectors with smaller and dispersed emission sources. Barriers in sectors such as the agricultural, transport and buildings sectors result, for example, from difficulties in MRV and difficulties in the distinct allocation of emissions to different services. However, exceptions in these sectors also exist which allow the development of benchmarks under specific conditions or for specific subsectors. This is, for example, the case when specific activities, services or products are designed in a reproducible way for manifold applications and in distinct boundaries.

The sectors which we generally take into consideration for our selection process are electricity and heat, industry, transport, households and services (including the building sector), agriculture and waste. Important subsectors within the industry category are cement, iron & steel, pulp & paper, refineries, chemicals, aluminium or other metals, production of lime and glass.

As criteria for the selection of sectors we take the following country dependent aspects into account:

- ▶ the share of greenhouse gas emissions in the sector compared to overall national emission levels,
- ▶ available information on trends or projections in sector emissions or respective production levels,
- ▶ the structure of the sector (government owned/controlled, monopoly, oligopoly, etc.),
- ▶ available information on reduction potentials in sectors,
- ▶ data availability within the sector,
- ▶ ambition within sectors or inclusion in national plans and
- ▶ existing experiences in sectors with greenhouse gas mitigation programmes.

Furthermore, aspects should be considered for the selection of sectors which are not always specific to the sector situation in individual countries. This includes, on the one hand, the general possibility to apply benchmarks and to implement related MRV activities as explained with the above described sector characteristics, and on the other hand, the general chance of generating further co-benefits which lead to pilot activities with a high overall quality and reputation.

2.2 Country selection

According to our stepped approach, we first apply the criteria of exclusion before we rank the remaining countries. However, preliminary information about the potential ranking of countries is already available at this stage. The criteria application which leads to the selection of specific countries is visualised in Figure 2.

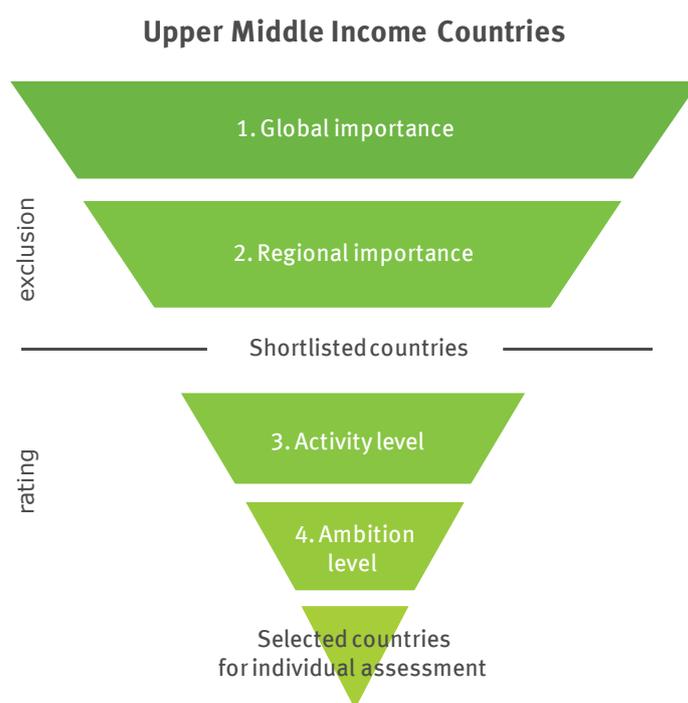


Figure 2: Criteria application for country selection process

The starting point for the selection of countries is the list of 50 upper-middle-income countries from the OECD DAC. The list also included overseas territories, which we excluded from our assessment due to their varying Kyoto status and the small amount of emissions. As overseas territories we excluded Anguilla, Montserrat, St. Helena and Wallis and Futuna. The remaining countries are listed in Table 6.

Table 6: List of Upper-Middle-Income Countries, based on (OECD 2012)

Upper middle income countries and territories				
Albania	China	Iran, Islamic Rep.	Mexico	Serbia
Algeria	Colombia	Jamaica	Montenegro	Seychelles
Antigua and Barbuda	Cook Islands	Jordan	Namibia	South Africa
Argentina	Costa Rica	Kazakhstan	Nauru	St.Kitts-Nevis
Azerbaijan	Cuba	Lebanon	Niue	Suriname
Belarus	Dominica	Libya	Palau	Thailand
Bosnia and Herzegovina	Dominican Republic	Macedonia	Panama	Tunisia
Botswana	Ecuador	Malaysia	Peru	Turkey
Brazil	Gabon	Maldives	Saint Lucia	Uruguay
Chile	Grenada	Mauritius	Saint Vincent and the Grenadines	Venezuela

2.2.1. Shortlisting process

In the shortlisting process we apply the two criteria “global and regional importance” for exclusion of less relevant countries from the detailed analysis.

Global importance

The first criterion for exclusion is the application of a minimum emission level to account for the potential with regards to activities under the scope of this project. We apply the threshold of 50 MtCO₂e/a (2008 emissions) to the list of remaining countries and exclude the countries with lower emission levels. Since this rather simple approach includes methodological limitations and might exclude smaller, but with respect to specific sector promising, countries for the further evaluation, we apply a second check of the countries that are excluded based on this step. For countries that receive a high ranking for the criteria “Activity” and “Ambition” based on preliminary information, we look into the breakdown of emissions per sector.

33 countries are excluded based on this approach. Among these countries we identify Costa Rica and Jordan which rank higher for the criteria “Activity” and “Ambition”. Since Costa Rica’s emissions (11 MtCO₂e) mainly stem from agriculture and forestry (40%) and transport (30%) and only to 5% from Industry and to 5% from electricity generation, we do not see a high potential for the development of activities based on benchmarks. Jordan’s total emissions amount to 22 MtCO₂e in 2008 and are allocated to agriculture and forestry (44%), industry (8%), transport (14%), electricity and heat generation (30%) and others. We do not consider Jordan further because although industry has a certain share of emissions, it is a small absolute amount and thus presents only little potential for emissions reductions.

Regional importance

The second criterion for exclusion is a minimum level of regional importance and respective leader status for a regional group of countries. Based on the 17 countries that meet the requirements for minimum emission levels we identify at this stage two countries that do not provide a minimum level of role model potential and rank low for the “Activity” and “Ambition” criteria based on preliminary information. These are Iran and Belarus which we exclude from further consideration.

The remaining 15 countries, as listed in Table 7, represent the short list of countries and will be analysed in more detail and ranked with the respective criteria application.

Table 7: Short list after criteria of exclusion

Short list for ranking		
Algeria	Colombia	Peru
Argentina	Kazakhstan	South Africa
Brazil	Libya	Thailand
Chile	Malaysia	Turkey
China	Mexico	Venezuela

2.2.2. Ranking process

After the application of ranking criteria and respective indicators as described in section 2.1.2, we achieve a ranking of the shortlisted countries depending on their general levels of ambition and activity. Table 8 provides an overview on the ranking results.

Table 8: Ranking results of shortlisted countries

Shortlisted countries	Region
Chile	Latin America
South Africa	Africa
Mexico	Latin America
Brazil	Latin America
Thailand	Asia
China	Asia
Colombia	Latin America
Peru	Latin America
Argentina	Latin America
Malaysia	Asia
Turkey	Europe
Algeria	Africa
Kazakhstan	Asia
Libya	Africa
Venezuela	Latin America

Looking at the top five rated countries, we find three countries from the region Latin-America (Chile, Brazil, Mexico), one country from Africa (South Africa) and one from Asia (Thailand). With regards to the overall rating, Chile leads the list, closely followed by South Africa, Mexico and Brazil. Thailand is more ambitious than the average of shortlisted countries, but significantly below the leading four countries. Looking solely at the level of activities, Chile scores highest, followed by Mexico and Brazil, which are followed by South Africa and Thailand, who have similar scores. Colombia, followed by China and Peru, comprise the following group of countries which received similar scores above average for their activity levels. Looking solely at the level of ambition, Chile and South Africa lead, followed by Mexico and Brazil and further followed by Thailand, China and Argentina. All sub-country groups have similar scores. South Africa has the largest gap between activity and ambition within the top five, with considerably higher ambition than activity.

Chile and South Africa achieve the maximum score for the indicators “renewable and energy efficiency targets”, “LEDS activities” and “membership in networks”. Both only have pledged emissions reductions rated “medium” by the Climate Action Tracker and thus could have scored more for this indicator. Brazil and Mexico also have “medium” rated pledges, but both have renewable energy as well as energy efficiency targets in place. Brazil is less engaged in LEDS activities, which may partly be a result from their rather advanced state of development in comparison to other upper middle income countries. Mexico only engages in one network (LEDS GP), leading to only a medium score for this indicator.

Chile achieves the best possible scores in all indicators except for the number of GEF funded projects related to MRV and the number of greenhouse gas inventories submitted to the UNFCCC.

Especially worth mentioning is Chile's involvement in the development of NAMA concepts, which it has taken much further than other countries in this area. As a first conclusion, we can say that Chile is by far one of the most active countries, although with small problems in their MRV system.

Mexico and Brazil both score with a very high number of CDM projects. Furthermore, Mexico is pushing the development on NAMAs. Both countries are among the most active concerning the submission of national communications and greenhouse gas inventories.

South Africa has a medium to high score in most indicators. It is involved to a rather small extent in the development of CDM projects but lacks consistency in MRV issues expressed in the lack of comprehensive greenhouse gas inventories over various years. Thailand, similarly, shows high interest in activity and has a large number of registered CDM projects, but lacks a consistent MRV framework.

With both the highest level of activity and ambition, Chile is leading the country ranking, followed by South Africa in second place and Mexico in third place. According to our stepped approach we assess next the individual suitability of the rated countries from the top of the list. These are **Chile, South Africa** and **Mexico** which cover the two regions Latin-America and Africa.

2.2.3. Individual country assessment (Chile, South Africa, Mexico)

According to the methodology as laid down in section 2.1.3 and the ranking results as presented in section 2.2.2 we individually assess the suitability of the rated countries Chile, South Africa and Mexico

Chile

General and carbon market specific attractiveness of countries for cooperation

Chile's political system is a presidential democracy. Since the return to democracy in the beginning of the 1990s, Chile has been politically stable. Poverty has been successfully fought and the economy has grown significantly, but high inequalities in the population remain (German Federal Foreign Office 2012).

Chile is well connected on the South American continent, for example via the Economic Commission for Latin America and the Caribbean which has its headquarters in Santiago de Chile, the Southern Common Market and the Andean Community of Nations. It is also a member of the Union of South American Nations, which it chaired until 2009 (German Federal Foreign Office 2012). Smaller territorial conflicts exist, especially with Bolivia.

Chile's economic and political system is market oriented and open to foreign investments and cooperation. In the global arena, Chile is active in a large number of organisations, such as the UN bodies where it especially focuses on the topics human rights and environment. Other cooperative activities take place under the framework of financial institutions such as the World Trade Organisation, the World Bank and the Inter-American Development Bank, which are all represented in Chile. Since 2010, Chile has been member of the OECD, as the second Latin American country after Mexico. As a member of the Asia-Pacific Economic Cooperation, Chile has also built relationships with Asian countries (German Federal Foreign Office 2012).

In the area of renewable energy, energy efficiency and climate change, Chile is also well connected. It is for example one of the founding members of IRENA (the International Renewable Energy Agency). There are specifically strong links to German institutions through various channels, for example with the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit), the International Climate Initiative, and initiatives from the German development bank KfW (Kreditanstalt für Wiederaufbau) (German Federal Foreign Office 2012).

Chile has been active as a host country for CDM projects. The first private emissions reduction trading platform in Latin America was established in Chile, the “Santiago Climate Exchange”⁴. Reduction units from CDM projects as well as voluntary offset units from the Verified Carbon Standard and the Gold Standard are traded.

Possibility for global role model status with regards to the environmental integrity of generated reduction units

According to statements made under the PMR, Chile believes in the role of market mechanisms to achieve long lasting mitigation objectives and committed to take actions to reduce the growth rate of its greenhouse gas emissions by 20% below the BAU scenario by 2020, with 2007 being the base year. Chile aims to fulfil its pledge with domestic efforts, international support and the use of New Market Mechanisms (PMR 2012b).

The Ministry of Environment acts as DNA for the CDM in Chile. Unfortunately no DNA website exists in Chile on which potential sustainable development criteria for Chile are published. A study conducted in the framework of the CDM policy dialogue was also not able to assess and evaluate Chilean sustainable development criteria (CDM Policy Dialogue 2012).

Chile is actively involved in the development of various NAMA concepts and takes over a leading role compared to other countries in this region. NAMA developments in Chile are also supported by the International Climate Initiative of the German Government. The sectoral distribution of NAMAs mainly covers the energy supply and the transport sector (Ecofys 2013). During NAMA developments key challenges such as alignment of MRV approaches of institutions and partners are identified. It was also identified that co-benefits might include job creation or technology transfer. To facilitate the project management an electronic platform for the tracking of the indicators of NAMAs in Chile is currently under development.

Other issues

Chile officially announced under the Partnership for Market Readiness Programme of the World Bank to study possibilities to develop a national ETS. The programme will in particular support Chile in

- ▶ Preparing for a political decision on the potential implementation of an ETS within the energy sector;
- ▶ Capacity-building for regulatory, economic and institutional analyses needed to design the energy sector ETS;
- ▶ Design and implementation of a MRV and GHG registry systems.

While this is seen as clear statement towards an ETS, it does not constitute a decision or guarantee for an ETS neither on short nor on longer term. According to an article from Point Carbon in April 2012 (Point Carbon 2012), Chile might even refrain from ETS plans. Bilaterally supported sectoral activities in the same sectors could contribute as transitional measure to the development of an ETS and might fill the potentially longer gap until an ETS is fully operational. Sectoral activities could also be designed in a way to co-exists with an ETS. A credited mechanism could, for example, include subsectors and measures not covered by the ETS and could potentially provide offsets into the ETS. Convergence between ETS and bilateral sector activities is also a realistic scenario when ETS plans actually lead to a market-based mechanism which is designed similar to the currently discussed trading option under an NMM.

Recommendation/Conclusion

We evaluate the relation between Chile and Germany in general as very good, and specifically in the context of renewable energy, energy efficiency and climate change. The government’s strong orientation to liberal markets may also be supportive for activities related to carbon markets.

4 See also homepage Santiago Climate Exchange: <http://www.scx.cl/>

South Africa

General and carbon market specific attractiveness of countries for cooperation

South Africa's political system is a presidential democracy with federal elements giving some power to provincial governments. Since the end of the Apartheid regime in 1994, South Africa has been politically stable and much progress has been made in the area of social reforms (German Federal Foreign Office 2012).

As the biggest African economy in terms of GDP, South Africa has key relationships with other African nations. Under the Southern African Development Community, it promotes economic integration of the Southern African countries. It is also represented in other African forums, such as, for example, the African Union. South Africa cooperates with other big emerging economies such as India, China and Brazil in topics like international trade and climate change and increasingly pushes South-South-cooperation, while still maintaining stable relationships with Western countries (German Federal Foreign Office 2012).

With the Trade, Development and Cooperation Agreement, a bilateral agreement which covers mainly trade relations, development cooperation and economic cooperation, South Africa has a strong link to the EU⁵. Since 1996, South Africa and Germany biannually participate in the German-African bilateral commission, which builds the framework for cooperation between the two countries (German Federal Foreign Office 2012). Furthermore a partnership with the German government on the development of MRV capacity in South Africa is underway (PMR 2012a).

In contrast to most other African countries, South Africa has frequently participated as a host country in CDM projects (54 registered projects, as of September 2013). For three of those, Germany was involved as investing Annex-I party. In comparison to other African countries, South Africa is more attractive for CDM development because of better infrastructure and a more stable investment environment. In terms of corruption, South Africa is also perceived as more transparent than most other countries in Africa⁶.

Possibility for global role model status with regards to the environmental integrity of generated reduction units

South Africa is committed to contributing its fair share to the global greenhouse gas mitigation effort and has aspired to its emissions peaking between 2020 and 2025, remaining stable for a decade and declining in absolute terms from around 2035 (Peak, Plateau and Decline). South Africa pledged to reduce its emissions by 34% by 2020 and 42% by 2025 below BAU, on condition that it receives the necessary finance, technology and support from the international community that will allow it to achieve this (PMR 2012a).

In 2004, South Africa's DNA already defined advanced sustainable development criteria for the CDM approval covering social, economic and environmental dimensions (DNA South Africa 2004). The detailed set of criteria is published on the DNA's website and South Africa is one of the only countries that also defined provisions for the monitoring of the sustainable development impact of projects (CDM Policy Dialogue 2012).

Few NAMA concepts are known for South Africa, although the South African Renewables Initiative reached already the implementation stage (Ecofys 2013). NAMAs in South Africa are rather called "Flagships" and have a mandatory job creation component. Specific interest for South Africa exists in the promotion of greenhouse gas emission reductions through renewable energy or energy efficiency programmes for low-income houses. Such activities could already be observed under the CDM.

5 See: http://europa.eu/legislation_summaries/development/south_africa/r12201_en.htm

6 Transparency International. Corruption Perceptions Index. <http://cpi.transparency.org/cpi2011/results/>

Other issues

South Africa is working on the design of a carbon tax for which the proposed date of implementation is October 2014. South Africa's aim is to provide the necessary, credible long term price signals to support energy efficient and low carbon alternatives. South Africa is aware that it should not set a fixed quantitative limit to carbon emission over the short term, but a carbon tax at an appropriate level and phased in over time to the "correct" level will provide a strong signal for behavioural change over the medium to long term. Although the exact planning is uncertain, these activities show South Africa's willingness to implement mechanisms affecting the market (e.g. by developing a domestic offset mechanism that helps firms reduce their carbon tax liability) and in this way reduce greenhouse gas emissions (PMR 2012a).

In 2011, together with other countries South Africa submitted to the Ad Hoc Working Group on Long-term Cooperative Action under the Convention its views on the general framework for cooperative sectoral approaches and sector specific actions in order to enhance the implementation of Article 4, paragraph 1(c), of the Convention (UNFCCC 2011c).

Recommendation/Conclusion

South Africa clearly has a key role on the African continent and shows considerable openness to carbon pricing. South Africa has good connections to Germany, and to further big emerging economies that might have an ETS operational in the near future and respective demand for carbon credits (e.g. China).

Mexico

General and carbon market specific attractiveness of countries for cooperation

Mexico is a federal republic with 31 states and the federal district around Mexico City. The country is politically stable, but has more problems with corruption in comparison with Chile and South Africa.⁷

With the North American Free Trade Agreement and its admission to the OECD, Mexico has opened to and integrated in global activities and markets. The country is active in international institutions such as the UN bodies and G20. Its geographic location grants Mexico an important role in the integration of Latin America with the northern countries (German Federal Foreign Office 2012).

Mexico and Germany have established strong links in various areas. Investments of German companies in Mexico are significant, but also on a political level, the countries cooperate. An element in the area of climate change is the German-Mexican Climate Alliance, which is designed to help the Mexican government develop and implement its climate protection programme (German Federal Foreign Office 2012). Germany and Mexico have furthermore signed a Memorandum of Understanding on sustainable development and climate policy in 2005, which simplifies the cooperation under CDM (BMU 2005). Through the International Climate Initiative, Germany also finances various emission reduction projects in Mexico (ICI 2012).

California will allow the use of offsets from REDD (Reducing Emissions from Deforestation and Forest Degradation) projects originating from the Mexican state of Chiapas. Thus a connection to the Californian ETS already exists.

Possibility for global role model status with regards to the environmental integrity of generated reduction units

Mexico is increasingly engaged in the area of climate change, for example by hosting the COP16 in Cancún in 2010, putting forward a relatively ambitious pledge and implementing a variety of policies in this area (Höhne et al. 2012). It passed its General Law on Climate Change (Ley General de Cambio Climático) on April 19th 2012.

⁷ Transparency International. Corruption Perceptions Index. <http://cpi.transparency.org/cpi2011/results/>

This new law stipulates mandatory greenhouse gas emission reductions of 30% compared to business as usual by 2020 and a long-term emission reduction target of 50 % below 2000 levels by 2050. The new law also specifies that 35% of the country's electricity should come from renewable sources by 2024 and requires mandatory reporting by the largest pollutants (Federal Government of Mexico 2012).

Mexico's DNA defined advanced criteria for sustainable development contributions of CDM projects that cover social, economic and environmental dimensions (CDM Policy Dialogue 2012). These criteria are published on the DNA's website (DNA Mexico 2012).

Two NAMA concepts are listed for Mexico in the NAMA database. One focuses on sustainable housing in Mexico and another is based on a Federal Mass Transit Programme (Ecofys 2013).

In 2012, Mexico, together with further countries, submitted its views on issues related to an NMM operating under the guidance and authority of the COP. In this submission Mexico proposes a mechanism that provides a net reduction in the host countries (UNFCCC 2012e).

Other issues

The General Law on Climate Change also encourages the establishment of a carbon-trading scheme and allows for greenhouse gas emissions regulation in most sectors. In April 2012, the law was just approved and shortly afterwards, in July 2012, a change in government took place. Thus the development of the ETS will to a large extent depend upon how the newly elected government decides to go ahead with the implementation of the law. It has been signalled that the ETS is currently difficult to implement, but that sectoral initiatives, also based on NAMAs, could be used to prepare certain sectors and pave the way for an ETS as the long-term aim. NAMAs are used as a transitory approach to a sectoral trading scheme. Mexico has established a NAMA office which is also responsible for capacity building on MRV. A national registry for domestic measures is under development. The approaches taken aim at retaining control on mitigation actions at the domestic level avoid double counting and create sustainability.

Recommendation/Conclusion

Mexico is characterised by its high activity and ambition level and has close connections to Germany in various areas. It furthermore qualifies to connect to North American demand markets such as the Californian ETS. General tendency for sectoral activities could be identified while it is difficult to judge if this constitutes a hindrance or an advantage in the context of this project.

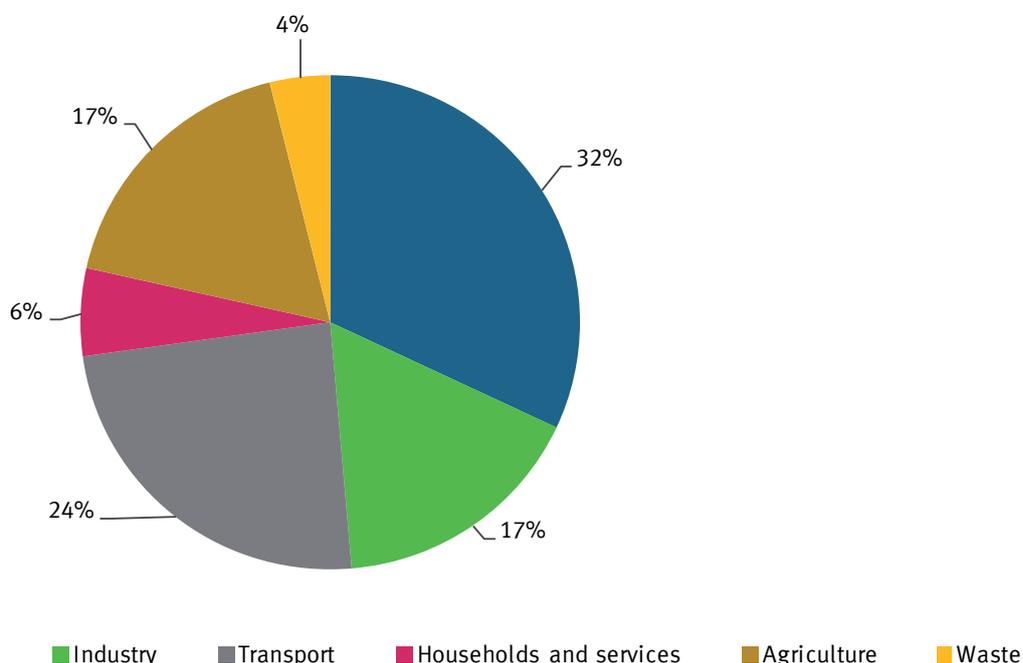
2.3 Sector selection

All three shortlisted countries as described in the previous section show positive conditions for the continuation of activities under this project. We have not identified reasons for the exclusion of any of these countries at this stage. In this section we therefore assess the feasibility of individual sectors from Chile and South Africa for the objectives of this project. Only in the case that no suitable sector can be identified or countries signal having no interest in cooperation, we will at a later point in time look into Mexico, which serves as a back-up candidate in the following project steps.

