CLIMATE CHANGE
10/2015

Final Report of the Project „Using Standardized Baselines (CDM) for Achieving Climate Policy Goals in Developing Countries (Suppressed Demand)"

For our Environment

Umwelt Bundesamt

CLIMATE CHANGE 10/2015

Environmental Research of the
Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety

Project No. (FKZ) 3713 41 502
Report No. (UBA-FB) 002130/E

Final Report of the Project „Using Standardized Baselines (CDM) for Achieving Climate Policy Goals in Developing Countries (Suppressed Demand)"

by

Christof Arens, Lukas Hermwille
Wuppertal Institute for Climate, Environment, and Energy, Wuppertal

Martin Burian
GFA Consulting Group, Hamburg

On behalf of the Federal Environment Agency (Germany)

Imprint

Publisher:
Umweltbundesamt
Wörlitzer Platz 1
06844 Dessau-Roßlau
Tel: +49 340-2103-0
Fax: +49 340-2103-2285
info@umweltbundesamt.de
Internet: www.umweltbundesamt.de

/umweltbundesamt.de
/umweltbundesamt

Study performed by:
Wuppertal Institute for Climate, Environment and Energy
Doeppersberg 19, 42103 Wuppertal

Study completed in:
2014

Edited by:
Section E 1.6 Emissions Reduction Projects – Designated National Authority (CDM) / Designated Focal Point (JI)
Verena Seemann

Publication as pdf:
http://www.umweltbundesamt.de/publikationen/final-report-of-the-project-using-standardized

ISSN 1862-4804

Dessau-Roßlau, June 2015

The Project underlying this report was supported with funding from the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear safety under project number FKZ 3713 41 502. The responsibility for the content of this publication lies with the author(s).

Kurzbeschreibung

Standardised Baselines (SB) im Rahmen des Clean Development Mechanism (CDM) sollen die Partizipationsmöglichkeiten von Ländern mit niedrigem Entwicklungsstand und anderen unterrepräsentierten Ländern verbessern, indem der Aufwand für die Erstellung von Referenzszenarien und Zusätzlichkeitsprüfung von den einzelnen Projekten auf die sektorale Ebene verlagert wird.

Im Rahmen dieses Forschungsvorhabens wurden zwei unterschiedliche Ansätze verfolgt, um Erfahrungen mit der Entwicklung von SBs zu sammeln und zur Verbesserung des SB-Regelwerks beizutragen. Es wurde eine SB für ländliche Elektrifizierung in Äthiopien entwickelt, mit den äthiopischen Behörden abgestimmt und beim UNFCCC Sekretariat eingereicht. Das Besondere an dieser SB ist, dass sie erstmals das Konzept von '*supressed demand'*, also auf Grund von mangelnder wirtschaftlicher Entwicklung unterdrückter Nachfrage, einbezieht.

Im zweiten Teil des Forschungsvorhabens wurde eine Studie angefertigt, die untersucht, wie sich SBs für komplexe integrierte Produktionsprozesse erstellen lassen. Diese Frage wird am Beispiel des indonesischen Zementsektors bearbeitet. Das SB-Rahmenwerk gibt keine expliziten Anweisungen, wie komplexe Produktionsprozesse methodisch adäquat erfasst werden können. Das Projektteam entwickelte hierzu drei Szenarien, die sich hinsichtlich des Detailgrads unterscheiden, in dem Teilprozesse der Produktion einzeln erfasst und bewertet werden.

Abstract

Standardised Baselines (SBs) shall improve the opportunities for least developed countries and other underrepresented regions to participate in the Clean Development Mechanism (CDM). SBs allow for shifting the effort of developing baseline scenarios and additionality testing from the individual project to the sectoral level.

This research project followed two separate approaches in order to gather experiences with the development of SBs and to contribute to the advancement of the SB regulatory framework. Under the first approach, an SB for rural electrification in Ethiopia was developed in cooperation with the Ethiopian Designated National Authority, which submitted the SB to the UNFCCC Secretariat. This SB for the first time incorporates the concept of 'supressed demand', i.e. demand that does not exist due to a lack of economic development.

In the second part of the project, a scoping study assesses how SBs can be developed to cover complex integrated production processes. The Indonesian cement sector was chosen as case for this study. To date, the SB framework does not provide explicit guidance on how to methodologically unpack complex production processes adequately. Three scenarios were developed that differ in the level of detail to which sub-processes of the production are considered for individual benchmarks on the basis of which a combined benchmark emission factor is calculated.

Table of Contents

List of Abbreviations

ASB	Approved Standardized Baseline
AMS	Approved Small Scale Methodology
BAU	Business as Usual
CER	Certified Emission Reductions
CDM	Clean Development Mechanism
CiDev	Carbon Finance Initiative for Development
CME	CDM Programme Managing Entity
CMP	Conference of the Parties serving as The meeting of the Parties to the Kyoto Protocol
CRGE	Climate Resilient Green Economy facility
DBE	Development Bank of Ethiopia
DEHSt	German Emission Trading Authority
DNA	Designated National Authority
DTU	Technical University Denmark
EB	Executive Board
EFs	Emission Factors
EPA	Environmental Protection Agency
EEPCo	Ethiopian Electric Power Corporation
GJ	Gigajoule
kWh	Kilowatt hour
LDCs	Least Developed Countries
MJ	Megajoule
MSL	Minimum Service Level
MRV	Measuring, Reporting and Verification
MoEF	Ministy of Environment and Forestry
MoWE	Ministry of Water and Energy
NAMAs	Nationally Appropriate Mitigation Actions
NCVs	Net Calorific Values
NMM	New Market Mechanism
PoA	Programmes of Activities
PSB	Proposed Standardized Baseline
QA/QC	Quality Assurance / Quality Control
RES	Rural Electrification Secretariat
SB	Standardized Baselines
UBA	Umweltbundesamt – German Federal Environmental Agency

UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank

Zusammenfassung

Die ungleiche Verteilung der CDM Projekte über die sog. Gastländer war einer der ausschlaggebenden Gründe für die Vertragsstaatenkonferenz der UN-Klimarahmenkonvention in Cancun 2010 (CMP6) um die Einführung von sog. Standardized Baseline- und Monitoring Methoden unter dem CDM zu beschließen. Die CMP6 beschloss: „[n]oting that the use of standardized baselines could reduce transaction costs, enhance transparency, objectivity and predictability, facilitate access to the clean development mechanism, particularly with regard to underrepresented project types and regions, and scale up the abatement of greenhouse gas emissions, while ensuring environmental integrity“ (UNFCCC 2010).

Die am wenigsten entwickelten Länder, sehen sich mit der Problemlage konfrontiert, dass ein großsteil der lokalen Bevölkerung, insbesondere in ländlichen Regionen, keinen Zugang zu Elektrizität haben. Grundsätzlich bietet der CDM die Möglichkleit die Erzeugung von CO2-armen Strom kozufinanzieren. Die Entwicklung einer CDM baseline basiert jedoch auf der Berücksichtigung von historischen Emissionen. In solch ländlichen Gebieten gibt es jedoch keine historischen Emissionen, da der Strombedarf auf Basis eines Mangels an Ressourcen ungedeckt bleibt. Diese Situation wird üblicherweise als ‚Suppressed Demand‘ bezeichnet.

An