2.3.1. Sector considerations for Chile

In Chile, greenhouse gas emissions are distributed to the different sectors as shown in Figure 3. Total emissions in 2008 excluding emissions from LULUCF were 89 MtCO₂e, according to Hagemann et al. (2011) (According to the EDGAR database, Chile's total emissions were 106 MtCO₂e in 2008 (European Commission 2011)). The sectors with the highest emissions are, in this order, electricity and heat, transport, agriculture and industry. The households, services and waste sectors account for only minor shares of the overall emissions.

The electricity and heat sector includes greenhouse gases resulting from the transformation of energy in the energy supply sector, namely power and heat plants. Emissions resulting from electricity and heat consumption in demand sectors are thus accounted for here. The sector also covers fugitive emissions from the production of fossil fuels, mainly oil and gas.



Source: Data as compiled for "Factors Underpinning Future Actions Factsheets" (Hagemann et al. 2011)

Figure 3: Chile - distribution of emissions to sectors in 2008, excl. LULUCF

In Chile, the share of fugitive emissions is small, representing only 2% of the total national emissions (UNFCCC 2012c). The remaining emissions from the energy sector relate to fuel combustion. The industrial sector includes energy related greenhouse gases emitted directly on site and process emissions (7% of total emissions in 2006) (UNFCCC 2012c).

Electricity and heat supply in Chile

Chile's electricity supply today is dominated by gas and hydro power plants. To decrease dependence on gas imports, especially from Argentina, Chile is exploring the domestic coal reserves and plans construction of new coal fired power plants. According to O'Ryan et al. (2010), the Chilean coal power plant capacity will increase to roughly 10 GW in 2020 and to roughly 20 GW in 2030, in comparison to the current capacity of less than 5 GW. Under this scenario 52% of the total capacity will be served by coal in 2030 (today less than 20%), leading to an increase of carbon intensity from 0.26 to 0.47 tCO₂e/MWh (O'Ryan et al. 2010).

These prospects bear significant mitigation potential, if the large share of coal was to be replaced by clean energies. In terms of emission reductions, O'Ryan et al. identify a total mitigation potential of 36.6 MtCO₂e/a in 2030 (O'Ryan et al. 2010) through use of unconventional renewable energy, hydro energy, carbon capture and storage, and nuclear energy.

Chile has vast potential for renewable energies: There is huge solar irradiation mainly in the north (Atacama Desert), significant wind energy available along the coast as well as in the south (Patagonia), and geothermal potential due to high volcanic activities in some of the Andes' regions (Woodhouse 2011).

To decrease the dependency on energy imports, Chile also supports renewable energy. With the law no. 20.257 in 2008, Chile requires all electricity companies with more than 200 MW to have a share of at least 5% of renewable energy in their sales (Government of Chile 2008). This percentage will increase starting in 2014 by 0.5ppts per year until 2024.

Chile has various CDM projects in the energy supply sector, especially in the area of hydro power and wind energy (UNFCCC 2012b). It is furthermore developing a NAMA in the area of renewable electricity generation in the industry sector (Ecofys 2013).

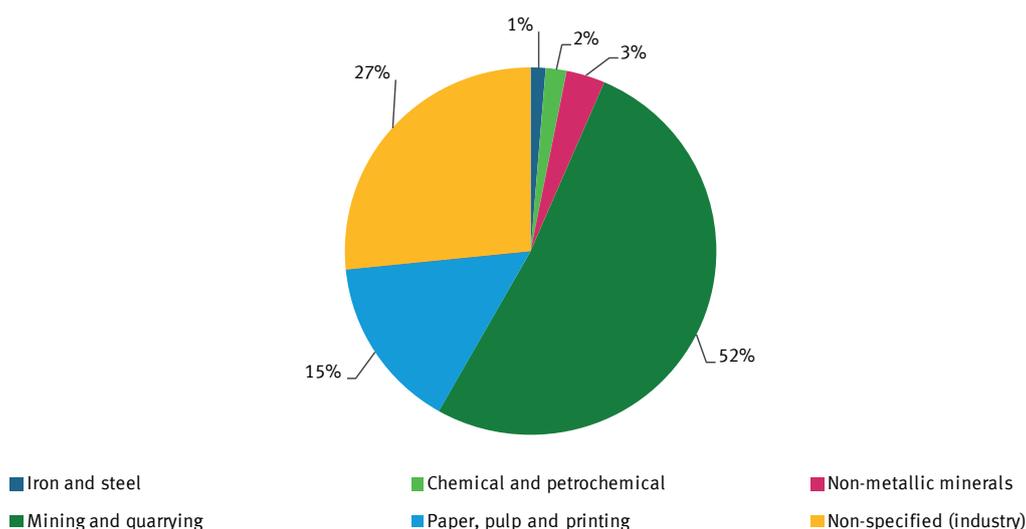
Industry in Chile

Chile’s industry is dominated by large mining activities mainly located in the north of the country. Other important industrial areas are the food processing industry, the iron and steel industry and the paper and pulp sector. These subsectors are analysed in more detail in the paragraphs below. Other industrial sectors, theoretically interesting for a benchmark such as production of aluminium or the cement sector, are smaller in terms of economic importance and to a certain extent in terms of greenhouse gas emissions. Also, the number of only three oil refineries might be too small to serve as reference group for the development of suitable benchmarks.

Chile has five registered CDM projects in the industrial sector, of which most are related to waste projects (UNFCCC 2012b) and several NAMA feasibility studies in the area of energy efficiency in different industrial subsectors (mining and cement industry) (Ecofys 2013).

The distribution of the final energy consumption in Chile’s industry among various subsectors is illustrated in Figure 4. Roughly half of the energy is consumed by the mining sector, of which about 50% relate to copper (O’Ryan et al. 2010). 27% of industrial energy consumption is from non-specified industries, which includes, beside others, the food processing industry. 15% of industrial final energy is consumed by the pulp and paper sector.

According to O’Ryan et al., the emissions mitigation potential in the total industrial sector is 15 MtCO₂e/a in 2030 for direct emissions and another 17 MtCO₂e/a in 2030 resulting from decrease of electricity use through efficiency measures in the industry (O’Ryan et al. 2010).



Source: Source: IEA Energy Balances 2012

Figure 4: Distribution of final energy consumption in the industry in Chile in 2010

Mining industry

Chile is the biggest producer of copper worldwide. The metal is extracted mainly in the northern part of the country (Government of Chile 2011). It also consumed more than half of the industrial energy demand in 2010 (IEA 2012b). Another important mining product is saltpetre. According to POCH Ambiental (2010), the copper mining industry is the biggest single industrial emitter of greenhouse gases with 5.6% of total national emissions in 2006, excluding electricity related emissions.

In terms of energy and emission reductions the sector is supported by the Chilean Copper Commission under the Ministry of Mining and the National Energy Efficiency Programme. The Commission collects and publishes energy consumption and emissions data from companies related to the copper industry. The National Energy Efficiency Programme established the Mining Energy Efficiency Working Group in 2006, which has the objective to promote energy efficiency and management and the exchange of experiences in the sector regarding these issues (Government of Chile 2011).

The MAPS project identified emission reduction potentials of 4.7 MtCO₂e in 2020 for the copper mining sector (Sanhueza 2011). A study by POCH Ambiental depicts a similar result with an expected potential of 5.1 – 5.2 MtCO₂e in 2020. Because of its great importance to the Chilean industry, information and data on this sector is abundantly available.

Pulp and paper industry

Chile is South America's second biggest pulp and paper producer after Brazil. With Chile's large forest areas in the south of the country, it has large resources available. This sector consumes 15% of final energy of the Chilean industry. According to POCH Ambiental (2010), it emitted approximately 1.4% of total national emissions in 2006, excluding electricity related emissions.

Unfortunately, little sector specific information is publically available. In the most relevant literature, the sector is not named explicitly as a point of attention when talking about efficiency improvements (compare for example (Government of Chile 2011) and (O'Ryan et al. 2010)). Within the scope of this project it is therefore not possible to assess in more detail different mitigation possibilities in this area.

Food processing industry

Another important part of the Chilean industry is the food processing industry. On the one hand, increased purchasing power of the population has led to a rising internal demand; on the other hand the government also aims to diversify the economy by creating a second pillar besides the mining industry. The food processing industry is based on Chile's agricultural resources and mainly produces fruit, wine, poultry, pork, beef and salmon (Herrera and Lopez 2009).

Because of the diversity of the sector, the application of a benchmark to the complete sector is not feasible. Treating each subsector individually would lead to high efforts in the development and implementation of a benchmark and data collection and not cover a relevant share of emissions. In statistics, this sector is furthermore combined with various others, making it difficult to quantitatively depict shares of emissions, energy consumption or potentials.

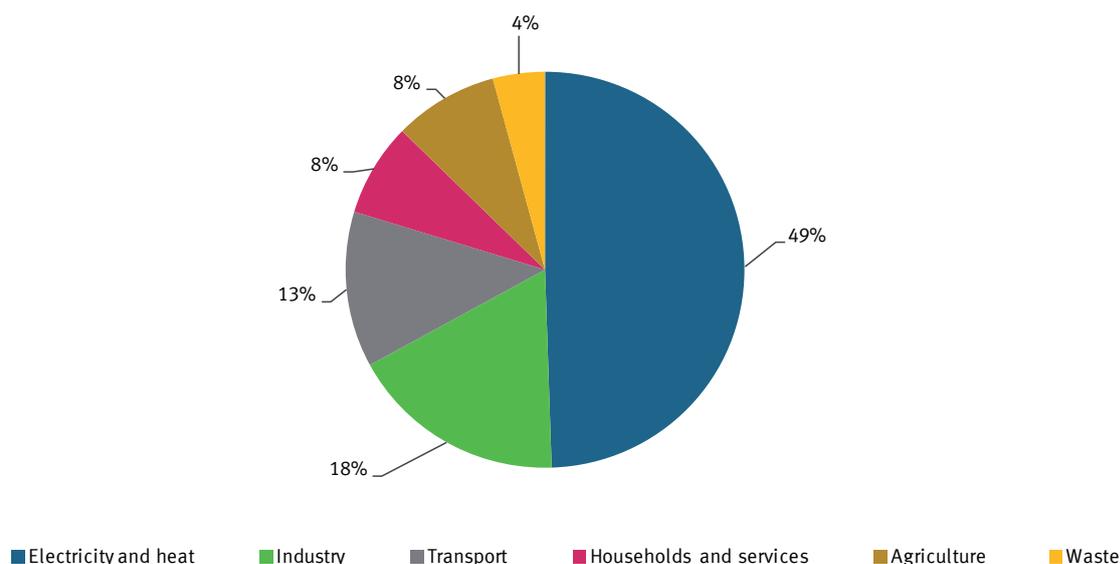
Recommendation/Conclusion

The assessment of the Chilean sector situation shows that mainly the electricity and heat sector as well as the mining industry (copper) are most suitable for further considerations in this research. Both sectors have rather good data availability and are prioritised in national activities. The prospects for the power sector additionally create some urgency for activities that contribute to a long term positive transformation. Due to the absence of major grid connections abroad, the Chilean grid can also be considered as a closed system within its boundaries.

2.3.2. Sector considerations for South Africa

In South Africa, greenhouse gas emissions are distributed to the different sectors as shown in Figure 5. In 2008, the total emissions excluding emissions from LULUCF were 482 MtCO₂e according to Hagemann et al. (2011) (According to the EDGAR database, South Africa's total emissions were 450 MtCO₂e in 2008 (European Commission 2011)). The sectors with the highest emissions is by far the energy supply sector (electricity and heat), emitting almost half of South Africa's emissions in 2008. The second biggest sector in terms of direct emissions is the industrial sector (18%), followed by transport (13%).

The industrial sector furthermore is responsible for a large share of electricity related emissions. The building sector's direct emissions contribute with 8%, but also in this case, electricity related emissions need to be added to reflect potentials in this area. The industrial sector consumed more than 50% of electricity in 2008, the buildings sector roughly 33%.



Source: Data as compiled for Factors Underpinning Future Actions Factsheets (Hagemann et al. 2011)

Figure 5: South Africa - distribution of emissions to sectors in 2008, excl. LULUCF

In South Africa, fugitive emissions contribute with a relevant share to the total; according to South Africa's 2nd National Communication, in the year 2000, almost 20% of total national emissions were fugitives (DEA 2011). This reflects South Africa's high activities in the extraction of coal as well as large refining capacities. The industrial sector includes energy related greenhouse gases emitted directly on site and process emissions (7% of total emissions in 2000) (DEA 2011).

Electricity and heat

South Africa's electricity today depends drastically on coal, which is produced domestically. This high share of a relatively carbon intensive fuel results in emissions per unit of electricity generated of 835 gCO₂/kWh in 2008 (the world average was 502 gCO₂/kWh in 2008) (IEA 2010).

The sector has a monopolistic structure, with the company Eskom generating more than 95% of the electricity in the country (Bolscher et al. 2012).

According to Winkler (2007), there is substantial reduction potential in this area. The study names a reduction potential of roughly 60 MtCO₂e in 2030 resulting from the use of renewable energy resources. Furthermore, there is further potential of roughly 40 MtCO₂e/a in 2030 resulting from the application of nuclear power technologies and smaller reduction possibilities in increasing the efficiency of coal fired power plants and carbon capture and storage.

South Africa supports renewable energy in its policy making, for example by implementing a feed-in tariff for renewable energy in 2009. However, there are many barriers besides the price for renewable energy that prevent a quick increase of renewable capacities, such as for example a lack in infrastructure (Höhne et al. 2012).

South Africa has a number of CDM projects in the electricity sector, all in the area of renewable energy (UNFCCC 2012b). Under the South African Renewables Initiative, it has also proposed one NAMA (respectively “flagship”) focusing on the scaling-up of renewable energy (Ecofys 2013).

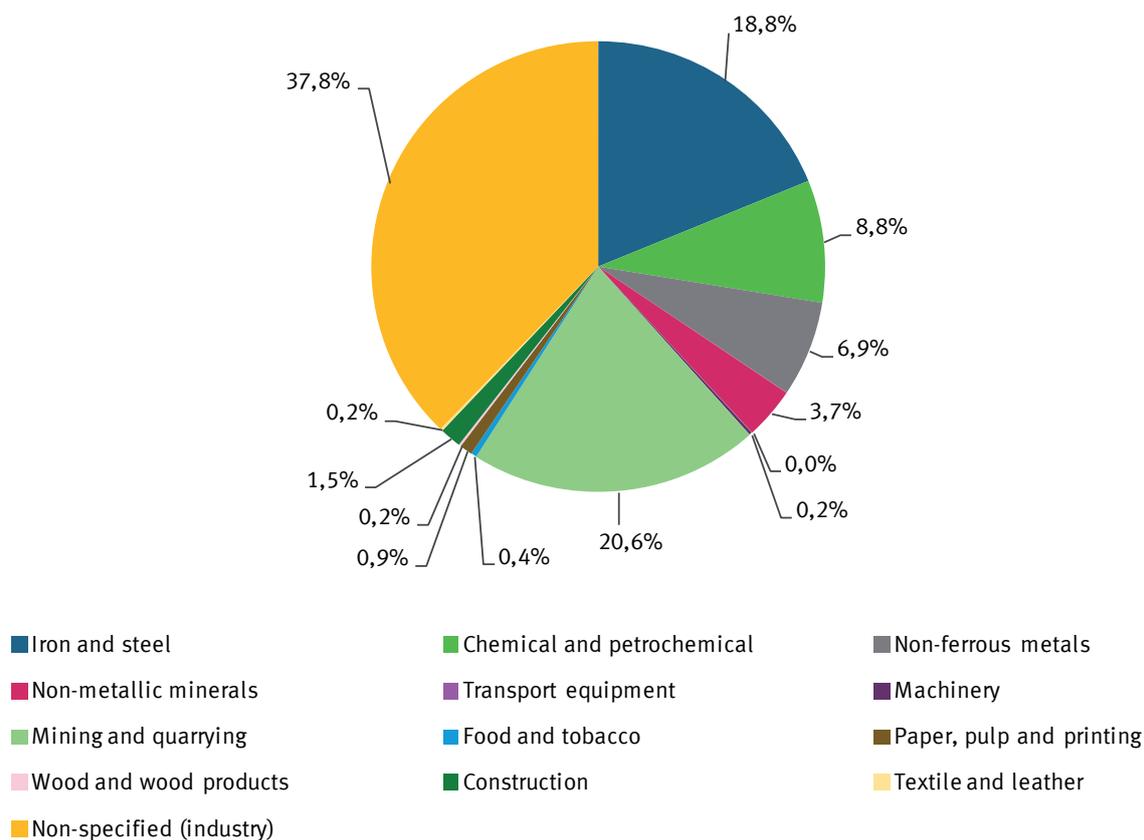
Industry

South Africa’s industry relies heavily on mining activities, producing different minerals including gold, platinum-group metals, diamonds and coal. Other key industrial sectors are the clothing and textiles industry as well as the automotive sector (Government of South Africa 2012). South Africa has six refineries, of which four are for crude oil, one for coal and gas and another one only for gas (South African Petroleum Industry Association 2012).

In its White Paper on Climate Change, South Africa recognises energy efficiency improvements as one of the important areas for greenhouse gas mitigation in the mid-term (Government of South Africa 2011). Furthermore, it has set targets for emission reductions for different subsectors: An improvement in energy intensity of 1% per year for the Iron and Steel industry and the chemical and petrochemical industries, 10% reduction below BAU for mining in 2015, and an improvement in energy intensity of 2% per year for the paper and pulp and printing industries and the cement sector.

In the industrial sector, South Africa has nine registered CDM projects (UNFCCC 2012b). There are various projects related to reduction of emissions from landfills, several for reduction of N₂O in the chemical industry, two supporting a fuel switch in industrial plants and one to reduce methane emissions from a gold mine. There are no NAMA activities (respectively “flagship” activities) known in the industry (Ecofys 2013).

According to Winkler (2007), energy efficiency improvements in industrial processes represents one of the largest single sources of mitigation potential in South Africa, with possible reductions of approximately 100 MtCO₂/a in 2030. This number includes emission reductions resulting from decreasing electricity consumption, which are part of “electricity and heat” in Figure 5. However, the measures applied to achieve these reductions refer directly to the industrial sector, some examples being improvement of boilers and steam systems, compressed air, heating, ventilation and air conditioning and pumping. The mitigation potentials are not broken down by subsector.



Source: IEA Energy Balances 2012

Figure 6: Distribution of final energy consumption in the industry in South Africa in 2008

Coal mining

South Africa’s coal mining industry is a key economic sector. Coal is the most important primary energy carrier. It is mainly used for electricity generation, but also for production of liquid fuels. About a third of the production is exported (DEA 2011).

Additional to the greenhouse gases emitted during combustion of coal, the mining process leads to a substantial amount of methane emissions from venting the mines. The potential for reduction of methane emissions from venting and using the methane as a fuel has a potential of up to 45 MtCO₂e/a according to Gouvello et al. (2008).

Buildings

The building sector in South Africa varies greatly between socio-economic groups leading “to a wide range of energy consumption per house, as well as a significant difference in appliances – and hence, energy carrier employed” (Winkler and van Es 2007). However, the low income housing sector might provide specific conditions suitable for benchmark-based pilot activities. This sector is in the focus of governmental action, and provides most potential for co-benefits.

South Africa today lacks about 2 million units of adequate shelter (Government of South Africa and Department of Human Settlements 2010). Since 1994, South Africa’s government has worked on improving the housing situation of low and middle income households. The document *A New Housing Policy and Strategy for South Africa* set the basis for future housing policies, with the target to establish “a permanent residential structure with secure tenure, ensuring privacy and providing adequate protection against the elements” and to provide access to water, electricity and sanitation services (Government of South Africa 1994). The *breaking new ground plan* from 2004 mentions social housing as a fundamental part of the strategy (Government of South Africa 2004).

The various targets can be combined and extended by including efficient and low-carbon technologies in the government programmes. Several projects and studies are looking into sustainable low income housing already. There is for example the Sustainable Settlements Facility managed by South South North in cooperation with the Development Bank of Southern Africa and with funding from KfW. The project is based on the first South Africa CDM project, the Kuyasa CDM project, which supported the retrofitting of 2,300 houses with solar thermal water heater, insulated ceilings and energy efficient lighting⁸. The Sustainable Settlements Facility is attempting to scale up the Kuyasa CDM project⁹.

Recommendation/Conclusion

The assessment of the sector situation in South Africa shows that the coal dominated electricity and heat sector as well as the mining industry seem most suitable for further considerations in this research. The electricity sector might however suffer from its monopolistic structure for the development of benchmarks. Alternatively the low income housing sector might provide suitable conditions emphasising the pilot character of this research and its considerable potential for further co-benefits.

2.3.3. Actual choice of sectors

For the development of concepts for sectoral benchmarks which will provide the basis for credited pilot activities we recommend the selection of the **electricity sector in Chile** and the **buildings sector in South Africa** with a special focus on low income housings. Both sectors are structured very differently and may provide therefore two good showcases on how benchmarking concepts for bilaterally designed approaches could be applied. They have different barriers and opportunities and might even have a connection when electricity consumption in the building sector is considerably reduced through activity within the envisaged mechanism. Also, with regards to the CDM, both sectors have a different track record. Facilitated by the concept and a structured calculation tool for grid emission factors, renewable electricity projects are widely developed, while the building sector remained underrepresented in the CDM despite existing methodologies.

The alternative choice of any industrial subsector for which considerable direct emissions exist and a benchmark development is feasible is generally possible but would probably not lead to new conceptual knowledge. Since these sectors are covered by the EU ETS allocation benchmarks and the envisaged mechanism builds on Article 11a (5) of the EU ETS Directive, major deviations from concepts as used in the EU ETS might not be meaningful. This might especially become evident by the wording used in Paragraph (6) of the Article 11a which already refers to the allocation benchmarks. The actual benchmark level might deviate but is rather a political agreement than a technical decision. Moreover, the data availability and collection in industrial subsectors often suffer from confidentiality concerns of companies. These barriers do, in the majority of cases, not exist in the electricity and the buildings sector.

Finally, it needs to be noted that this recommendation is based on the knowledge available at the time of analysis. The reasons as presented further above might change over time and during the rather long duration of this research study. The selection of sectors and countries is made for the following parts of this research work and can't be changed anymore even if new information might become available which would justify a different choice.

8 See: <http://www.kuyasacdm.co.za/>

9 See: <http://www.southsouthnorth.org/sustainable-settlements-facility-ssf/>

3 Benchmark concept development

After completion of the selection of target countries and sectors we focus in the next step on the development of concepts for sectoral reference levels based on benchmark approaches. The definition of reference levels provide the basis for credited pilot activities based on bilateral agreements. In the following sections we first give general information on the concept of benchmarking with a focus on its opportunities and barriers (cf. section 3.1). Thereafter, in section 3.2, we will briefly describe the existing benchmarking approaches which are applied mainly in the CDM and the EU ETS, and which could serve as examples and starting points for the development of sectoral benchmark concepts for the selected target sectors. In section 3.3 we develop actual benchmark concept approaches for the target sectors, followed by recommendations for further actions.

3.1 The benchmarking approach in a nutshell¹⁰

The concept of benchmarking is generally defined as the comparison of performance levels against selected peers based on a set of criteria. It allows for an assessment of the relative performance of the benchmarked activity or entity. The purpose of benchmarking is to provide for an objective picture of one's own performance. Benchmarking, if done properly, increases the objectivity of an evaluation, especially if it can be based on a quantifiable criterion. As such, it often replaces subjective assumptions about performance. Figure 7 illustrates the potential result of an assessment using the concept of benchmarks.

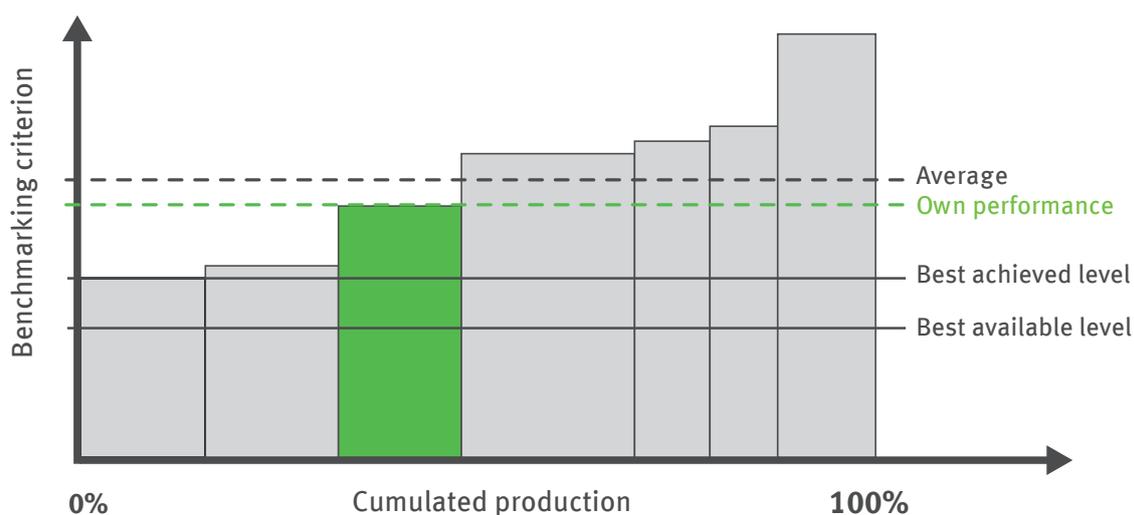


Figure 7: Benchmarking and performance levels

Evaluations based on benchmarking are often used as a management tool within larger improvement processes. Benchmarking can either be a static or dynamic process. As a static process, it is implemented once while the dynamic approach requires continuous processes with periodical reviews. The dynamic approach of benchmarking has multiple advantages, such as leading to a deeper and continuous analysis and allowing for periodical updates of the envisaged performance targets. This is especially true regarding rates of improvement (in % per year) and objective assessments of results of implemented measures. The key steps in benchmarking approaches are shown in Figure 8. Dynamic benchmarking continuously repeats the steps (4) to (5).

¹⁰ This subchapter is based on Ecofys (2008).

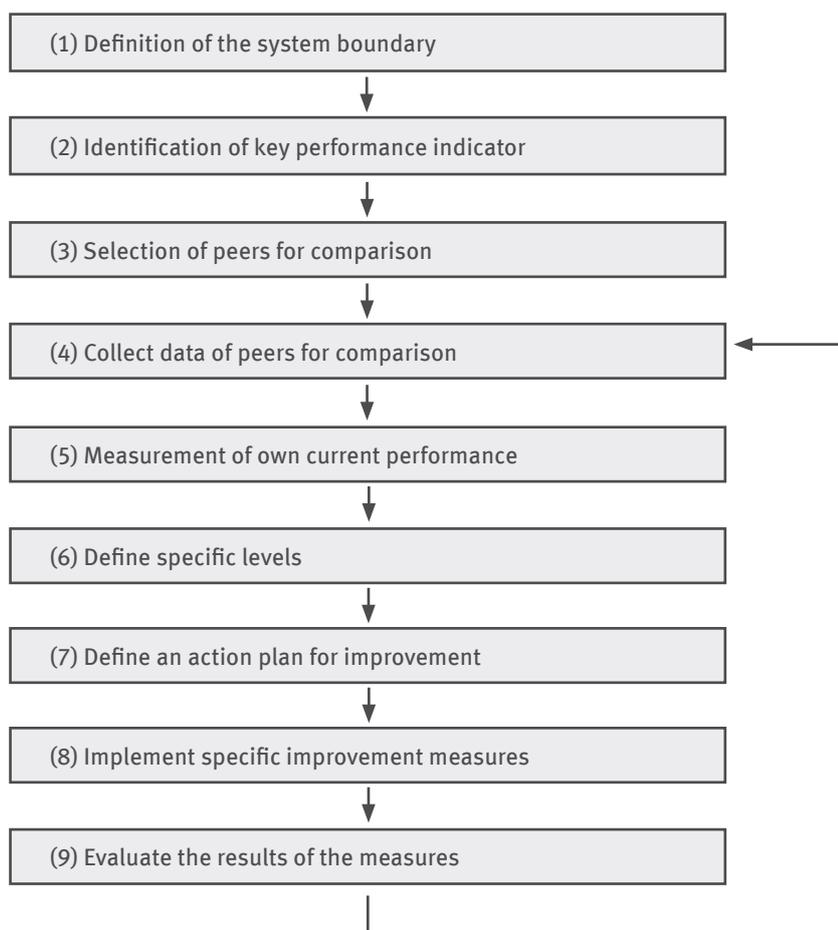


Figure 8: Key steps of benchmarking approaches

Since benchmarking is also a useful tool for comparing the performance of plants, with regards to greenhouse gas emission levels for example, it can be applied in the carbon markets and some examples already exist (e.g. the EU ETS allocation for the third trading period or selected CDM methodologies). Generally, the number of fields to which benchmarking could potentially be applied is large. Benchmarking can be applied to energy-related greenhouse gas emissions (e.g. power generation) and non-energy-related greenhouse gas emissions (e.g. PFC emissions in the production of aluminium). Benchmarking can be used at almost any functional level. With regards to energy use it might, for example, be used to compare sources of energy, their efficiency of transportation, the conversion, or their final use. Existing CDM benchmarking methodologies have also been applied to the efficiency of power generation from specific fossil fuels (e.g. methodologies for efficient coal power plants). Practically, other sectors such as building or transportation could also benefit from approaches based on benchmarking.

In practical application, however, benchmarking has its opportunities and barriers. We therefore describe in the following section some of the key steps of benchmarking approaches as listed in Figure 8.

(1) Definition of the system boundary

One of the main challenges in using benchmarking approaches is the definition of the system boundary. The system boundary defines activities or production phases for example, which are considered in the benchmark. Benchmarking can encompass single technologies, activities or services, partial production processes, or the entire production chain. When the benchmarking criterion is the amount of emitted greenhouse gases, the decision on the system boundary, might for example take account of whether to include transport emissions, the heating of office buildings, or to only focus on a certain part of the production process.

Benchmarks defined for very large system boundaries will be able to capture much more reduction potential than the ones defined for narrow system boundaries. In turn, emission-reduction projects combining several measures (e.g. efficient motors and drives, efficiency at small-scale components, electricity savings and management, waste-heat recovery, good practices and management, preventive maintenance) can be implemented at a much lower transaction cost than those taken individually. As such, larger system boundaries might be an advantage.

Large system boundaries lead to the maximum inclusion of elements in one major unit. In this case the interaction of the sub-components of the system does not need to be treated as a leakage, as it only influences the system itself. This means that the effect of these interactions will be captured by the global indicators for the whole system, thus reducing the monitoring for external leakages. In turn, in some cases a broader system boundary can lead to a reduced need for monitoring. However, for certain technologies or sectors, large system boundaries might not be feasible due to a high heterogeneity of the production process.

The choice of system boundaries will ultimately be based upon the expert judgement with the main goal of avoiding possible perverse incentives. Perverse incentives due to the system boundaries might arise from diverted energy exports leaving the system boundary. An industry could, for example, choose to stop energy exports to a district heating network and instead use the low temperature heat with a very low efficiency for its plant. While greenhouse gas emissions would slightly decrease within the system boundaries, they would globally increase. However, for the operator of the plants, this would be beneficial, as greenhouse gas savings beyond the system boundary are not accounted for.

(2) Identification of the key performance indicator

The key area to improve for entities participating in a benchmark is the climate impact for a defined function (product or service). In turn, the performance related to climate change can be defined by the following formula:

$$\text{Performance} = \frac{\text{impact (GHG emissions, CO}_2 \text{ emissions, energy use, etc.)}}{\text{function (tonnes of product, useful lighting, electricity produced, etc.)}}$$

This performance is the ratio between the climate impact of a certain activity (e.g., emission of certain greenhouse gases) and the function provided by this activity (e.g., the production of certain goods or services). Both the function which is to be benchmarked as well as its climate impact must be defined and quantified. A ratio between both (such as the energy or emission intensity) can provide a performance indicator which can be used to compare peers independently from certain parameters such as their size or the process used.

A comparison against peers implies that entities have a common function which makes them comparable (e.g., production of electricity, production of crude steel, conversion of electricity into light, etc.). Another criterion to assess this comparability is the possibility to be substituted for other entities. A good comparability further requires that the input, output (product or service), and local parameters are either the same or do not matter. For example, recycled steel does not have the same input as primary steel. In turn, if no further steel scraps are available, it cannot be substituted for primary steel. This points out a limited comparability in this case.

Ideally, goods compared would be commodities. This means that they are technically entirely identical and are only differentiated by the price. This is, however, in reality often not the case and additional parameters might be needed to apply some corrections. Aluminium and base load electricity, for example, correspond well to the definition of a commodity. Services in the building sector on the other hand are diversified in a large amount of different services further highly differentiated by their quality. The decision about a product or service depends in turn very much on the homogeneity and their comparability via benchmarks.

Using the example of paper production, choices for the denominator of the benchmark could be tonnes of paper, independently of the quality of the paper, tonnes of paper differentiated by paper types, or tonnes of paper differentiated by certain parameters (e.g., thickness of paper).

For the numerator, the climate impact of a specific function can be based on the energy use, the CO₂ emissions, or all associated greenhouse gases. This will largely depend on the function which has to be benchmarked. A key choice to make when deciding on how to quantify the climate impact is the inclusion or the benchmark of the indirect greenhouse gases, such as the ones caused by the upstream and downstream transportation of goods, people, and energy. The decision taken at this step is largely influenced by and not clearly separable from the definition of the system boundary selected for the benchmark. The choices of the elements to be measured will be done according to their relevance and their feasibility.

A broader coverage will, of course, lead to a more precise benchmarking of the greenhouse gases' impact on the activity. Nevertheless, an increased complexity might defeat the purpose of simplification through benchmarking. An expert judgement is needed to decide on which elements to include in the approach. In the case of heavy industries such as cement, steel, and aluminium or paper, indirect emissions represent a major source of emissions and should thus be included, in other sectors or for specific services exclusion could be justified.

The data availability in the selected sector in particular might be an important criterion when selecting the metric. Several sectors have very low or inaccurate reporting of their greenhouse gas impact. Numerous sectors have not yet even defined metrics on which their performance can be judged, thus limiting the development of benchmarks. In order to create benchmarks, an agreement needs to be reached across the sector about which metrics to use or about a neutral third party to decide on them. Such a decision about which metrics to use is generally highly political, as specific interests among competitors lead to divergent interest about the metrics to be used.

Once all the criteria for the comparison have been clearly defined and the metrics selected, the performance can be quantified in units. Examples for metrics to be used are the greenhouse gas intensity of power production (CO₂e/kWh), the greenhouse gases intensity in buildings (CO₂e/m²), or product-specific intensities in heavy industries (e.g., CO₂/t cement, GHG emissions/t steel).

(3) Selection of peers for comparison

The selection of peers for comparison, step (3), will significantly influence the relative performance of the benchmarked entities. The following parameters can be used when determining the peers for comparison:

- ▶ age (also new plants vs. retrofit)
- ▶ scale (e.g., plants over 100 MW; 200 t per day; buildings over 5,000 m²)
- ▶ local parameters (e.g., local biomass availability, local quality of raw materials)
- ▶ geographic scope (e.g., only plants in a country or specific province)
- ▶ functional parameters (e.g., production of primary goods vs. recycling or both)
- ▶ input (e.g., fuel input and raw materials with differentiated qualities)

In most cases, the choice of entities to compare against is limited by the availability of data in the selected sector. A common solution is to use some of the listed parameters to limit the data collection to good performers. This preserves the environmental integrity of the methodology and reduces the work needed for data collection. This is, for example, already done in the power sector, where fossil power plants can be benchmarked against identified, new large plants all over the world.

It is also likely that a smaller geographic scope will be selected if regional parameters have a strong influence on the benchmark. This is, for example, the case regarding the availability of biomass, which shows very strong disparities worldwide. Thus, for example, power generation in regions without sufficient biomass might have higher CO₂ emissions. They will also not be able to switch to this alternative fuel to the same extent as power generation located in a region with abundant biomass supply. Another strong example is regions with different average temperature levels. The comparisons of services provided in buildings (e.g. specific indoor temperature levels) on an international level would be unfair if regional or geographical parameters are ignored.

(4) Data collection of peers for comparison

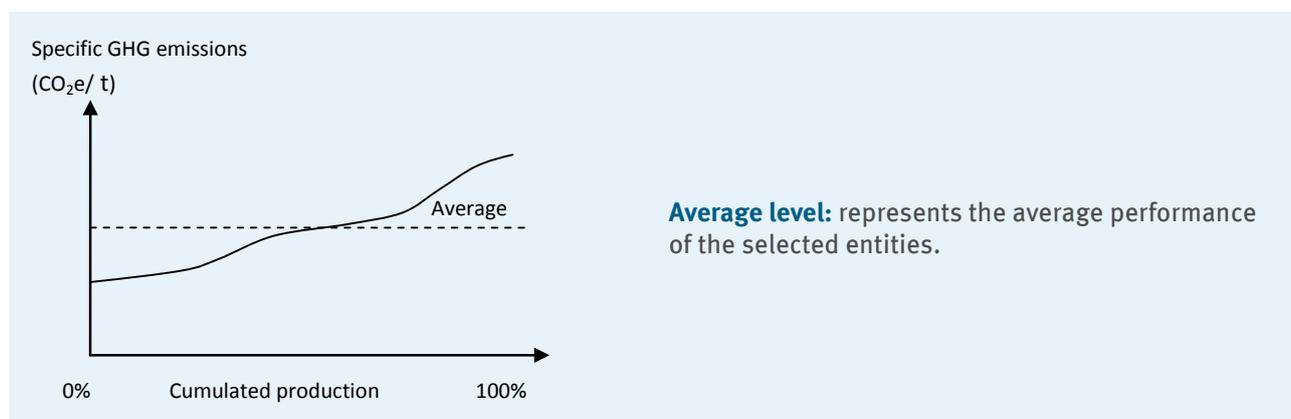
Regarding the collection of data for benchmarking, a first essential step is to have uniform reporting across the sector, which will allow for fair comparison. Ideally, the metrics agreed on should be measured and/or monitored in a similar way according to an open and neutral procedure agreed upon. This reporting should also include, when needed, indicators for local parameters such as the grid emission factor for most industries or the degree of the day's temperature difference for buildings. For several sectors the reporting is still the main barrier to benchmarking and the availability of data will be discussed in following sections. Most of the time, peers for comparison might be competitors. For this reason, the collection of the data and its management can be a highly sensitive issue, as the greenhouse gas emission intensity reported as well as other indicators might be highly sensitive market intelligence data. For data collection, the set-up and involvement of independent institutional structures is therefore rather important. Some existing benchmarking initiatives have solved this via their industry associations in collaboration with independent institutions. A good example is the WBCSD Cement Sustainability Initiative (CSI) together with the World Resource Institute, who for several years have already received reported data on a plant-by-plant basis and derive key indicators from that data while keeping the confidentiality of individual reported data.

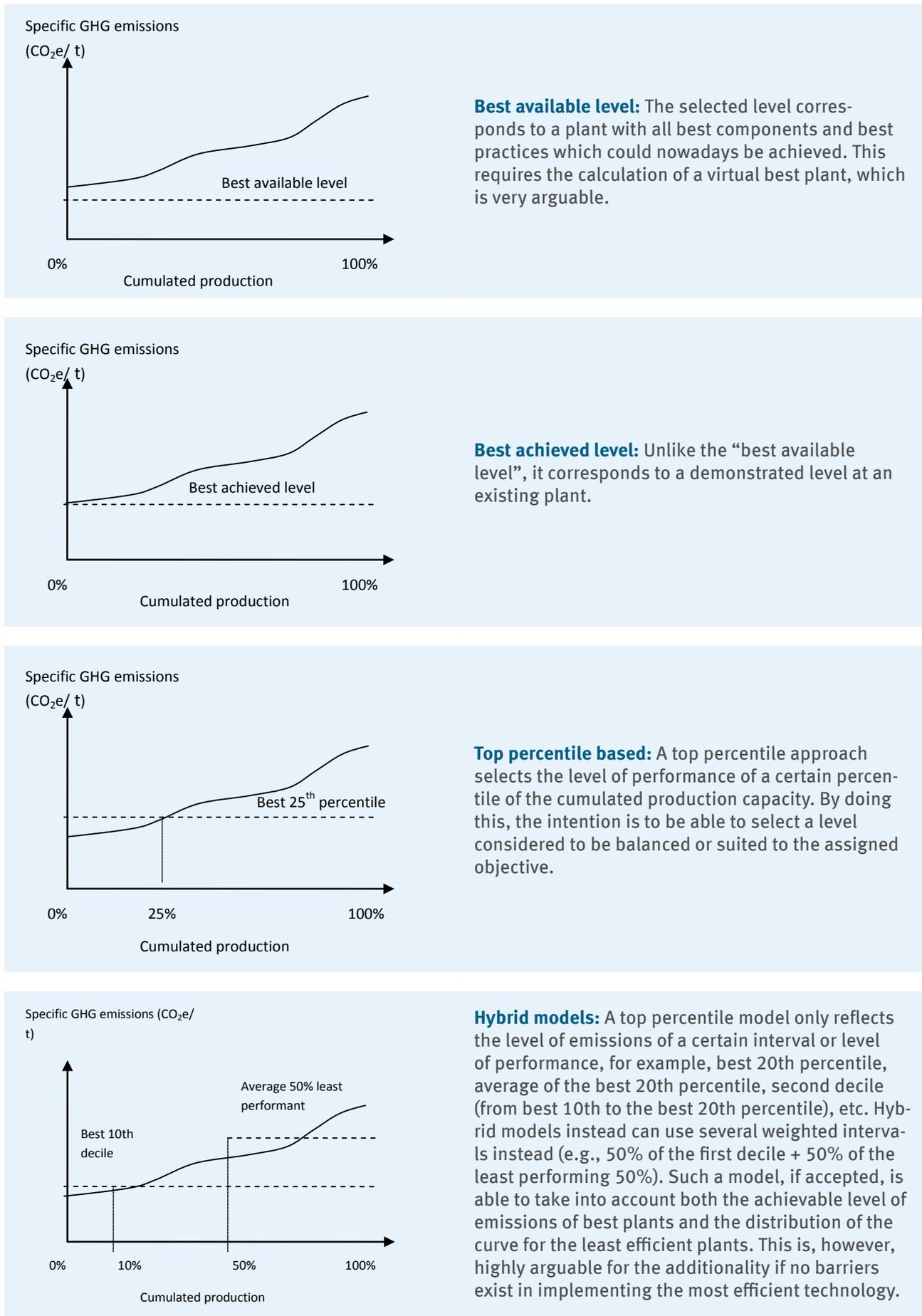
(5) Measurement of own current performance

Monitoring and reporting of one's own performance has to be coherent with the methodology and procedures used for the data collection of peers for comparison. Therefore, the development of rules for monitoring and reporting of the data used for the benchmark has to be developed hand-in-hand with the one used for the measurement of one's own performance.

(6) Definition of the benchmark level (stringency)

There are several approaches that can be used to select the benchmark levels. The following overview gives some examples:





Best available level: The selected level corresponds to a plant with all best components and best practices which could nowadays be achieved. This requires the calculation of a virtual best plant, which is very arguable.

Best achieved level: Unlike the “best available level”, it corresponds to a demonstrated level at an existing plant.

Top percentile based: A top percentile approach selects the level of performance of a certain percentile of the cumulated production capacity. By doing this, the intention is to be able to select a level considered to be balanced or suited to the assigned objective.

Hybrid models: A top percentile model only reflects the level of emissions of a certain interval or level of performance, for example, best 20th percentile, average of the best 20th percentile, second decile (from best 10th to the best 20th percentile), etc. Hybrid models instead can use several weighted intervals instead (e.g., 50% of the first decile + 50% of the least performing 50%). Such a model, if accepted, is able to take into account both the achievable level of emissions of best plants and the distribution of the curve for the least efficient plants. This is, however, highly arguable for the additionality if no barriers exist in implementing the most efficient technology.

Figure 9: Approaches to define the benchmark level

Most sectors constantly improve their performance. An update of the dataset is likely to show an increased performance level. The benchmark level as previously seen is likely to have been set as a relative performance compared to peers. Without an update of the performance level, the benchmark will stay at the same absolute level of stringency (e.g., tCO₂/t product). This means, however, that the level of performance as x percentile of the cumulative production probably decreased as technologies and practices improved (relative performance). Thus, the relative performance of the benchmarking can only be maintained through a regular update of the data. It might be appropriate in most cases to establish a dynamic benchmark with regular updates of the data.

Another innovation possible with dynamic benchmarking is the possibility to use an improvement ratio for a certain industry on a certain geographic scope. In turn, it is possible, for example, to say that for a given sector, the rate of autonomous improvement for the energy efficiency or the recycling is of x% per year. This improvement ratio can be measured (ex-post), assumed for a given sector (ex-ante) or even chosen on an arbitrary basis, depending on the climate goals that a sector has to achieve. Such a rate can be used in a methodology to establish another baseline scenario, for a plant for example, under which it would improve at a rate comparable to other plants in the region. In turn, the baseline can be taken as the lowest of:

- ▶ one's own plant-based historical data corrected with improvement ratio in the region,
- ▶ the production of the same good in the region by the plant at the xth best percentile.

As both of these options generally lead to an absolute increase of the stringency of the baseline over time, the approach gets to a level where there is no further improvement possible.

Actual decisions on the stringency level of a benchmark are in any case very challenging. A too-stringent baseline will eliminate incentives for project developers, while a loose baseline leads to the creation of CERs which are not backed by real emission reductions. When benchmark concepts are applied based on bilateral or multilateral agreements with relation to the carbon markets, the final decision on the benchmark setting approach and the actual stringency level is also a political decision based on agreements. The introduced methodological options can however support this decision and provide a kind of toolbox for the decisions makers.

3.2 Existing experiences with benchmarks

Creating a benchmark or a standardised sector-wide baseline is a difficult exercise for the multiple reasons quoted, especially the availability of data and standardised procedures for monitoring and reporting. In the following section, we will therefore look at the availability of benchmarking approaches which are already applied primarily in the CDM and the EU ETS, and which could serve as good examples to derive an approach suitable for bilateral agreements and sectoral emission reductions based on benchmarks.

3.2.1. Benchmarks in the Clean Development Mechanism

The baseline determination for CDM projects generally follows a project-by-project approach. This results in resource-intensive and lengthy approval processes with potential for inconsistent treatment of project activities. Against this background, the use of benchmarking and general standardisation approaches in the CDM has been discussed since the invention of the CDM. The discussions are led by the trade-off between advantages such as increased simplicity and reduced transaction costs against the fear that decisions taken on a level of a larger group might support projects that would have been excluded if decisions are made on a project-by-project level.

However, paragraph 48 of the CDM's modalities and procedures already opened the opportunity to use benchmarking in the calculation of CDM baselines (UNFCCC 2006). It considers three different approaches for setting the baseline:

- a) Existing actual or historical emissions, as applicable;
- b) Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;
- 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% of their category.

However, approach c) is used only rarely due to barriers which may be summarised as:

- ▶ The stringency implied by using an average of similar projects in the top 20th percentile. The applicability of this option is in turn very limited and is expected to be viable only for large projects applying a better performing technology than this stringent baseline (e.g., a greenfield plant applying the best available technology in a sector with a fast-improving technology);
- ▶ The effort related to the data collection itself needed for option c) is higher than the one used for approaches a) and b).

The benchmark based approach has to date only been taken up as an option in a limited number of methodologies (e.g. ACM0013 for new grid connected fossil fuel fired power plants or AM0070 for manufacturing of energy efficient domestic refrigerators). Furthermore, some initiatives for the use of benchmarks in CDM methodologies were not approved by the CDM Executive Board (EB), for example the proposed methodology for emission reductions in cement production facilities (NM0302), which is based on the database of the WBCSD Cement Sustainability Initiative (CSI)¹¹.

The concept of benchmarking is however frequently applied to determine the baseline for grid-connected electricity generation which consists of the “avoided generation”. This is the generation of electricity substituted by the electricity produced by the CDM project and is calculated based on the so-called “Combined Margin”. The latter represents a combination of the “Operating Margin” and the “Built Margin”. The operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project activity.¹²

The operating margin emission factor is to be calculated according to one of four calculation methods. These calculation methods differ mainly in their complexity and accuracy. Ideally, the “dispatch data analysis” would be used as a calculation method. In this case the operating margin generation emission factor is calculated as the hourly generation-weighted average emissions per unit of power (tCO₂/MWh) for the set of power plants falling within the top 10% of the grid system dispatch order. This calculation method, which is the most accurate, is, however, strongly limited by the data availability on the grid level. Therefore, a lack of accuracy in the calculation of the operating margin is not due to the methods available, but rather a lack of adequate monitoring and reporting of data.

The build margin emission factor is to be calculated as the generation-weighted average emission rate (tCO₂/MWh) of recent capacity additions to the system. These capacity additions consist of either the five power plants that have been built most recently, or the power plant capacity additions to the system that comprise 20% of the system generation and that have been built most recently. The sample group that comprises the larger annual power generation shall be used.

11 For further information we refer to <http://www.wbcsdcement.org/index.php/key-issues/climate-protection/cdm-benchmarking>.

12 For further details, see the “Tool to calculate the emission factor for an electricity system”; http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v4.0.pdf/history_view.

Standardised baselines

The benchmark based concepts in the CDM are recently reinforced by efforts to reform and upscale the CDM. These upscaling measures aim to address different limitations of the CDM and include the introduction of Programme of Activities as a new project category and the concept of Standardised Baselines. SBLs will however include benchmark based approaches. SBLs in the CDM are defined “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”¹³.

Transaction costs are reduced once SBLs exist and are available for project developers. Lack of data is a main barrier in some countries and the individual baseline definition often overcharges single project participants. Risks for the project initiation are reduced by confirmation of already accepted baseline scenarios prior to project registration. SBLs have moreover the ability to lower the complexity of MRV processes and offer the flexibility to cover different measures (e.g. energy efficiency) with one emission baseline. They also allow broader regional coverage either for regions or even cross-country depending on the homogeneity of the baseline situation.

The concept of SBLs was introduced by a decision of the COP in Cancun (CMP.6/2010). The initial rules and procedures for the submission of SBLs were finally adopted by the EB of the CDM in 2011 (EB 63/September 2011)¹⁴. The rules allow for two approaches to initiate the development of SBLs. From top-down, the UNFCCC institutions themselves can bring forward baselines, while the bottom-up approach allows all stakeholders to develop proposals. The latter are, however, required to be submitted to the CDM EB for approval via the host country DNAs.

The Guidelines for the establishment of sector specific standardized baselines were initially adopted in July 2011 (EB 62) and revised in November 2011 (EB 65)¹⁵. This methodological framework for the development and assessment of standardized baselines currently covers four types of measures which are:

1. Fuel and feedstock switch;
2. Switch of technology with or without change of energy source (including energy efficiency improvement);
3. Methane destruction;
4. Methane formation avoidance.

The guideline further defines four steps for the establishment of SBL for each of the four measures as listed above:

Step 1: Identify host country(ies), sectors, output(s) and measures;

Step 2: Establish additionality criteria for the identified measures (e.g. positive lists of fuels /feed stocks and technologies);

Step 3: Identify the baseline for the measures (e.g. baseline fuel, technology, level of greenhouse gas destruction);

Step 4: Determine the baseline emission factor where relevant.

Compared to PoAs, SBLs are a rather new concept which is reflected by a currently low rate of proposed baselines. As of November 2013 the list of submissions comprises only six proposals, three of which have been approved.¹⁶

13 Cf. paragraph 46 of Decision 3/CMP.6 Further guidance relating to the clean development mechanism; UNFCCC (2011b)

14 See: http://cdm.unfccc.int/Reference/Procedures/meth_proc07.pdf

15 See: http://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid42.pdf

16 The full list can be found here: http://cdm.unfccc.int/methodologies/standard_base/index.html

It is however noteworthy that two of the three approved SBLs are for electricity grid emissions and follow the already available 'Tool to Calculate the Emission Factor for an Electricity System'. One submission is from Uzbekistan and another one from the Republic of Botswana. The latter applies to the Electricity System of the Southern African Power Pool (SAPP) and covers a variety of countries such as Botswana, Congo, Lesotho, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe.

Despite their currently limited impact, SBLs are without doubt a suitable approach to successfully reduce barriers and scale up the impact of the CDM. In addition to the general challenges already presented for benchmarking approaches, SBL developments suffer, for example, from the fact that bottom-up developments require significant resources and capacity of the host country DNAs (see e.g. respective QA/QC guidelines for SBLs). Unfortunately, a large number of DNAs in underrepresented host countries are not even able to cope with the current requirements. Furthermore, the alternatively possible top-down development of SBLs by the UNFCCC is not yet effective.

A recent policy paper issued by a group of carbon market experts raised some important questions on the suitability of the current approach for standardised baselines in the CDM (Schneider et al. 2012). The identified shortcomings also have relevance for the benchmark concept development of the selected target sector in this study. These include issues of concern, such as:

- ▶ one approach for all sectors, not adequately considering sector-specific circumstances,
- ▶ a limited dynamic component, updates apply only at the renewal of the crediting period,
- ▶ the linking of methodological approaches for additionality assessment and baseline determination, with limited flexibility to select the most suitable approach for sectors and project types,
- ▶ the voluntary use of standardized baselines and
- ▶ the lack of clarity in various terms and definitions.

Benchmark based additionality assessment

Especially challenging for benchmark concept developments are approaches that address both (a) the additionality assessment and (b) the baseline determination of project activities with benchmarks. While the Marrakesh accords refer to baseline determination only, benchmarking was in various occasions also proposed as a way to overcome problems of demonstrating additionality. The recently implemented concept of SBLs under the CDM addresses for instance also the additionality assessment of projects. This is implemented as a double benchmark concept which sets separate benchmarks for additionality and the baseline. Using a single benchmark value for the demonstration of additionality and the level of the baseline does not seem to be an appropriate concept to guarantee the additionality of CDM projects. Benchmark based baselines should generally be lower than individually determined baselines to account for the increased uncertainty level linked to this option. For the objective of additionality demonstration the benchmark should be set even lower. If both approaches are implemented in one step, it might become impossible to demonstrate if and to what extent both objectives are met.

Similarly to the baseline determination, the demonstration of additionality through the use of a benchmark is challenging. The most difficult decision concerns the stringency of the additionality benchmark. If it is set too stringently, no CDM projects will go forward, while a loose benchmark will allow too many projects to generate CERs, for emission reductions that would have happened anyway. A double benchmark concept might use the same methodological approach for setting two different stringency levels for additionality and baselines, although this might not be the appropriate approach in all sectors or situations. Furthermore an additionality benchmark might in specific situations only ensure that the environmental additionality is met but does not address the financial additionality of projects.

This is, for example, problematic if activities with even ambitious greenhouse gas reductions represent an economically attractive way of action.

3.2.2. Benchmarks in the EU Emissions Trading System

Benchmark based concepts are also applied in the EU ETS. While the majority of allowances are auctioned (e.g. in the power sector) in the third trading phase (2013-2020), the remaining free allocation of certificates, primarily to industries, is based on benchmarks. Free allocation in previous trading periods was however still based on grandfathering.

The benchmarks developed by the EU Commission for the third trading period are product related and do not differentiate by technology, fuel used or other factors like size or location of an installation. The product benchmarks were developed to reflect the average greenhouse gas performance of the best 10% performing installations in the EU producing the specific product. Altogether, 52 product benchmarks (allowances/unit of production) were developed. Still, these product benchmarks are not able to cover all production processes under the EU ETS, therefore additional benchmarks in the form of a heat benchmark (62.3 allowances/TJ heat consumption or export), a fuel benchmark (56.1 allowances/TJ fuel consumption) and a process emissions benchmark (0.97 allowances/tCO₂ process emissions) were developed. These benchmarks also aim at setting high-performance requirements; for example, the fuel benchmark is oriented at the emission factor for natural gas.

The development of benchmarks involved the respective industries and the EU Member States. Development of the benchmarks was complex, as benchmarks had to be specific enough to appropriately represent a product, but general enough to be applicable to that product throughout the EU Member States and to various technologies and installation sizes. This required considerable effort with regards to data collection and technical assessment. Industry took an active part in the development of data but also showed an interest in being subject to benchmarks which were not too demanding. EUROFER, the European association of iron and steel producers filed a law suit against the EU Commission at the European Court of Justice as they considered the respective benchmarks to be unrealistic. It might be fair to say that benchmarking required far more effort than initially assumed. This is connected to the number of benchmarks required, their development as well as their application. The experience of benchmark development shows that both the technical as well as the political aspects of this exercise should not be underestimated.

Since with relevance for this study, it needs to be noted that paragraph 6 of Article 11a of the EU ETS Directive refers to the free allocation benchmarks in the context of bilateral agreements:

“Any such agreement may also provide for the use of credits from projects where the baseline used is below the level of free allocation under the measures referred to in Article 10a or below the levels required by Community legislation.”

Article 10a covers the transitional community-wide rules for harmonised free allocation, including community-wide ex-ante benchmarks. The wording of this paragraph might imply that the additionality requirements for the import into the EU ETS are already met if activities result in emission levels below the free allocation benchmarks in the EU ETS. In this way, additionality and maybe also baseline benchmarks are rather set on a political level, disregarding the specific situations in host countries. Power generation activities are excluded from free allocation and no benchmark has been developed for this sector.

3.2.3. Benchmarks in the context of a New Market-based Mechanism

The COP in Durban defined a New Market-based Mechanism as a mechanism covering broad segments of the economy and going beyond pure offsetting (UNFCCC 2012d). However, negotiations on an international level have, so far, generated very little with regards to concrete rules for an NMM. Parties submitted their views on the design of the mechanisms in different stages.

The submissions basically proposed two options which are distinguished into “sectoral crediting and sectoral trading (cf. European Commission 2012).

With **sectoral crediting**, a crediting baseline is set for a broad segment of the economy of the host country (e.g. a sector or sub-sector). The host country government provides incentives for the sector to reduce emissions. Credits are issued to the government ex-post if the emissions are verified to be below the baseline. No penalty is applied if emissions are above the threshold.

With **sectoral trading** an emission target is defined for a broad segment of an economy in a cap-and-trade approach and tradable emissions allowances are issued to the government ex-ante. The government can sell surplus allowances or buys allowances in case it is short.

Modalities and procedures for these approaches still need to be elaborated. This includes approaches for the definition of ambitious reference levels such as emission targets (sectoral trading) or crediting baselines (sectoral crediting). While not yet decided, benchmarks could be used for the determination of both reference levels either directly or integrated into larger concepts. The baseline setting based on benchmarks in the context of an NMM is likely to have the same challenges and opportunities as described in the previous sections. However, the NMM implementation on governmental level might support benchmarking activities through providing capacities and institutions at the national level. Activities such as baseline definitions, data gathering for benchmarking or the set-up of institutions is time consuming and might lead to delays until such a mechanism can be operational. Alternatively, the mechanism might start with only selected eligible countries in the beginning.

Finally, it needs to be noted that credited benchmarks in an NMM will likely be lower than actual baseline benchmarks since the Cancun agreements already defined that such a mechanism is required to ensure a net decrease and/or avoidance of global greenhouse gas emissions (UNFCCC 2011a). In this way the NMM would be a mechanism that goes beyond pure offsetting. Host country's own contributions, according to the capabilities of specific countries, will likely also be expected by various donor countries for the initiation of piloting activities in the current situation.

3.3 Framework conditions for benchmarks in the selected pilot sectors

For the development of a concept for benchmarks, a number of decisions have to be taken about the system boundary and further metrics as described in the previous sections (e.g. the aggregation level, the cohort of plants included in the benchmark, local/regional parameters, as well as the frequency of updates). While all these decisions have an effect on the benchmark and its impact, in the following section, we focus on providing a comprehensive basis that provides useful information to support the actual decision on the choice of the level of the benchmark.

For differently structured sectors, different elements of benchmarking will be applicable or different approaches will be appropriate, for example the level of (dis-)aggregation. It is therefore likely that the proposed approaches for benchmarking in the selected sectors and in the context of this study are highly differentiated. We therefore analyse both selected sectors separately and focus in the following sections on individual sector opportunities and challenges which exist for the development of benchmarks. Our analysis basically follows the key steps 1 to 6 of benchmarking approaches as introduced in section 3.1 and shown in Figure 8:

- (1) Definition of the system boundary
- (2) Identification of the key performance indicator
- (3) Selection of peers for comparison
- (4) Data collection of peers for comparison
- (5) Measurement of own current performance
- (6) Definition of the benchmark level (stringency)

Still, the final decision on the level of the benchmark (stringency) is a political agreement. This is especially relevant in the setup of bilateral systems as envisaged in this study and when the instrument shall go beyond pure offsetting and is aiming for reduction contributions from host countries. A stringent level for the baseline would certainly add to the environmental integrity of the instrument but decreases the attractiveness. On the contrary, a generous baseline with a low stringency would generate more certificates, but increases the risk of not representing real emission reductions. The availability of detailed technical and methodological information can thus support finding reasonable agreements.

3.3.1. The Chilean electricity sector

For the benchmark concept development in electricity sectors, several general issues should be considered. Power generation is different to other industries because it is characterised by a wide range of different generation technologies with large variations in installation sizes and fuels used for the production of electricity.

This sector is well represented in the CDM with several methodologies covering activities in the sector and a large share of implemented and planned project activities. Moreover, the sector already applies a benchmark approach in the CDM for grid-connected electricity projects which consists of the “avoided generation” that is substituted by electricity produced by the CDM project. The benchmark is calculated on combined margin according to the rules as specified in the tool to calculate the emission factor for an electricity system (cf. section 3.2.1). For small scale off-grid electricity generation often the default value of 0.800 tCO₂e/MWh is used and serves as benchmark value for many projects¹⁷. This value is derived from diesel generation units.

According to the general approach of this section, we aim to learn from existing benchmarking approaches which are already applied primarily in the CDM and also the EU ETS. However, the EU ETS provides little insights in this respect, although the electricity sector in Europe is stringently regulated by the EU ETS. In the third trading phase power generation activities are excluded from free allocation and have to buy all required allowances through the market and via government auctions. Due to this circumstance the development of a benchmark was not required and does not exist for this sector (cf. section 3.2.2). Only the national allocation plans in previous EU ETS phases included a reference emission levels that might be useful.

The specific situation in the Chilean electricity sector is described in sections 2.2.3 and 2.3.1 and can be summarised with the following main facts:

- ▶ Almost one third of the Chile’s greenhouse gas emissions stem from electricity and heat generation.
- ▶ Electricity generation is currently dominated by gas and hydro power plants.
- ▶ Future capacity additions will likely be based on combustion of domestic coal reserves to reduce the import dependence and to respond to demand increases.
- ▶ Chile has plans to develop an ETS under the PMR which also covers the electricity sector. Timeline and implementation details are, however, still to be developed.
- ▶ Chile has vast potential of renewable energies including solar potential in the north, wind potential along the coast and geothermal potential in regions with volcanic activities.
- ▶ Chile released a law which requires electricity companies with more than 200 MW capacity to have a share of at least 5% of renewable energy in their sales. This percentage will increase starting in 2014 by 0.5ppts until 2024 (10%).

In addition, Chile is active in the development of NAMAs also covering initiatives in the electricity sector.

¹⁷ See for example the methodology AMS-I.A. ‘Electricity generation by the user’: <http://cdm.unfccc.int/methodologies/DB/8FKZFJ7SG551TS2C4MPK78G12LSTW3>

(1) Definition of the system boundary

The elements considered in a benchmark for the electricity sector might include upstream emissions from the production and transportation of fuels (e.g. mining and refining activities, biofuel plantations) and emissions from the production of energy technologies (e.g. raw material for renewable energy technologies, energy use in processes and transport). Direct greenhouse gas emissions mainly occur in the plant through the combustion of fuels for electricity generation. Further, mainly indirect, emissions occur through transmission and distribution losses when the electricity is delivered to the consumer (cf. Figure 10).

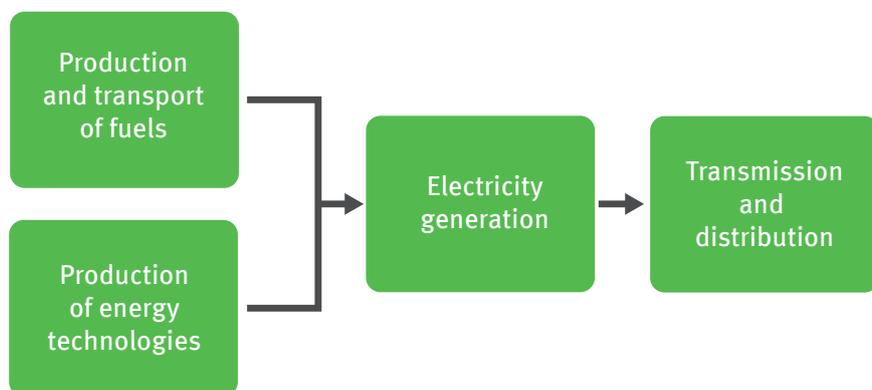


Figure 10: Simplified scheme of emission sources in the electricity supply sector

Boundaries in the EU ETS are set around installation sites and the covered greenhouse gas emissions from the electricity sector are only direct CO₂ emissions. The CDM defines the boundary for project power plants as its spatial extent and all power plants connected physically to the electricity system that the CDM project power plant is connected to, and is referring to the calculation of the grid emission factor. While cap-and-trade mechanisms can decide to only cap specific gases, baseline-and-credit mechanisms have to guarantee the complete consideration of atmospheric effects. The CDM thus only excludes minor sources for simplicity reasons in the definitions of the methodology. In the methodology ACM0002 which is specific for grid-connected electricity generation from renewable sources, the CDM considers CO₂ emissions from combustion processes in power plants, fugitive CO₂ and CH₄ emissions from geothermal power plants and CH₄ emissions of hydro reservoirs¹⁸. All these emissions can be allocated to the “electricity generation” box in Figure 10.

Considering the parts of the value chain previous to activities on the electricity generation plant would increase complexity significantly and would lead to difficulties in the identification of the key performance indicator. Other sectors would have to be involved in the data collection. The fact that Chile imports many of the resources used, implies that it would be necessary to extend the system boundary to other countries.

Considering the transmission and distribution of electricity would mean to include the electricity grid and its components in the assessment. The CDM when referring to grid emissions generally includes the emissions from all power plants connected to the grid but not the physical grid itself. Some CDM methodologies which provide requirements for energy efficiency measures relating to electricity savings allocate the respective avoided emissions from avoided technical distribution losses to the electricity efficiency activity (cf. AMS-III.AE.). As in Chile, the generation and distribution fall into the responsibility of the same institutions, the additional effort might be manageable and worth giving a more complete picture and including potentials from grid improvements. However, grid losses technically cannot be accounted for plant by plant – which are still the physical source of emissions – in most cases, so that we would have to draw on a theoretical methodology to assign the total grid losses to individual power plants to determine the benchmark.

¹⁸ ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”. Available online at <http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT>

Equally, the improvements done by one entity in the grid would then improve the complete sector, and could only theoretically be accounted to the entity which implemented the measure. Furthermore, this approach would require data collection on the end users side, for example via electricity bills. Here, we could face problems of inadequate metering of electricity use at the consumer level resulting from informal grid connections and incorrect installation of metering systems.

To keep the benchmark for this pilot sector transparent, we recommend limiting the scope to activities in electricity generating installations. Improvements that will thus affect the benchmark are the choice of fuel and the efficiency of the plant. With this choice the actual setting of boundaries around installation sites in the electricity sector seems easy but requires common definitions on, for example, the inclusion of auxiliary equipment and the treatment of cogeneration units in which the electricity generation is accompanied with the production of heat or cold.

Another dimension of system boundary is reflected in the question “Does the benchmark look at single installations or at groups, for example at all installations of one operator?”. The second option would allow for more flexibility in the way improvements can be made. An operator of a coal fired power plant for example could install additional renewable energy capacity to lower the average emission factor of his power plant park and thereby gain credits.

(2) Identification of the key performance indicator

The most common indicator of the electricity sector’s performance in terms of emissions is the amount of greenhouse gas emissions per electricity output in unit of GHG/unit of electricity. One common combination of units is tCO₂e/MWh which can be converted to other combinations of SI (Standardised International) units.

Depending on the gases included, we either look at CO₂ only (being the most relevant gas in the combustion processes on electricity plants) or CO₂-equivalent, if other greenhouse gases are to be considered. It seems recommendable to follow in a first step the simplifications made by the CDM for minor or major sources while this might be expanded to further Kyoto greenhouse gases (CO₂, CH₄, N₂O, HFCs, PFCs and SF₆) in successive steps. However, it needs to be assessed if greenhouse gas sources under consideration have an impact that justifies the increased complexity of the underlying calculations and monitoring tasks.

If the electricity is generated in a cogeneration unit an allocation methodology needs to be applied in order to determine which output type is responsible for which amount of emissions.

(3) Selection of peers for comparison

The choice of entities to be included in the benchmark development for comparison requires decisions on a variety of questions. Some are specific to the Chilean electricity sector others are generally required. These decisions include the geographic scope of the benchmark, the size and type of plants to be included, the fuel used and the existence of a grid connection.

What is the geographic scope of the benchmark?

The Chilean electricity system is divided into four geographic zones without or with very limited grid connection between them. These include:

- ▶ the Sistema Interconectado Central (=Interconnected central system) (SIC),
- ▶ the Sistema Interconectado del Norte Grande (=Interconnected system of the great north) (SING),
- ▶ Aysén and
- ▶ Magallanes (IEA 2012c).

Due to the geographical expansion of Chile over more than 4,000 km, the structures of electricity generation in the four zones vary substantially in various aspects: the size in terms of electricity generation and distribution, currently dominating energy sources, and potential of alternative energy sources (Instituto Nacional de Estadísticas 2011). Table 9 shows some features of the zones in comparison.

Table 9: Comparison of capacities in Chile’s electricity system’s zones (CDEC-SIC 2012)

GRID	Total Installed Capacity (MW)			Total GRID (MW)
	Thermal (MW)	Hydro (MW)	Wind (MW)	
SING	4.570	13	0	4.583
SIC	6.680	5.840	196	12.715
Aysén	21	18	2	41
Magallanes	99	0	0	99
Total National	11.370	5.870	198	17.438

These factors have an impact on current specific emissions and on the mitigation potential. It might therefore be advisable to apply a further disaggregation on the level of regional grids or exclude certain zones and/or to apply different benchmarks to them. To make a choice on which zones to include, we suggest consideration of the size of the zone, the current status of the generation, including efficiency of power plants and fuel type, and the geographical potential in the area for renewable electricity generation.

Generation of electricity concentrates within the SIC with about 72%, supplying the central part of Chile and a major part of the population, and within the SING with about 22%, supplying mainly the big mining industry in the north of the country (Instituto Nacional de Estadísticas 2011). The southern systems (Aysén and Magallanes) are both very small in terms of electricity generated.

In terms of generation types, the SIC and the SING vary significantly. While the SIC includes a substantial share of hydro power (between 41% and 59% of electricity generation in 2008 – 2012) and to a smaller extent coal and oil, the SING relies heavily on coal (between 57% and 83% in the years 2008 - 2012 and also includes gas (12% to 27%). The Aysén zone includes a mixture of natural gas power plants and hydro power, while the Magallanes zone has several big gas power plants, complemented with smaller diesel generators (Comisión Nacional de Energía 2013). Gas is imported from Argentina and the share of gas varies significantly over the years, depending on policies related to the trade of fuels of both Argentina and Chile (Ministry of Energy Chile 2013).

Chile is a country with abundant renewable energy resources in all parts of the country. In the north, solar irradiation is among the highest in the world and could be used for generating electricity with photovoltaic or concentrating solar power plants. Along the coast towards the centre and in the south, there are important wind energy potentials as well as hydro reserves in the Andes¹⁹. At the first glance, no region suffers from real disadvantages. However, the costs of technologies have to be considered, as well as the extent to which the potential (e.g. for hydropower) has already been exploited, so that there might be a disequilibrium between the two big zones. Bloomberg New Energy Finance presents levelised cost data for different renewable electricity generation technologies in Chile, which show a competitive advantage for biomass, hydro, geothermal and wind energy in comparison to solar electricity generation (Bloomberg New Energy Finance 2011). This disequilibrium might be dissolved by compensation instruments between the zones and embedded in the design of the credited mechanism.

19 SWERA Map. Available online at <http://maps.nrel.gov/SWERA>

Alternatively, a single benchmark value for Chile might be considered, which is not further disaggregated to the level of regional electricity grids. Similar incentive levels in all regions of Chile could have advantages since a credited mechanism with ambitious benchmarks will probably not lead to investment in unrequired installations. Additional revenues from electricity sales should always be required and a respective demand for the generated electricity. In this respect potential future developments might also be anticipated. Currently the physical linkage of the regional grids in Chile is again under consideration while it is discussed controversially.

Should the benchmark be fuel- or plant-type specific?

Benchmarks for electricity generation by fossil fuel power plants could further be disaggregated and set on a fuel-by-fuel basis (coal, petroleum, gas, etc.). This however leads to a greater number of benchmarks to be developed, as at least one benchmark per fuel would have to be available. Furthermore, setting plant type-specific benchmarks would not provide any incentive for renewable energy projects. Setting fuel- or plant type specific benchmarks has advantages if incentives for the improvement of the efficiency of fossil fuel power plants shall be given.

Which size of plants will be included?

Setting a minimum size for installations covered under the benchmark limits the effort needed for data collection. However, limiting the participation to a certain size of power plants can result in the exclusion of a large number of plants and might affect the comparability between the installations, because very small installations may differ in terms of efficiency and fuel use depending on their size. Additionally, cases might exist where small renewable electricity generation units replace fossil fuel fired units with a similar size which is not reflected in a benchmark that is applied to all different sizes. A disaggregation according to different plant size ranges might, from individual perspectives, be reasonable, although it will be difficult to show in each case which individual installation is replaced.

The size of the plants is either determined by their size in installed capacity, electricity generated or emissions. Easiest for data collection is the installed capacity as data is publicly available from official data sources. We therefore use this as a first indicator.

Plant size according to capacity installed in Chile's two big zones is distributed as shown in Figure 11. We can see that especially in the SIC zone, there is a great number of small power plants, which contribute little to the overall electricity generation in comparison to the bigger plants but are significant in number. In the SING network, there are more plants at a medium level of capacity installed in comparison to the SIC.

Because setting a minimum value in terms of size would lead to the exclusion of many plants, we suggest including all sizes. Data on all grid connected plants is collected already in the Chilean statistics system, so we can assume that data collection should be manageable. This exercise is however already successfully performed in the CDM. However, it should be noted that the EU ETS only covers installations with a thermal capacity above 20MW.

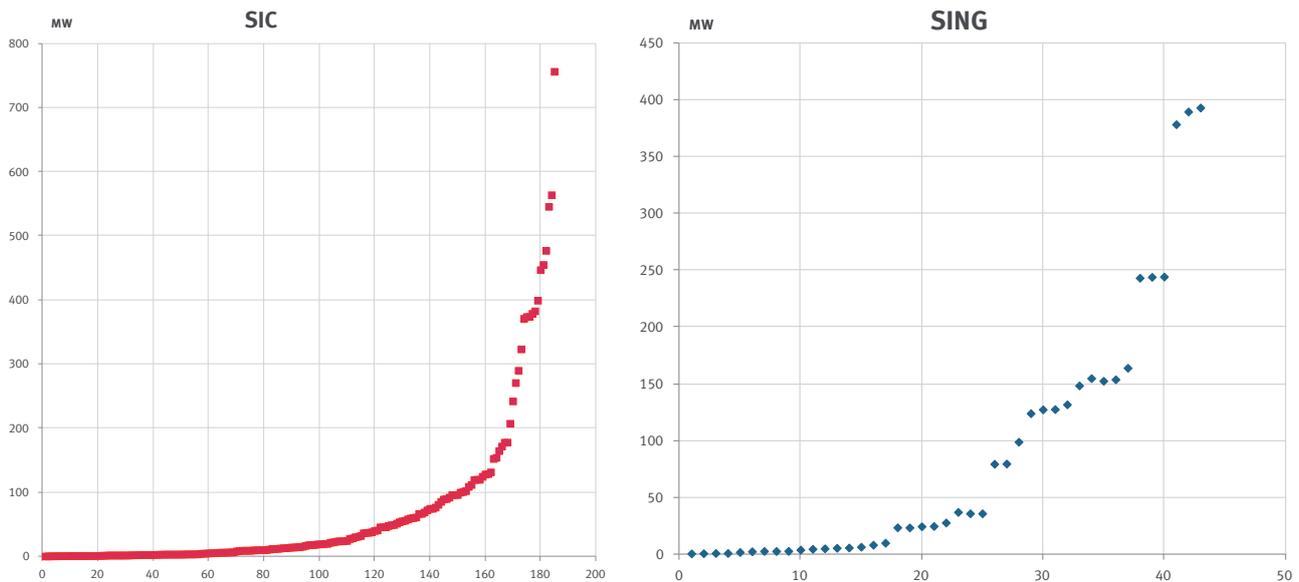


Figure 11: Distribution of plant size according to capacity installed in SIC and SING zone in December 2011. Data source: (Comision Nacional de Energía 2013)

Will the benchmark also include off grid electricity generation units?

Off grid electricity generation units are not physically connected to the grid and thus are not included in the boundary defined for the grid-connected electricity generation benchmark. The CDM, however, optionally considers off grid electricity generation units under the condition that the total capacity of off-grid power plants (in MW) is at least 10% of the total capacity of grid power plants in the electricity system, or that the total electricity generation by off-grid power plants (in MWh) is at least 10% of the total electricity generation (UNFCCC 2013). This is mainly to reflect situations in countries where grid instability exists due to large difference in supply and demand, and off grid electricity generation has a major contribution to the electricity supply in the country. However, this is not the case in Chile and we suggest to not consider off-grid generation units for the benchmark(s).

A separate benchmark concept for off-grid generation units could be developed outside the considerations in this study. The default value of 0.8 tCO₂/MWh, as used in the CDM for many projects, could be a starting point. One can however also argue that the grid electricity benchmark can as well be applied to off-grid generation since it is in most countries lower than the default value. Off-grid generation technologies might however have different needs for support and the required support level might further vary between different renewable electricity off-grid generation solutions. A useful overview on renewable off-grid generation with estimations on different needs for support is provided in the NAMA proposal for “Expanding self-supply renewable energy systems in Chile” (CER et al. 2013).

Will the benchmark include all existing power plants or new power plants?

If the benchmark comparison includes all existing power plants, it reflects the complete power plant stock which has built up over time. This approach in determining a benchmark value is called “Operating Margin” under CDM (cf. section 3.2.1). The group of peers for comparison may thus include very old plants which do not necessarily reflect current trends. The CDM moreover mostly excludes low-cost/must-run power units from the operating margin emission factor calculations. To emphasise recent developments, we can focus on recently constructed power plants, as in the built margin approach under the CDM. This way, only the newest trends are considered and the remaining plant stock is excluded.

Advantages and limits of both approaches were discussed already for projects in the electricity sector under the CDM. There, the consensus evolved of using a combination of both approaches, that is to determine a benchmark level (as in “step 6” in this document) for both and then combine them by calculating a weighted average (combined margin).

We recommend following the approach of the combined margin in choosing the peers, because it reflects adequately both the existing plant stock as well as current trends. Specifically in Chile it is important to find a good balance between old and new plants, as the BAU projections suggest a shift from the high share of hydro energy today to emission intensive coal fired power plants. For further details please also see consideration in step 6 “Definition of the benchmark level (stringency)”.

Will the benchmark include existing CDM power generation units?

This decision requires a trade-off between two perspectives. Following from the additionality requirement, the implementation of CDM projects is dependent on the existence of the CDM and CDM projects would not be part of the BAU scenario without the CDM. However, the CDM is available as a supporting instrument especially for renewable electricity generation activities and is thus part of the baseline scenario. In particular, a new bilateral mechanism might be set up in parallel to the CDM and builds on the BAU scenario which includes CDM support for projects.

This perspective leads to strong arguments to fully include CDM projects in the benchmark development. However, if the combined margin approach from the CDM is applied, the calculation of the build margin might lead to very low emission factors in case the recent generation capacity additions are CDM supported renewable electricity projects. To avoid these potential disincentives a potential combined margin approach could stronger focus on the operating margin or could consider specific rules for situations where CDM projects dominate the BAU scenario. The recent version of the CDM tool to calculate the grid emission factor considers existing CDM projects in the operating margin calculation and excludes them for the build margin calculations as long as capacity addition in the last 10 years meet the required thresholds²⁰.

CDM projects should however not be allowed to participate in a possible bilateral crediting mechanism to avoid double counting and to ensure a high reputation of such a new mechanism. Exclusion from participation for CDM projects might easily be implemented for renewable electricity grid additions. However, exclusion of other activities which reduce emissions from power generation, such as fossil fuel switch activities, might be more difficult to exclude. These activities can still have potential under such a bilateral mechanism to further reduce emissions even if measures previously supported by the CDM have been undertaken. These cases might be treated sensitively or always excluded.

Renewable electricity generation capacity additions that are counted towards the obligations of large electricity companies (>200 MW capacity) to have a minimum share of renewable energy in their sales should also be excluded from the mechanism and companies that do not fulfil their required targets should not be allowed to participate.

(4) Data collection of peers for comparison

The data required for the development of a benchmark expressed in accordance with the key performance indicator, as defined in step 2, includes:

- ▶ the electricity output per installation for all peers and
- ▶ the greenhouse gas emissions per installation for all peers.

Publicly available data includes installed capacities per plant, the technologies used and generation of electricity per plant.

²⁰ See: http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf/history_view

The Comisión Nacional de Energía (=National Energy Commission) collects this information and publishes it on its website²¹. Websites from the different load economic dispatch centres also provide information about the different types and quantities of fossil fuels used. The generally good availability of this information across the sector is specific for the electricity generation sector and has positive effects for the application of a benchmark concept in this sector. Usually, only minor confidentiality concerns exist and government authorities collect the required data already for other purposes and statistics.

The CDM basically calculates the greenhouse gas emissions per installation based on the data for the used fuel type and quantity as well as based on available values for the “Net calorific value” and “CO₂ emission factors” of fuel types. If such data is partly not available, default values might be used or other calculation options may apply. In the EU ETS direct CO₂ emission measurement approaches (stack gas measurements) are allowed but rarely used. The most commonly used approach is based on calculations and thus similar to the CDM. The CO₂ emission data per covered installation is monitored, reported and calculated based on the used fuel (activity data) and relevant emission factors.

In Chile, power plant operators do not currently directly monitor and report greenhouse gas emission data in a centralised manner. To design a benchmark, the mechanism administrator might once or periodically calculate the data of peers for the benchmark development based on the available data or will decide to implement a MRV system and MRV requirements for installations. This has advantages such as MRV capacity building and preparations for a potentially forthcoming ETS. The introduction of MRV requirements for all installations in the sector, however, also requires that installations that do not actively participate in the mechanisms to report on their emissions. The actual possibilities for the data collection either by the mechanism administrator (e.g. host country government) or the installation operators depend on the actual design of the bilateral mechanism and should be discussed in conjunction with the mechanism design.

Under the PMR Chile is evaluating options to establish a national ETS including the energy sector. This includes the design and implementation of MRV and registry systems. Pilot projects under a potential bilateral credited mechanism could provide a first basis for preparing data collection processes in the electricity sector.

(5) Measurement of own current performance

The measurement of the own current performance in existing power plants or new generation sites that participate in the potential bilateral crediting mechanisms requires the same data as for step 4 but from the own installation or generation site. While the electricity output determination is rather easy, the determination of the greenhouse gas emissions requires a combination of measurements and calculations. It is methodologically required to follow the same approach as chosen for the previous step but also seems most efficient to follow the general approaches as presented for the CDM and EU ETS in step 4.

The determination of activity data is required for each fuel used but normally available due to internal control procedures. The required accuracy level needs to be determined by the mechanism administrator and determines to a large extent the choice of means. Actual requirements could represent a trade-off between accuracy and cost-efficiency and could result in a wide range of options, for example on the one side the use of supplier data (e.g. invoices) and on the other side the requirement to use calibrated high precision measurement equipment. A tiered approach according to the size of installations (respectively the amount of annual emissions) and considering the different capabilities available in installations as in the EU ETS might be more appropriate than applying the same accuracy levels to all participants as in the CDM.

²¹ See: <http://www.cne.cl/estadisticas/energia/electricidad>

The mechanism administrator might furthermore decide that reported data on installations' current own performance is verified by independent third party verifiers. Comparable verification steps are foreseen in the CDM and the EU ETS.

The required default values, such as emission factors and net calorific values, could as well be determined with different certainty levels. The CDM and the EU ETS define broadly similar priority orders for accepted sources of default values. IPCC values should only be used when country or project/plant specific data are not available. The EU ETS requires only from the largest installation operators using non-commercial fuels to analyse these parameters by default.

The determination of the performance of new renewable electricity generation sites that participate in the potential bilateral crediting mechanisms might be rather easy and could be defined by default. As long as no auxiliary fuels are used and no further emission sources within the defined boundary exist, the performance might be constantly equivalent to 0 tCO₂e/MWh.

Theoretically, the possibility of carbon capture and storage needs to be taken into account. There are however no carbon capture technologies yet in Chile. If this changes, a mechanism specific treatment or even discount approach from the total emissions calculated from fuels for the amount of carbon captured might be required.

(6) Definition of the benchmark level (stringency)

Looking at the complete set of peers for comparison, the “best achieved level” will be 0 tCO₂e/MWh for renewable electricity. This level is not achievable for operators of fossil fuel plants, even if the system boundaries consider as an indicator the average emission intensity of a number of plants belonging to one operator. The approach of the “best achieved level” however could be varied to include only fossil fuel power plants, which would lead to a benchmark level of very efficient natural gas fired powered plants, or to look only at recently built plants to reflect current developments. A fuel- or plant type specific benchmark development would however not lead to incentives for investments in renewable electricity generation as described in the considerations to step 3.

Using the average emission intensity as a benchmark might provide a solution in most cases while regional grids with a high share of renewable energy might still not provide incentives for new investments. In Chile, especially in the SIC zone there is a higher share of hydro energy plants (cf. Table 9), so particularly here this could result in a lower average emission intensity, if the average of all peers is considered.

When setting the benchmark level, one also needs to consider the BAU development of the indicator, to be sufficiently ambitious but also to be not too stringent, maintaining realistic incentives. The BAU development in the Chilean electricity sector is likely to include a substantial increase of the share of coal: O’Ryan projects the capacity of coal, which at the time of his study in 2007 was approximately 2 GW (of 13 GW total), to increase to 10 GW (of 27 GW) in 2020 and to 20 GW (of 40 GW) in 2030. The average emission factor of electricity generation in Chile will thereby increase by 80% between 2007 and 2030 (O’Ryan et al. 2010). Note that O’Ryan’s analysis reflects the national level, not indicating differences between the generation and distribution zones.

However, the grid emission factor calculation tool of the CDM considers already the BAU development and the existence of different regional grids but requires a project-by-project determination. This calculation exercise has been performed in the past by many CDM projects and project initiatives which provide a valuable source of information.

Table 10 shows the results of an evaluation of the used grid emission factors in Chilean CDM projects. The data is based on information provided in the Project Design Documents (PDDs) of registered Chilean CDM Projects. No registered CDM project activities are connected to the Aysén and Magallanes regional grids, and no grid emission factors could be extracted from PDDs for these grids.

Since significant variations in the values for one regional grid were detected, the range of variation in grid emission factor calculations of CDM project activities is separately shown in Figure 12. The variations mainly result from various different methodological choices which are possible or required in the grid emission factor calculations, and from the different data vintages used.

Table 10: Grid Emission Factor use in Chilean CDM projects (own calculations based on IGES (2013))

Average grid emission factors calculated for Chilean CDM project activities [tCO ₂ /MWh]	SIC	SING
No. of projects using a grid emission factor (projects with registration dates as of 2005)	66	12
Operating margin	0.707	0.802
Build margin	0.429	0.553
Combined margin	0.572	0.736

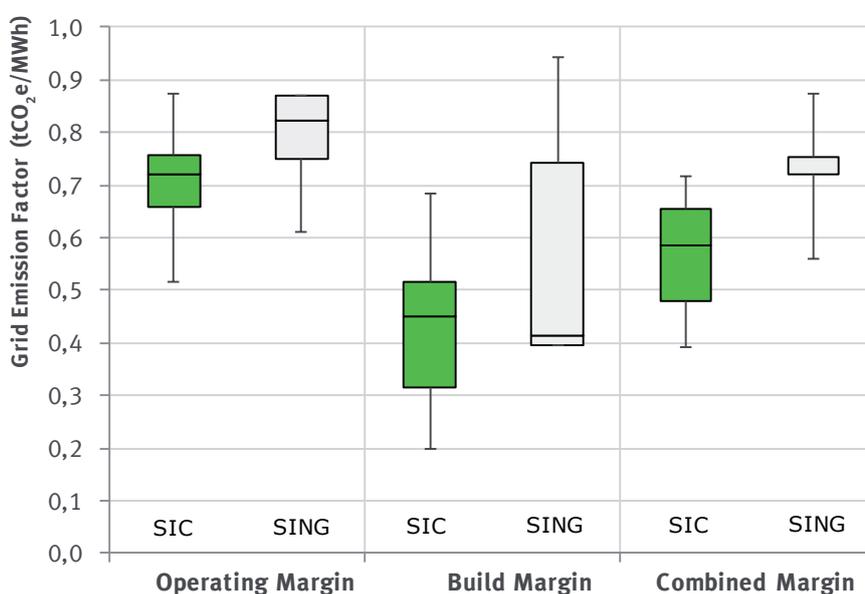


Figure 12: Range of variation in grid emission factors of Chilean CDM project activities (box plots based on data from IGES (2013))

Table 11: Grid Emission Factor for Chilean electricity grids (Ministerio de Energía 2013)

Grid emission factor for Chile according to statistics of the Ministry of Energy [tCO ₂ /MWh]	SIC	SING
2010	0.346	0.715
2011	0.379	0.725
2012	0.391	0.806
Average (2010 – 2012)	0.372	0.749

It should also be noted that average emission factors from other sources (e.g. Chilean Ministry of Energy or IEA) are often lower since they do not follow the methodological approach of the CDM (cf. Table 11 and Figure 13). A key difference is that the CDM approach allows in most cases to exclude low-cost/must-run power plants.

“Low-cost/must-run resources are defined as power plants with low marginal generation costs or dispatched independently of the daily or seasonal load of the grid. They include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If a fossil fuel plant is dispatched independently of the daily or seasonal load of the grid and if this can be demonstrated based on the publicly available data, it should be considered as a low-cost/must-run” (UNFCCC 2013).

This rule compensates the different share of hydro, wind and other renewables sources in the different regional grids and leads to smaller differences between the two major grids compared to the emission factor difference in the data from the Ministry of energy statistics, which are shown in Table 11. The small difference in the incentive level does obviously not result in insufficient incentives since still most of the projects are located in the region of the SIC grid. Other factors, such as size and potential, might overcompensate for this difference.

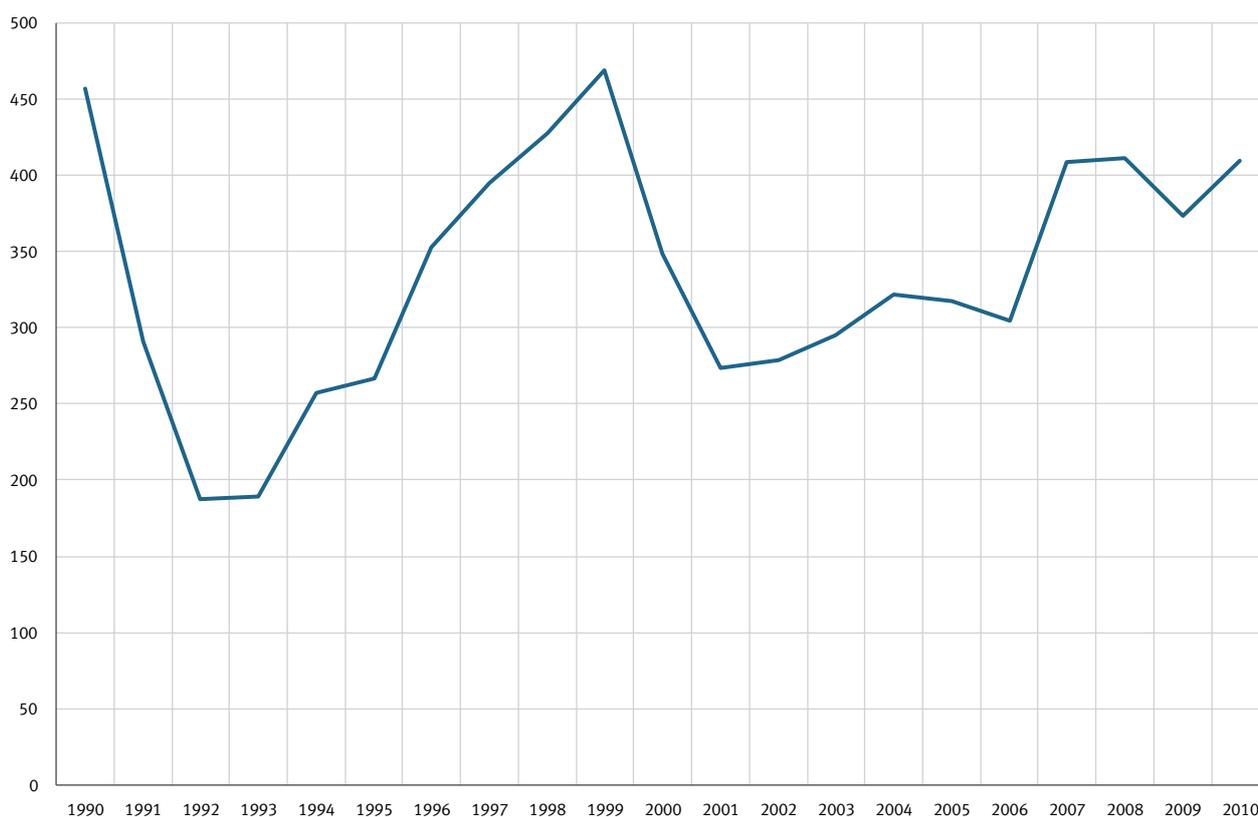


Figure 13: Overall CO₂ intensity of electricity generation in Chile, 1990-2011. (IEA 2012a)

Specific for the Chilean grid is also the large difference between emission levels in different years. This variation level is shown in Figure 13, based on IEA data, and can be explained with Chile’s high dependence on hydro power sources whose availability varies considerably between different years and the political dimension around the import of natural gas whose amount might also vary over years. The choice of data vintages can therefore significantly influence the results of average emission factor calculations.

Based on the considerations as presented in the previous steps, three methodological choices appear feasible depending on the specific objectives of a crediting mechanism:

Use of the current CDM framework

This approach includes the application of the current CDM tool to calculate the grid emission factor. The current version of this tool together with some methodologies for the power generation sector addresses already various issues with relevance also in a bilateral crediting mechanism.

This includes, for example, the combined margin approach which considers BAU developments, the definitions and priority orders for the accuracy of allowed data sources and the existing consideration for the use of simplifications for minor emission sources and provisions for non-CO₂ related greenhouse gas sources.

To allow a sector wide application which is independent from a project-by-project benchmark determination, it is recommended to pursue once or periodically the application of a standardised general application of the grid emission factor calculation, as foreseen in the standardised baselines approach of the CDM for example. Two of the three approved SBLs in the CDM already target grid emission factors (cf. section 3.2.1).

The CDM approach would however require four SBLs or reference values for all regional grids. This might be adjusted based on the actual design of a potential bilateral mechanism and the politically pursued objectives to provide sufficient incentives in all regions (cf. also consideration in step 3 - selection of peers for comparison).

Moreover, electricity sector benchmarks developed based on the CDM framework might result in a compensation level that reflects a broad consensus on the atmospheric effects of the specific measure. However, the envisaged bilateral mechanism approach shall ensure a high level of environmental integrity on sector level and aims for maximised international acceptance while pilot activities are attractive for investors when they go beyond the pure offsetting approach of the CDM. This is also one precondition for a potential continuation under a NMM. Against this background the benchmark value should ensure a net contribution to greenhouse gas emission reductions on a global level and needs to be more conservative compared to the CDM benchmark level. In this approach a discount on the calculated standardised grid emission factor could realise this contribution. Depending on the politically agreed or required stringency a fixed percentage or a percentage relative to the profitability situation of individual projects could be deducted (Warnecke et al. 2014).

Application of a default value

Alternatively the stringency of the benchmark level could be a purely politically set default value. Based on the specific agreement, this benchmark could be set clearly below the CDM grid emission factor to ensure an own contribution. The reference point could be the emission factor of a natural gas fired power plant which represents the fossil fuel based generation option with the lowest greenhouse gas emissions. In various EU ETS phase II national allocation plans such benchmark emission levels are set at levels between 0.350 – 0.450 tCO₂e/MWh (Neelis et al. 2008).

Such values are in the range of Chile's current average emission levels (based on IEA data) and far below the CDM calculated grid emission factors which range between average values of 0.570 and 0.740 tCO₂e/MWh (cf. Table 10). The use of a default value might allow renewable electricity generation units to earn reduction units with rather low transaction costs since no resources and capacity needs to be invested to determine the baseline value. A further advantage of this approach is the relative high planning security for investors, since the exact contribution from a credited mechanism is known in the beginning of the project planning and is not determined with delay during the process as it is the case in the CDM with its project-by-project approach.

The application of this default value does not incentivise investments in fossil fuel based power generation capacities if it is based on the most efficient newly build natural gas fired power plants. Such default value might therefore also be based on the best achieved 10% of all fossil fuel fired power generation installations (or installed capacity) instead of the best available level. This approach would also be in line with the benchmark setting of the EU ETS but would still generate only marginal incentives in a credited mechanism approach while in a trading approach this might be sufficient.

Hybrid approach

A hybrid approach might combine elements of both approaches as described above, which is relevant if incentives shall be ensured to increase efficiency of existing fossil fuel fired power plants or to build new natural gas fired power plants (instead of diesel or coal) and also for renewable electricity additions. All renewable electricity additions could by default get reduction units according to the application of a default value while fossil fuel based additions and activities to switch fuels or efficiency improvements can apply for a benchmark based on the CDM approach deducted by a certain percentage.

Although in this approach the benchmark level is higher for fossil fuel based electricity generation, the incentives per MWh could still be higher for renewables. The incentive is determined as the difference between the benchmark and the actual emission level. For fossil fuel based generation this difference might be 0.200 tCO₂e/MWh (e.g. in case the benchmark level is 0.550 tCO₂e/MWh and the emission level is 0.350 tCO₂e/MWh) and since renewables will have no or minor remaining emissions, their benchmark could for example be directly translated to the incentive level of 0.350 tCO₂e/MWh.

All these three main choices could be further adjusted to be applicable in specific situations according to the bilateral agreement between participating countries. This could, for example, include the question of whether the benchmark should consider installation sizes (e.g. when advantages from smaller decentralised generation are seen as important despite the often lower efficiency compared to larger power plants) or other aspects as discussed in the previous steps. On this bilateral negotiation level intervals for dynamic renewal of the benchmark level should also be agreed. The intervals should not be too short, in order to ensure planning security for investors, and not too long, in order to ensure that benchmark levels always consider recent developments and maintain a high level of environmental integrity for the bilateral crediting mechanism.

3.3.2. South Africa's low income housing sector

The benchmark concept development for the buildings sector needs to consider the specific characteristics of the sector and the experiences gained through the application of crediting mechanisms. In contrast to the previously discussed electricity sector, projects in the buildings sector which aim to cover the whole building rather than only specific appliances in buildings (e.g. lighting, space heating) reached only a low penetration in the CDM despite their large mitigation potential.

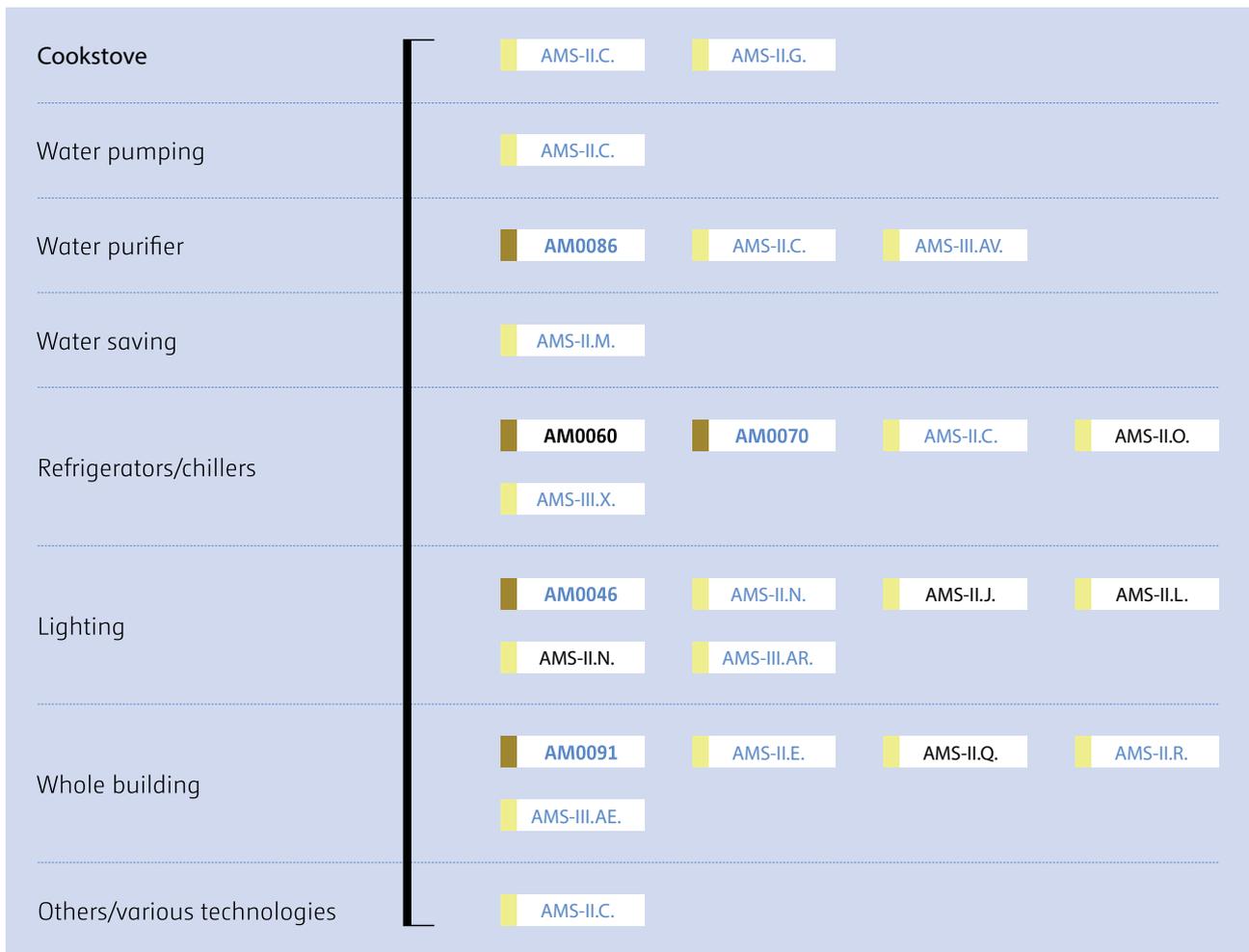


Figure 14: Overview on available methodologies for “household & building energy efficiency” (UNFCCC 2012a)

As shown by the methodology overview in Figure 14 for the category “household & building energy efficiency” most available methodologies refer to single measures in buildings and do not cover whole buildings and their overall energy efficiency. By the end of 2012 four methodologies were approved which offer an application to the entire building²². Most of these methodologies are however seldom applied and project activities with these methodologies are characterised by limited success in the CDM project cycle as shown by the number of projects in the pipeline, registered projects and projects that actually received at least once CERs.

²² Note that AMS-II.R., which was just recently approved and initially available as of 31 May 2013, is not yet included in the overview provided by Figure 14.

Table 12: Building CDM methodology overview

Reference number (available since)	Latest version	Name	No. of CDM projects: in pipeline / registered / issuing (*)	No. of PoAs: in pipeline / registered / issuing (*)
AMS-II.E. (31 Oct 02)	10.0	Energy efficiency and fuel switching measures for buildings	27 / 9 / 1	5 / 1 / 0
AMS-III.AE. (17 Jul 09)	1.0	Energy efficiency and renewable energy measures in new residential buildings	0 / 0 / 0	0 / 0 / 0
AM0091 (03 Jun 11)	1.0.0	Energy efficiency technologies and fuel switching in new buildings	0 / 0 / 0	0 / 0 / 0
AMS-II.Q. (20 Jul 12)	1.0 (top-down)	Energy efficiency and/or energy supply projects in commercial buildings	1 / 0 / 0	0 / 0 / 0
AMS-II.R. (31 May 13)	1.0 (top-down)	Energy efficiency space heating measures for residential buildings	0 / 0 / 0	0 / 0 / 0

(*) Numbers based on UNEP Risoe CDM and PoA Pipeline Overview, October 1st 2013, <http://www.cdmpipeline.org/>

Table 12 demonstrates that **AMS-II.E.** is the most frequently used for buildings. The small scale methodology covers greenhouse gas mitigation measures such as electricity and/or fuel savings through energy efficiency improvements and optionally through the use of less-carbon-intensive fuels. The methodology covers more efficient appliances and better insulation and thus has a rather holistic approach for the whole building. However, despite its long history the methodology is rather generic in its description, especially with respect to baseline building identification and monitoring provisions. Too general descriptions of requirements can lead to frequent use of methodologies since their requirements seem feasible in the first instance. Subsequent problems occur during validation and verification when requirements need to be practically implemented and turn out to be ambiguous or missing (Warnecke 2014). Thus, as of 01 October 2013, only 9 projects were registered while even only one project managed to successfully undergo the MRV process and to receive CERs. Besides one project in the low income segment (Kuyasa project in South Africa) most projects cover large single buildings with high specific emission levels such as hotels, office buildings, server buildings or even airport terminals.

AMS-III.AE. has a very narrow application scope since it only accounts for electricity savings in new, grid-connected residential buildings and stipulates that all equipment used needs to be new. Buildings in which any of the services provided are based on the use of fossil fuel or biomass cannot apply this methodology. Emission reduction determination is based on annual ex-post comparison of measured annual average electricity consumption of a sample of the occupied project residences with either a sample of baseline residences using regression analyses or with an estimate of the annual average electricity consumption of baseline residences as determined using a calibrated computer simulation model. Actual weather conditions need to be taken into account. No project applies the methodology so far despite the fact that this methodology has already been available since 2009. This might be due to barriers inherent in the allowed baseline determination approaches (simulation) and the narrow scope. The limitation to electricity consumption reduces the complexity and the number of parameters and might fit to the situation of many low income housings in South Africa but also sets incentives for the locked-in use of electricity as the preferred energy carrier which is especially in South Africa the energy source with the largest CO₂ emissions.

AM0091 was developed for Masdar City, a new sustainable low carbon part of Abu Dhabi, in the United Arab Emirates. The methodology is by far the most technically advanced and the only large scale methodology for buildings. The methodology is applicable to new buildings only and uses a benchmark approach for baseline setting and additionality demonstration expressed in emissions per floor area (tCO_2/m^2). The benchmark follows the specifications as laid down in paragraph 48 of the Marrakesh Accords (cf. section 3.2.1) and considers the top 20% of building units under similar conditions in the previous five years. Besides conditions such as climate and building size also the socio-economic status of residents is taken into account. The methodology covers whole buildings with the consequence that not all single measures within buildings need to be measured. Electricity and fossil fuel savings as well as refrigerant leakage reductions are considered while biomass and biogas usage is excluded. The downside of this consequent rule application and comprehensive coverage is the need for detailed data that describes the calculation of the project and baseline emissions. Project participants might be required to conduct their own extensive surveys to be able to gather the required building data which is usually not available from official statistics in developing countries. Parameters describing the socio-economic status of residents might even raise confidentiality concerns, an issue that is rather uncharacteristic for the building sector. Besides high capacity requirements and costs for MRV compliance, the limited availability or cooperation of national authorities in host countries might create a success limiting factor. No project applies the methodology so far.

AMS-II.Q. was developed with the top-down approach and approved in July 2012. The methodology specifically builds on the use of computerised simulation models for existing and greenfield commercial buildings. The methodology has a rather broad coverage and applies to projects that include energy efficient building design features; energy efficient appliances, equipment and/or technologies; energy management controls; on-site renewable energy projects; on-site cogeneration; and fossil fuel switching alone or in combination. In the case that legally binding building codes are available, the baseline emissions scenario is based on minimum energy requirements in the building code for the subject of the building type and the classification in the same climate zone (e.g. in kWh/m²/year). However, extensive knowledge and efforts are required to comply with exercises such as data collection, model calibration, computer simulations, documentation and reporting. Data about the complete building system is required including its orientation, shape and envelope, heating, ventilation and air conditioning (HVAC), the number of occupants and the operating hours. Additionally a prediction of energy use for services provided and the actual weather conditions might be required. One project developed a PDD based on this methodology and started a validation process.

AMS-II.R. is applicable to energy-efficiency activities involving the installation of new equipment or products or the modification of existing equipment or products that are implemented within residential buildings (single or multiple-family residences). The methodology includes only those activities that are intended to reduce emissions associated with space heating. This includes, for example improving building insulation, enhanced glazing of windows and improved efficiency of heating equipment. The methodology application is furthermore limited to existing buildings where it is possible to directly measure and record the energy use within the project boundary. The methodology requires that the impact of implemented measures in project activities needs to be clearly distinguished from changes in energy use due to other variables not influenced by the project activity. In this way the methodology leaves the major challenge of CDM activities in the building sector with the participants. For the determination of the baseline energy consumption three options are allowed: the use of a “baseline measurement survey”, the use of a “treatment group versus control group study” or the use of “existing data from registered CDM projects”. The second option requires a control group of residences that are assigned not to receive the project efficiency activities. This might however lead to tension between occupants and is therefore seen as problematic in the low income housing segment. Monitoring approaches included in AMS-II.R. allow representative sampling.

Apart from the limitation that the methodology is not applicable to new buildings, it might still have potential, since the proposed approaches seem rather pragmatic and transparent. Since the methodology was approved just recently, the actual applicability needs still to be proven and depends very much on the question of whether the requirements can unambiguously be interpreted during implementation, and whether verifiers and the EB accept the implemented approaches.

This low success rate for the initiation of greenhouse gas emission reduction projects through the CDM in the buildings sector might be caused by various barriers linked to this sector and also linked to the CDM. The CDM's principles, to generate real, measurable, verifiable and additional emission reductions, seem to be partly incompatible with some sector characteristics. The CDM-MRV rules require proof and exact determination of each avoided ton of emissions which is difficult in the buildings sector due to the rather low "signal to noise" ratio. The quantification of the actual interfering effects of e.g. changes in user behaviour or interaction with other measures are often indeterminable. Projects in the building sector also tend to have a high level of complexity due to numerous potential energy carriers and various services combined within the project boundary.

The available methodologies are either too specific or do not provide practicable solutions to address these challenges in a pragmatic way. This results in high transaction costs which come along with rather small emission reduction amounts per project activity. Most of the registered projects are far below 10 000 tCO₂e per annum and have only a limited multiplication potential (for example, through upscaling in PoAs) due to their complexity and the required tailor-made approaches.

Moreover, the full potential of the reduction measures is realised over the full lifetime of buildings which is usually much longer than the CDM crediting periods. In this way the CDM does only insignificantly increase the payback time of investments and building measures remain less attractive compared to alternative investments.

The lessons learned from the application of the CDM in its current form to entire buildings leads to the conclusion that any mechanism that aims to tap these mitigation potentials should have pragmatic MRV approaches, might reward indirect and long term effects and should allow bundling of less homogeneous single activities to facilitate reaching a large coverage in the sector.

No specific insights can be drawn from the EU ETS since direct emissions from buildings are not covered in the scheme. The national emissions budgets for the building sectors in the EU are set by the Effort Sharing Decision and mainly regulated through national policies and measures not related to the carbon markets or other carbon pricing initiatives. Thus the EU ETS cannot serve as source of approaches for a credited mechanism applied to the building sector.

The specific situation of the building sector in South Africa is characterised by a huge demand for low cost buildings to supply the growing population with adequate housing facilities. The government has set itself targets for new buildings and is supporting this segment heavily: Between 1994 and 2011, the government built around three million homes, providing housing to 13 million people. By 2014, the government plans to improve the housing situation for 500 000 further households by upgrading informal settlements²³. There are three different categories of supporting housing in South Africa:

- ▶ Low income housing: Government provides free housing to poorest part of the population
- ▶ Social housing: Government provides subsidised rental to low income persons (below R7 500 per month)
- ▶ Gap housing: Subsidised mortgages

In the low income sector, houses are usually constructed in a standard way, resulting in a large number of similar homes.

23 See: <http://www.info.gov.za/aboutsa/housing.htm>

Some activities in the low income housing sector have already been tested under the CDM. The most noteworthy is the Kuyasa project²⁴, which was already registered in 2005 as a pioneering CDM project, and which was the first CDM project ever in the buildings sector. The project activity aims to improve the thermal performance of existing and future low-income housing units and to improve the lighting and water heating efficiency. These measures also include a better roof insulation as part of the overall project, and the methodology also addresses suppressed demand. The City of Cape Town is the only project participant and the project is additionally registered as Gold Standard due to its manifold co-benefits. The annually expected emission reduction and respective CERs amount to 6 580 tCO₂e, although no actual issuance took place yet.

The initiatives evolving from Kuyasa project are now followed up by the Sustainable Settlements Facility which is operated by South South North (cf. section 2.3.2). Initially scaling up was envisaged via extension from CDM project level to a CDM PoA approach. However, due to the various barriers and current changes in carbon markets, a development under the NAMA framework (respectively “flagship”) is currently considered as an option. This is not yet finally defined and might also be a starting point for activities under a bilateral mechanism.

Beside the above mentioned barriers for CDM projects, further specific challenges occurred. Carbon credits in South Africa are treated as assets and specific procurement rules prohibit municipalities selling assets within a minimum period of three years. Furthermore, especially in the beginning of the project, quality of the technologies available was rather low with limited replacement and repair options. According to local experts this situation has however improved since local manufacturers have picked up production of ceiling insulation and solar thermal water heaters.

Various further CDM and/or PoA based activities in the buildings sector in South Africa exist. These projects however focus mainly on single activities related to buildings (e.g. efficient lighting or the use of solar thermal water heaters) but do not cover the whole building.

(1) Definition of the system boundary

The building sector is characterised by the use of different energy carriers causing direct and indirect emissions while the amount of indirect emissions can represent the largest share under specific circumstances. The challenge is to find an approach limited in complexity but still widely accepted and covering all relevant emissions and mitigation opportunities. The list below contains a description of emission sources in residential buildings which might be considered for the development of a benchmark.

Direct emissions:

- ▶ Fossil fuel consumption
- ▶ Leakage of refrigerant

Indirect emissions:

- ▶ Electricity consumption of electric appliances
- ▶ Heat consumption from district heating
- ▶ Emissions from deforestation due to use of fuel wood
- ▶ Emissions from production of building materials and appliances

Figure 15 illustrates the relationship of direct and indirect energy related emissions. The main source for direct emissions is usually the fuel consumption within buildings and indirect emissions are mainly generated through the use of electricity. In low income housing segments this can however differ significantly from average values also having a regional variation.

²⁴ See: <http://cdm.unfccc.int/Projects/DB/DNV-CUK1121165382.34/view>

Depending on the services provided to this segment and dependent on the financial capabilities of households the share of consumed fossil fuel and electricity might be small despite the existence of a theoretic larger demand, which is considered in the CDM under the concept of “suppressed demand”. Also alternative fuels such as fuel wood, harvested in an unsustainable way, might have an increased share if locally available.

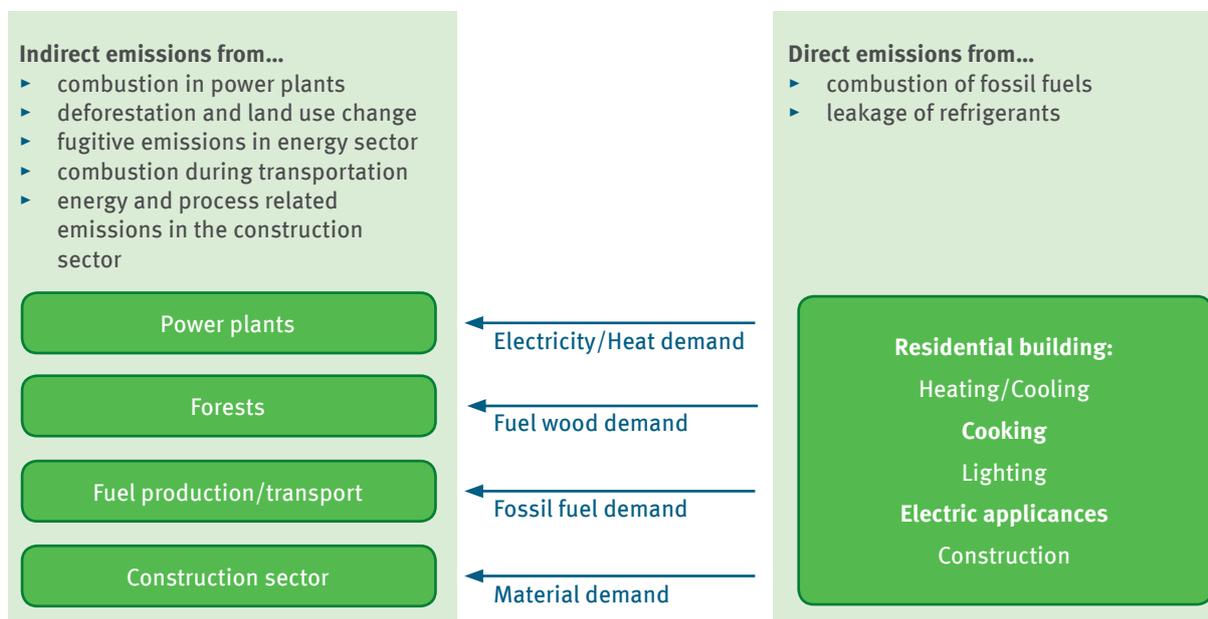


Figure 15: Simplified overview on energy related emission sources of the building sector

Opportunities for improvements leading to emission reductions exist in the areas of low energy building envelopes, energy efficient appliances and renewable energy supply. All can effect direct fuel consumption as well as indirect emissions. For example the insulation of the building envelope reduces the need for heating and cooling. Depending on how this need is served, either electricity consumption and thus indirect emissions or fuel combustion and thus direct emissions are reduced.

According to the modalities and procedures of the CDM, the definition of the system boundary for CDM projects shall include all emissions which are significant and reasonably attributable to the CDM project activity (UNFCCC 2006). The term significant is, however, not further defined. Individual methodologies contain information on project boundaries and often include a table which indicates emission sources to be included and emissions occurring outside the project boundary but measurable and attributable to the CDM project. The boundaries in most building related methodologies are defined as the physical, geographical site of the buildings. Methodologies that also allow the replacement of appliances in buildings require from project participants to address how double counting with potential activities that focus on the distribution of efficient appliances. Avoided grid transmission losses are attributed to the project despite occurring outside the boundary.

To cover all relevant emission sources, we suggest including emissions related to all energy fed into the building. This approach excludes the leakage of refrigerants as well as emissions from production of other appliances or the building materials. We believe that these factors need to be addressed in the corresponding industrial sectors. Suitable environmental standards should however be considered during procurement processes of for example appliances or building materials to maintain the environmental reputation of the overall mitigation activity. Refrigerants can be ignored for approaches in the low income segment due to the absence of cooling services but needs to be reconsidered if this concept is translated to other segments in the building sector.

For the emission reductions achieved by electricity savings, we suggest to use one of the approaches to develop an electricity emissions benchmark as described for the electricity sector in section 3.3.1, and to consider the allocation of reduced transmission losses to the activity analogue to the methodologies AMS-II.Q. or AMS-III.AE.. Furthermore, we recommend at least for the starting phase of a bilaterally agreed mechanism to exclude individual determination of emissions from the production of fuels, as data collection will be highly complex and different to the approaches necessary for the remaining building sector. Such up-stream emissions should rather be included in the emission factors of the corresponding fuels. Alternatively the major upstream emission sources could be addressed by default emission factors for specific activities provided by the IPCC guidelines and applied as in AMS-II.E. Annex 1 for PoAs.

Questionable is, whether the system boundary should include emissions from deforestation related to fuel wood use. In rural areas of developing countries this is an important driver of greenhouse gas emissions. However, this might impose significant additional requirements for MRV while the importance for the low income housing sector might vary.

According to Sykes (2009) “*despite a mass electrification scheme and access to subsidised electricity, South Africa’s urban poor continue to choose to use more affordable dirtier fuels such as biomass, paraffin and coal burnt directly in stoves or imbawulas²⁵. Poor thermal performance of subsidy housing and shack dwellings reinforces decisions to use these fuel types.*” This suggests that alternative non-commercial standard fuels can be an important contribution to baseline emission levels and should be considered for the BAU emission scenarios.

However, these fuels should not be used anymore in the situation with implemented measures in the building sector, leaving this complexity to the ex-ante determination of the benchmark and the BAU scenarios. It should not lead to additional parameters of the (ex-post) MRV of activities.

We assume that low income housing constructions often concentrate in urban or semi-urban regions, where fuel wood contributes with a smaller share to energy supply of the residential sector than in rural areas. Standardised default approaches might be developed (based on short baseline studies for example) to include these emission but avoid a significant increase in complexity. This might be tackled with the development of an additional benchmark.

(2) Identification of the key performance indicator

As a performance indicator for greenhouse gas emissions in buildings, the total greenhouse gas emissions per floor area is the most common, although approaches that further simplify and target greenhouse gas emissions per house or housing unit might be more appropriate in the low income segment (cf. considerations in the following steps).

The unit of the performance indicator based on floor area will be tCO₂e/m² floor area. The numerator specifies the greenhouse gases included in the assessment, whilst the denominator determines the area taken into account. Generally, we distinguish between the living space or the floor space of a building, where the living space is the area where inhabitants move around, and the floor space also includes rooms for storage. As space in houses will be limited in the low income sector, we do not expect much space for storage and other non-functional spaces, thus the difference between the floor space and the living space will be insignificant.

The reference to the floor area means that emissions are coupled to the size of the house. For heating and cooling demand, there is certainly a direct relationship between energy consumption and size. For electric appliances, the connection is less direct and might also or even stronger be linked to the number of residents.

²⁵ “imbawulas” are used for heating in very poor households which consist of a recycled metal container with holes and filled with combustible residues to produce heat.

However, as the pilot sector is the low income housing area, we assume that the appliances are, just as the buildings themselves, standard equipment, and more or less the same in each household.

Against this background it might be more appropriate, or at least worthy of consideration, to deviate from the “greenhouse gases per floor area” indicator. A performance indicator that describes the “greenhouse gases emissions per standardised housing unit” might be sufficiently accurate while the efforts for the monitoring and greenhouse gas quantification of implemented units can be considerably reduced (cf. subsequent steps). If within the low income housing sector different housing sizes exist that deviate from the standardised approach assumed in our considerations, it should be assessed if different benchmark levels will be required for differently designed housings.

(3) Selection of peers for comparison

The building sector is quite diverse, which makes it necessary to limit the assessment to those peers, which actually make comparable sense. We suggest to exclude all not directly related segments of the sector such as middle and high income houses, as their different standard of living causes energy consumption and resulting emissions to differ significantly from the low income segment.

For the initial phase of sectoral activities based on bilateral agreements, we recommend to only consider new buildings as peers for comparison, as the structure of existing houses differs from current construction materials and techniques. Furthermore, we recommend to consider only buildings which offer a similar type and level of service. In the low income sector older buildings might have lower technical standards but still lower emission levels than current reference cases. Older buildings might not provide the services required by its users and such do not deliver on suppressed demand. Not only existing buildings (from the same segment and with similar service levels) might serve as peers for comparison but also programmes that are under development and complying with available laws and regulations. Applicable and enforced building codes with minimum energy efficiency standards could for example provide the basis for the simulation of a default building case that replaces the actual selection of new buildings as peers for comparison (cf. subsequent steps). It might however sometimes be difficult to determine the level of enforcement of building codes without the selection and analysis of real examples.

Another possible issue is the need to differentiate between climate zones. Buildings in very cold or very hot areas usually consume more energy than they would with the same efficiency in moderate areas. The climate in South Africa is relatively moderate, however in higher regions temperatures can differ significantly (cold nights in winter, hot days in summer). Along the coast of the Indian Ocean, the climate is more tropical with higher and more constant temperatures. From this first overview, differences of energy demand due to climatic factors per region might exist. We therefore suggest to consider peers for comparison only from the same climatic region. The National Building Regulation (SANS 10400) distinguishes, for example, between 6 different climatic regions which might be used as basis also in a bilateral agreement approach.

Table 13: Climatic zones of South Africa (Republic of South Africa 2011)

Zone	Description	Major centre
1	Cold interior	Johannesburg, Bloemfontein
2	Temperate interior	Pretoria, Polokwane
3	Hot interior	Makhado, Nelspruit
4	Temperate coastal	Cape Town, Port Elizabeth
5	Sub-tropical coastal	East London, Durban, Richards Bay
6	Arid interior	Upington, Kimberley

(4) Data collection of peers for comparison

There is little data available for emissions or energy consumption in the residential sector in South Africa. The Long-Term Mitigation Scenarios from 2007 use approximate per household energy consumption and number of households to calculate emissions from the residential sector (Energy Research Centre 2007).

The Kuyasa CDM project uses data from results of a combination of a calculation model and measurements in sample houses, to establish a baseline and determine energy consumption reductions implied through the measures (Thorne 2010).

Table 14: Annually avoided CO₂ emissions per household in the Kuyasa CDM project (Reference number: 0079)

Emission source	Annual CO ₂ emissions avoided per household [tCO ₂ /hh/year]
Water heating	1.29
Lighting	0.23
Space heating	1.33
Total	2.85

The implementation of measures is monitored by quarterly sampling of at least 30 (or 1.25%) of the total houses affected by the CDM project activity. The number of installed appliances (efficient light bulbs or solar water heater) as well as the number of insulated roofs are multiplied with an ex-ante defined emission factor in the baseline and project situation and reported for the issuance of CERs. Table 14 depicts the annually avoided CO₂ emissions per household which is basically the difference between project and baseline emissions taking into account reduced grid losses and suppressed demand.

Further insights can be drawn from Sykes (2009) who compared available data on incremental costs of interventions and associated emission reductions for new build and retrofit of low income homes in South Africa. It was found that for new buildings the combined implementation of roof overhangs, insulation (ceilings and walls) and solar water heater lead to savings below 1 tCO₂ per year and household. Only when suppressed demand is fully accounted for, the emission savings per annum and household can reach approximately 10 tCO₂. The incremental costs of this combined intervention are estimated at slightly above €1,600. Sykes (2009) furthermore estimated that in large project set-ups where transaction costs play even a minor role the financing via reduction units would require a price of €50/tCO₂ to provide payback periods that would attract private investment.

Alternatively, minimum standards for low income housing additions could also be taken to build a reference case that is used as peer for comparison purposes.

The National Building Regulation (SANS 10400) for energy usage in buildings describes minimum efficiency of new constructions, also covering residential housing. It fixes, for example, the requirement to meet at least 50% of the annual hot water demand by non-electric sources and sets the minimum thermal resistance (R-values) of different parts of the building envelope (Republic of South Africa 2011). This regulation furthermore gives recommendations on the design of the building, for example its orientation.

SANS 10400 does not fix the specific energy consumption per m² or per person, which would be closely related to the key performance indicator. This value will depend on additional features, which are not covered by the standard and would need to be modelled. To do so for the low-housing segment, a standard house could be calculated as a sample, using the requirements from SANS 10400 for different climatic zones.

In case already existing low income housing additions are built in a standard way, the greenhouse gas emission level and the energy consumption could be measured from some housing units that are selected in a way to build a representative sample. It needs to be taken into account that the implementation of low housing projects is organized on the level of municipalities who might also set standards.

(5) Measurement of own current performance

The measurement of the own current performance could, in contrast to most CDM methodology requirements, rely on an ex-ante agreed performance standard that is reached with the implementation of standardised low income houses under the credited programme. This means that instead of ex-post monitoring of the actual performance (or emission levels), the performance or emission levels of example houses are calculated or measured, and agreed as a reference case which is compared to the baseline case to calculate emission reductions per house. Ex-post MRV then only consists of a count of the number of implemented houses complying with the standards as agreed in the reference case. The emission level of baseline housing units minus the emission level of implemented housing units complying with the agreed more ambitious standards are multiplied with the number of housing units. While only the latter variable is unknown ex-post.

This constitutes a pragmatic approach that has uncertainties but reduces transactions cost and barriers for implementation mainly stemming from greenhouse gas quantification and MRV aspects. This proposal basically follows the method chosen by the Kuyasa CDM project but applies to whole building units rather than specific measures in the buildings. While the Kuyasa CDM project seems to be a good showcase also for efficient approaches embedded in the CDM it might be questioned if this approach would be accepted on the basis of the most recent methodology versions and newly accepted methodologies.

The alternative approach is to monitor, report and verify every single housing unit which results in transition costs that are soon beyond the level of revenues that could be generated from such a credited mechanism. Also, the most accurate greenhouse gas quantification would not solve the overlapping effects of the change in user behaviour (signal to noise). This is not taken into account in the simplified approach but it can be assumed that this effect is levelled out when the number of homes is large and the reference consumption is close to the average.

(6) Definition of the benchmark level (stringency)

While the actual determination of an explicit benchmark level requires various assumptions on the building specifications and considerable modelling work a reasonable proposal for the general concept to develop a benchmark can be drawn from the gathered information during the previous steps. The benchmark concept could include the following steps:

1. Definition of technical specifications of a standard housing unit that will or could be build (supported or) based on bilateral agreements. Technical specifications should inter alia include the building size (e.g. 40 m²), the services provided, the design basics and the climate region.
2. Estimation of the resulting energy use and the total greenhouse gas emission level of the standard housing unit per annum as per the current building stock. This should consider the actual level of enforcement of the building code, different energy carriers and suppressed demand.
3. Simulation or estimation of the energy use and the total greenhouse gas emission level of the same standard housing unit per annum, assuming that the currently available building code is fully implemented (SANS 10400). The resulting emission level is expected to be lower but could also be the same or even slightly higher compared to the result of step 2 depending on the strictness and the level of enforcement of the building code.
4. Simulation or estimation of the energy use and the total greenhouse gas emission level of the same standard housing unit per annum, in the case that a reasonable level of (additional) insulation, renewable energy supply (for hot water supply for example) and more efficient appliances are implemented in the scenario of a bilateral agreement supporting this sector. All measures should be significantly above the building code requirements and business as usual constructions. However, the measures should still be proportional in the national or regional sector context and affordable for a “supported programme” to reach a comprehensive coverage.

The above scenarios could be used for the determination of the own contribution of sectors and host countries and to determine the amount of reduction units that could be allocated to re-finance the measures. The emission level in the situation (2) could be defined as BAU scenario, the emission level in situation (3) as the actual benchmark stringency level (credited baseline) and scenario (4) would describe the remaining emission level which is the objective of the programme and after implementation the actual monitored emission level. These three emission levels are schematically indicated in Figure 16.

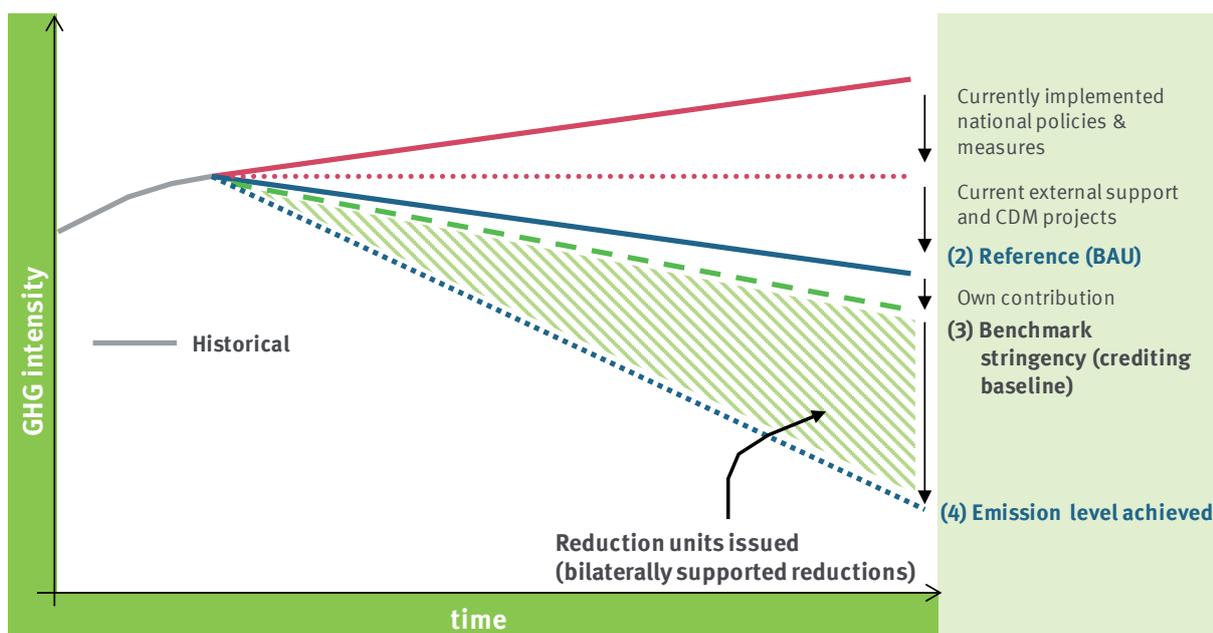


Figure 16: Schematic representation of different emission levels for the determination of the benchmark stringency

The difference between (2) and (3) constitutes the “own contribution” of the sector or the host country to deviate from the BAU emission levels while the difference between (3) and (4) would be the greenhouse gas emission reductions for which the financing is received via potentially issued and purchased credits by the financing country in a bilateral agreement. Depending on the own capabilities and the required level of support the own contribution might be reduced to a minimum to allow maximising the bilaterally supported reductions. This might especially be required in the building sector given the information provided in the previous steps and is already considered for the above described benchmark stringency setting approach. Defining the benchmark stringency at the level of the full implementation of the building codes already assumes an own contribution due to incomplete building code implementation in the BAU scenario.

Incomplete building code implementation is a realistic assumption. According to Sykes (2009) lack of knowledge, lack of competence of building inspectors and problems with corruption are the main barriers that prevent the full implementation of building codes and standards in South Africa’s low income building sector. Moreover, the interviewed sector experts confirmed that the government specifically agreed to exclude the low income housing sector from the building code enforcement due to too high implementation costs in this segments. Additionally local experts reported that also disincentives exist to actually achieve efficient building units. Municipalities are often responsible for the low income housing additions and at the same time own shares of the local electricity supplier. Low income housing units purchase their electricity from the local suppliers while by law often the first 50 kWh/month are for free for poor households. The electricity supplier and indirectly the municipality might therefore have an interest that the electricity consumption is not too low for these housing units.

Going beyond the BAU scenario in the building sector immediately ensures environmental integrity and justifies a supported approach. According to our considerations in section 3.3.1 this seems however not sufficient for all sectors. The dashed area in Figure 16 should be, for example for measures in the electricity sector in Chile, considerably smaller and the share of own contribution respectively larger.

3.4 Concluding remarks on benchmark concept development opportunities

The development of benchmark based concepts for a bilateral mechanism has shown that the two selected sectors are most different with regards to their opportunities and challenges. Table 15 briefly summarises these different characteristics.

Table 15: Comparison of market mechanism related sector characteristics

	Power generation sector	Building sector
Data availability	Good, no confidentiality issue, grid emission factor calculations	Difficult
Success in the CDM	well represented; several methodologies, high share of projects, first SBL	Limited, low penetration rate, mostly single measures in buildings
Barriers in the CDM	Large differences in regional baseline and respective incentive level	MRV, boundary setting, high transaction costs, high “signal to noise ratio”
Size of average projects in terms of emission reductions	Small to very large	Small, up-scaling desired but difficult
Benchmarks in the EU ETS	None, no free allocation	None, not covered by the EU ETS

For the benchmark concept development in the power generation sector the CDM appears to be a valuable framework which could be applied to a large extent if agreed from all participating countries. The CDM has addressed most of the identified sector challenges with its respective methodological tools and describes solutions that constitute a consensus for many stakeholders.

Our suggested proposals follow the CDM approach to the extent possible but also require a few important modifications that increase pragmatism, ambition and suitability for sector coverage.

For the building sector we found a completely different picture. The CDM showed a low performance in the past and does not provide ideal solutions for a sector based approach. The existing barriers will persist as long as most accurate greenhouse gas quantification is the main objective. However, we suggest pragmatic approaches that allow projects with at least sub-sector wide coverage. An increased uncertainty emerging from required simplifications can in this approach be levelled out by ambitious definition of benchmarks to ensure a high level of environmental integrity.

The pragmatic approaches suggested in setting benchmarks are possible since in the framework of a bilateral agreement the methodological choices are finally a decision between the two collaborating Parties. However, scientifically justified choices are required to ensure a high environmental integrity of the achieved reductions and to safeguard the agreement against criticism. This can be ensured by the above presented approaches which ensure that every single activity covered under the agreement gets rewarded with credits only below the actual baseline emission situation. Even if doubts in specific cases might emerge it is obvious that the benchmark or respective credited baseline is chosen in a conservative way ensuring that the overall agreement on a sector level leads to significant net greenhouse gas emission reductions.

Accuracy of greenhouse gas quantification in such a pragmatic approach is not possible to the same extent as it is provided by the CDM. However, the actual rewarded reduction (difference between agreed sector wide credited benchmark and actual remaining emissions level) is real and quantifiable. The amount of achieved but not rewarded greenhouse gas reduction, the so called “own contribution” (net emission reduction), in the sector or host country remains subject to uncertainty and can be estimated rather on the level of the sector than exactly quantified on the level of single project activities.

This potential disadvantage is, however, balanced against the advantage that the transaction costs are minimised and thus the funds provided based on a bilateral agreement are to a large extent invested in actual greenhouse gas reduction rather than in the mechanism itself. It could also be questioned if a more accurate greenhouse gas quantification for the “own contribution” share in a sectoral approach is required at all. Since this share is not used for offsetting or crediting the final recognition will occur via changes in the Parties’ inventory compared to the BAU inventory projection. Inventories are affected with rather large uncertainties and a high signal to noise ratio. Also in the case that climate financing funds are used, the estimate of the own contribution or net reduction is even more accurate compared to the majority of current NAMA proposals, although double counting of efforts and financing needs to be addressed and avoided.

In comparison to the CDM and under the assumption that the bilateral agreement on a sector level is purely planned as a crediting/offsetting mechanism, this framework proposal follows a conservative approach in allocating emission reductions to projects but might still be attractive to the private sector. Rather than to the final amount of achievable emission reductions, project developers might give more importance to benefits from planning security, low transaction costs and a secure demand which would at least for piloting projects be guaranteed. In this approach the private sector will also be released from the burden to prove on their own that activities have a high environmental integrity. This is ensured on the level of Parties by determining an ambitious sector wide benchmark. The success and acceptance in the private sector might be in the end determined based on actual prices paid for the generated credits.

The actual feasibility of activities under a bilateral agreement is finally defined by the prices that are paid for achieved emission reductions or respectively issued reduction units. This price should be high enough to provide the additional financing that is required to initiate greenhouse gas reduction activities compared to BAU activities. Prices under the umbrella of bilateral agreements can furthermore be negotiated between Parties as long as no connection to the further markets is established. Prices might also be further distinguished according to the needs of different technologies. For the determination of most efficient price signals and the required support level “reversed auctioning” might be the preferred option while other opportunities exist to most effectively spend the available funds to support project activities (Warnecke et al. 2013). As soon as market demand is re-established and the mechanism leaves its pilot status, a reconnection to markets should be considered and would thus ensure that price determination and financing is realised through the markets again.

In case of the building sector it is however questionable if market prices will ever reach the required levels to attract private financing and tap the significant mitigation potential in this sector on the larger scale. Even if transaction costs and “own contributions” are reduced to the absolute minimum the resulting amount of reduction units will probably not be sufficient to generate the required financial incentives. Price calculation from Sykes (2009) show that even in these cases prices far above current and past market price levels would be required. Additionally, project developers from India (which has the largest share of registered projects in the building sector under the CDM) reported that building sector projects are registered under the CDM mainly for marketing and reputational reasons and that an attractive co-financing was never expected even in price scenarios with a balanced demand and supply. Against this background it might be considered to develop away from market-based approaches and consider non-market mechanism such as “Result-based Financing” or NAMAs. Both mechanisms could use the above proposed approaches simultaneously while the required financial support levels could be allocated in a more tailor-made fashion to the specific needs in the covered segments.

6 References

Bloomberg New Energy Finance, 2011. Chile levelised cost of energy - Presented to NRDC. http://docs.nrdc.org/energy/files/ene_11052401a.pdf (22 April, 2013).

BMU, 2005. Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: Absprache über die Zusammenarbeit bei Projektmaßnahmen im Rahmen des Mechanismus für umweltverträgliche Entwicklung und in klimapolitischen Fragen. http://www.jiko-bmu.de/files/service/rechtstexte_grundsatzbeschluesse/mou/application/pdf/mou_deutsch_mexiko.pdf (28 November, 2012).

Bolscher, H., van der Laan, J., Slingerland, S., Sijm, J., Bakker, S., Mikunda, T., Wehnert, T., Sterk, W., Hoogzaad, J., Wemaere, M., Conway, D., 2012. Design options for sectoral carbon market mechanisms. http://ec.europa.eu/clima/policies/ets/linking/docs/study_20120831_en.pdf (4 December, 2012).

CDEC-SIC, 2012. Estadísticas de Operación (2002 - 2011). Year Book of the Load Economic Dispatch Center. <https://www.cdec-sic.cl/datos/anuario2012.pdf>.

CDM Policy Dialogue, 2012. Mapping of Criteria set by DNAs to Assess Sustainable Development Benefits of CDM Projects. Contribution to the Research Programme of the CDM Policy Dialogue. http://www.cdmpolicydialogue.org/research/1030_mapping.pdf (27 November, 2012).

CER, Ecofys, Fundación Chile, 2013. NAMA Proposal: Self-supply renewable energy (SSRE) in Chile. Working draft. http://www.nama-database.org/images/b/b4/SSRE_NAMA_Chile_-_Working_draft.pdf (23 October, 2013).

Comision Nacional de Energía, 2013. Electricity statistics. <http://www.cne.cl/estadisticas/energia/electricidad> (25 March, 2013).

DEA, 2011. South Africa's Second National Communication under the United Nations Framework Convention on Climate Change. Department of Environmental Affairs. <http://unfccc.int/resource/docs/natc/zafnc02.pdf> (4 December, 2012).

DNA Mexico, 2012. DNA website. http://www.cambioclimatico.gob.mx/index.php?option=com_content&view=article&id=70&lang=en (28 November, 2012).

DNA South Africa, 2004. Sustainable Development Criteria for approval of Clean Development Mechanism projects by the Designated National Authority of the CDM. <http://www.energy.gov.za/files/esources/kyoto/Web%20info/Annex%203%20SA%20Sustainable%20Development%20Criteria.pdf> (28 November, 2012).

Ecofys, 2008. Benchmarking as an option for standardisation under the CDM. in: UK DEFRA (Ed.), A review of the current state and options for reform of CDM, (unpublished), pp. 146–212.

Ecofys, 2013. NAMA database. <http://www.nama-database.org/> (31 January, 2013).

Energy Research Centre, 2007. Long Term Mitigation Scenarios: Technical Appendix. http://www.erc.uct.ac.za/Research/publications/07ERC-LTMSTechnical_Appendix.pdf (23 April, 2013).

European Commission, 2011. Emission Database for Global Atmospheric Research (EDGAR). release version 4.2. European Commission Joint Research Centre (JRC) and PBL Netherlands Environmental Assessment Agency. <http://edgar.jrc.ec.europa.eu/overview.php?v=intro&sort=des8> (24 September, 2012).

European Commission, 2012. Submission by Denmark and the European Commission on behalf of the European Union and its Member States. Submission on the views of modalities and procedures for a new market-based mechanism. http://unfccc.int/files/bodies/awg-lca/application/pdf/new_market_based_mechanism.pdf.

European Parliament, 2009. Consolidated version of Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community. 2003/87/EC. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2003L0087:20090625:EN:PDF>.

Federal Government of Mexico, 2012. Gaceta Parlamentaria, año XV, número 3489-IV, jueves 12 de abril de 2012. Ley General de Cambio Climático. <http://gaceta.diputados.gob.mx/Gaceta/61/2012/abr/20120412-IV.html>.

German Federal Foreign Office, 2012. Country information. http://www.auswaertiges-amt.de/DE/Laenderinformationen/SicherheitshinweiseA-Z-Laenderauswahlseite_node.html (28 November, 2012).

Gouvello, C. de, Dayo, F.B., Thioye, M., 2008. Low-carbon Energy Projects for Development in Sub-Saharan Africa. Unveiling the Potential, Addressing the Barriers. <http://siteresources.worldbank.org/INTCARFINASS/Resources/MainReportLowCarbonEnergyprojectsforDevelopmentofSubSaharanAfrica8.18.08.pdf> (13 December, 2012).

Government of Chile, 2008. Introduce modificaciones a la ley general de servicios electricos respecto de la generacion de energia electrica con fuentes de energias renovables y no convencionales. <http://www.leychile.cl/Navegar?idNorma=270212> (4 December, 2012).

Government of Chile, 2011. 2nd National Communication of Chile. <http://unfccc.int/resource/docs/natc/chinc2e.pdf>.

Government of South Africa, 1994. A New Housing Policy and Strategy for South Africa. <http://www.info.gov.za/whitepapers/1994/housing.htm#4.2> (17 December, 2012).

Government of South Africa, 2004. Breaking new ground. A comprehensive plan for the development of sustainable human settlements. <http://abahlali.org/files/Breaking%20new%20ground%20NewHousingPlanCabinetapprovedversion.pdf> (17 December, 2012).

Government of South Africa, 2011. National Climate Change Response White Paper. http://rava.qsens.net/themes/theme_emissions/111012nccr-whitepaper.pdf (5 December, 2012).

Government of South Africa, 2012. South Africa Government Information. <http://www.info.gov.za/aboutsa/index.htm> (5 December, 2012).

Government of South Africa, Department of Human Settlements, 2010. Delivery agreement for outcome 8: Sustainable human settlements and improved quality of household life. <http://www.info.gov.za/view/DownloadFileAction?id=135746> (17 December, 2012).

Hagemann, M., Moltmann, S., Escalante, D., Masidi, M., Höhne, N., Busch, P., 2011. Factors underpinning future action. Country factsheets, 2011 update. http://www.ecofys.com/files/files/ecofys_2011_country_factsheets_update.pdf (8 November, 2012).

Herrera, M.J., Lopez, J., 2009. Chile - Food processing sector. http://gain.fas.usda.gov/Recent%20GAIN%20Publications/FOOD%20PROCESSING%20SECTOR_Santiago_Chile_11-17-2009.pdf (12 December, 2012).

Höhne, N., Braun, N., Fekete, H., Brandsma, R., Larkin, J., den Elzen, M.G.J., Roelfsema, M., Hof, A., Böttcher, H., 2012. Greenhouse gas emission reduction proposals and national climate policies of major economies. Policy brief. <http://www.pbl.nl/sites/default/files/cms/publicaties/PBL-2012-Greenhouse-gas-emission-reduction-proposals-and-national-climate-policies-of-major-economies.pdf> (28 November, 2012).

ICI, 2012. International Climate Initiative (ICI) - Projects in Mexico. <http://www.bmu-klimaschutzinitiative.de/en/projects?region=Central+and+South+America%3A%3AMexico&subject=subject&keywords=enter+keyword&filter=enter+search> (28 November, 2012).

IEA, 2010. Energy Statistics and Balances. Beyond 20/20 v4.1 Browser, Washington DC.

IEA, 2012a. CO₂ Emissions from Fuel combustion.

IEA, 2012b. Energy Statistics and Balances. Beyond 20/20 v4.1 Browser.

IEA, 2012c. Oil & Gas Security, Emergency Response of IEA Countries. Chile. http://www.iea.org/publications/freepublications/publication/Chile_2012.pdf (25 March, 2013).

IGES, 2013. CDM Publications - Grid Emission Factors data. (Updated 1 April 2013).

Instituto Nacional de Estadísticas, C., 2011. Generación y Distribución Eléctrica (=Generation and Distribution of Electricity). http://www.ine.cl/canales/chile_estadistico/estadisticas_economicas/energia/series_estadisticas/informacion_2010.php (18 March, 2013).

Ministry of Energy Chile, 2013. Partnership for market readiness (PMR) - Market Readiness Proposal for Chile. http://www.thepmr.org/system/files/documents/Chile_MRP_Final_20-02-2013.pdf (26 March, 2013).

Neelis, M., Worrel, I.E., Angeline, T., Mueller, N., Cremer, C., Schleich, J., 2008. Developing benchmarking criteria for CO₂ emissions. http://ec.europa.eu/clima/policies/ets/cap/allocation/docs/benchm_co2emiss_en.pdf.

OECD, 2012. The DAC List of ODA Recipients. Factsheet - January 2012. <http://www.oecd.org/dac/aidstatistics/49483614.pdf> (30 October, 2012).

O’Ryan, R., Díaz, M., Clerc, J., 2010. Energy Consumption, Greenhouse Gas Emissions and Mitigation - Options for Chile, 2007-2030. <http://www.energycommunity.org/documents/Aplicacion%20de%20LEAP%20en%20Chile.%202010.pdf>.

PMR, 2012a. Template for Organizing Framework for Scoping of PMR activities. Country: South Africa. <http://www.thepmr.org/country/south-africa-0> (28 November, 2012).

PMR, 2012b. Template for Organizing Framework for Scoping of PMR activities. Country: Chile. <http://www.thepmr.org/country/chile-0> (28 November, 2012).

Poch Ambiental, 2010. Análisis de opciones futuras de mitigación de gases de efecto invernadero para Chile en el sector energía. http://www.sinia.cl/1292/articles-50188_recurso_6.pdf (13 December, 2012).

Point Carbon, 2012. Chile backtracks on carbon market plans. (25 Apr 2012).

REN 21, 2012. Renewables 2012. Global Status Report. <http://www.map.ren21.net/GSR/GSR2012.pdf> (26 July, 2012).

Republic of South Africa, 2011. The application of the National Building Regulations Part X: Environmental sustainability Part XA: Energy usage in buildings. SANS 10400-XA (2011). <https://law.resource.org/pub/za/ibr/za.sans.10400.xa.2011.pdf>.

Sanhueza, E., 2011. MAPS Case study: Chile. http://www.mapsprogramme.org/wp-content/uploads/Mitigation-Action-Country-Study_Chile_English1.pdf (13 December, 2012).

Schneider, L., Broekhoff, D., Juerg Fuessler, Michael Lazarus, Axel Michaelowa, 2012. Standardized Baselines for the CDM – Are We on the Right Track? Policy paper. <http://www.sei-international.org/mediamanager/documents/Publications/Climate/Policy-paper-2012-Standardized-baselines-CDM.pdf> (1 March, 2013).

Shishlov, I., Bellassen, V., 2012. 10 Lessons from 10 Years of the CDM. http://www.cdclimat.com/IMG/pdf/12-10-05_climate_report_37_-_10_lessons_from_10_years_of_cdm.pdf (19 November, 2012).

South African Petroleum Industry Association, 2012. Industry Overview - South African Fuel Industry. <http://www.sapia.co.za/industry-overview/fuel-industry.html>.

Sykes, J., 2009. Energy Efficiency in the Low Income Homes of South Africa. http://www.eprg.group.cam.ac.uk/wp-content/uploads/2009/09/isda_south-africa-low-income-housing-study_september-2009-report.pdf.

Tänzler, D., Kachi, A., Sterk, W., 2013. Reform efforts for the international carbon market: CDM, bilateral offsets and beyond. Workshop Documentation (Bonn, 5 June 2013).

Thorne, S., 2010. National Sustainable Settlements Facility - opportunities to finance domestic energy service improvements through climate change mechanisms and Energy Efficiency and Demand Side Management (EEDSM) instruments. Human Settlements Review, Volume 1, 217–235.

UNFCCC, 2006. Modalities and procedures for a clean development mechanism. Annex to Decision 3/ CMP.1. <http://unfccc.int/resource/docs/2005/cmp1/eng/08a01.pdf#page=7> (20 April, 2012).

UNFCCC, 2011a. Report of the Conference of the Parties on its sixteenth session, held in Cancun from 29 November to 10 December 2010. Part Two: Action taken by the Conference of the Parties at its sixteenth session. FCCC/CP/2010/7/Add.1. <http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf>.

UNFCCC, 2011b. Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its sixth session, held in Cancun from 29 November to 10 December 2010. Part Two: Action taken by the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol at its sixth session. FCCC/KP/CMP/2010/12/Add.2. <http://unfccc.int/resource/docs/2010/cmp6/eng/12a02.pdf> (14 May, 2012).

UNFCCC, 2011c. Submission by India, Brazil, China, South Africa, Argentina, Venezuela, Bolivia (Plurinational State of), Uruguay, Egypt, Thailand, Saudi Arabia, Ecuador, Nicaragua and Philippines on the general framework for cooperative sectoral approaches and sector specific actions in order to enhance the implementation of Article 4, paragraph 1(c), of the Convention. FCCC/AWGLCA/2011/CRP.22. http://unfccc.int/documentation/documents/advanced_search/items/6911.php?preref=600006528.

- UNFCCC, 2012a. CDM Methodology Booklet. Fourth edition: November 2012. <https://cdm.unfccc.int/methodologies/documentation/index.html> (24 May, 2013).
- UNFCCC, 2012b. CDM project search. <http://cdm.unfccc.int/Projects/projsearch.html> (28 November, 2012).
- UNFCCC, 2012c. Greenhouse Gas Inventory Data. Detailed data by party. <http://unfccc.int/di/DetailedByParty/Event.do;jsessionid=43AADAC601D8A73F6CBE5A84CAB79561.diprod01?event=go> (23 July, 2012).
- UNFCCC, 2012d. Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to 11 December 2011. Part Two: Action taken by the Conference of the Parties at its seventeenth session. FCCC/CP/2011/9/Add.1. <http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf>.
- UNFCCC, 2012e. Views on the new market-based mechanism; Submissions from Parties; Addendum. Paper no. 2: Costa Rica on behalf of Costa Rica, Dominican Republic, Mexico, Panama and Peru. <http://unfccc.int/resource/docs/2012/awglca15/eng/misc06a01.pdf>.
- UNFCCC, 2013. Methodological tool: Tool to calculate the emission factor for an electricity system. Version 04.0; EB 75. <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf> (4 October, 2013).
- Warnecke, C., 2014. Can CDM monitoring requirements be reduced while maintaining environmental integrity? Climate Policy, 1-24. <http://www.tandfonline.com/doi/abs/10.1080/14693062.2014.875285>.
- Warnecke, C., Klein, N., Perroy, L., Tippmann, R., 2013. CDM Market Support Study. <http://www.ecofys.com/files/files/kfw-ecofys-2013-cdm-market-support-study.pdf>.
- Warnecke, C., Wartmann, S., Höhne, N., Blok, K., 2014. Beyond pure offsetting: Assessing options to generate Net-Mitigation-Effects in carbon market mechanisms. Energy Policy, 68, 413-422. <http://dx.doi.org/10.1016/j.enpol.2014.01.032>.
- Winkler, H., 2007. Long Term Mitigation Scenarios: Technical Report. <http://www.erc.uct.ac.za/Research/publications/07-Winkler-LTMS-Technical%20Report.pdf> (5 December, 2012).
- Winkler, H., van Es, D., 2007. Energy efficiency and the CDM in South Africa: constraints and opportunities. Journal of Energy in Southern Africa, 18, 29–38. <http://www.erc.uct.ac.za/jesa/volume18/18-1jesa-winkler.pdf> (17 December, 2012).
- Woodhouse, S., 2011. Renewable Energy Potential of Chile. <http://www.geni.org/globalenergy/research/renewable-energy-potential-of-chile/Chile%202020%20Report%20II%20PBM%20final.pdf> (4 December, 2012).

Annex 1: Overview of criteria and sources for selection process

Table 16: Overview of criteria and sources

Name of indicator	Indicator of exclusion?	Source	Direct link
Total emissions 2008, MtCO _{2e}	Yes	EDGAR 4.2 Factors Underpinning Future Actions Factsheets	http://edgar.jrc.ec.europa.eu/overview.php?v=GhGts_pc1990-2010 http://www.ecofys.com/files/files/ecofys_2011_country_factsheets_update.pdf
Regional importance	Yes	Expert judgment	-
Number of registered CDM projects (and JI, voluntary)	No	UNFCCC, Gold Standard, VCS	http://cdm.unfccc.int/Statistics/Public/CDMinsights/index.html http://ji.unfccc.int/II_Projects/ProjectInfo.html http://www.cdmgoldstandard.org/our-activities/project-registry https://vcsprojectdatabase2.apx.com/myModule/Interactive.asp?Tab=Projects&a=1&t=1 (all checked on 16 November 2012)
Number of NAMA projects	No	Ecofys NAMA Database	www.nama-database.org (checked on 31 January 2013)
Activity under PMR	No	World Bank PMR, IETA	http://www.thepmr.org/content/participants , (checked on 16 November 2012) http://www.ieta.org/assets/Reports/Ieta%20greenhouse%20gas%20market%202012.pdf
Number of submitted National Communications	No	UNFCCC	http://unfccc.int/national_reports/non-annex_i_natcom/items/2979.php (checked on 16 November 2012)
Number of GEF funded projects related to MRV	No	GEF	http://www.thegef.org/gef/gef_projects_funding , (checked on 16 November 2012)
Active in MRV partnership	No	MRV partnership	http://www.mitigationpartnership.net/partners-0 , (checked on 16 November 2012)
Number of submitted greenhouse gas inventories	No	UNFCCC	http://unfccc.int/ghg_data/ghg_data_unfccc/ghg_profiles/items/4626.php
Emission reduction pledge	No	Climate Action Tracker, Ecofys; Climate Analytics; PIK	www.climateactiontracker.org (checked on 16 November 2012)
Renewable energy target in place	No	REN21	http://www.map.ren21.net/GSR/GSR2012.pdf (checked on 16 November 2012)

Name of indicator	Indicator of exclusion?	Source	Direct link
Energy efficiency target in place	No	WEC (World Energy Council)	http://www.wec-policies.enerdata.eu/ (checked on 16 November 2012)
Number of LEDS projects	No	LEDS	http://ledsgp.org/activities (checked on 28 November 2012)
Membership in networks relevant for climate change mitigation	No	LEDS Global Partnership, MAPS, CCAP, CCAP	http://ledsgp.org/home http://www.mapsprogramme.org/ https://sites.google.com/site/mappartnerresearch/ http://www.ccap.org/index.php?component=programs&id=43 (all checked on 16 November 2012)

German Emissions Trading Authority (DEHSt) at the Federal Environment Agency
Bismarckplatz 1
D-14193 Berlin

www.dehst.de/EN | emissionstrading@dehst.de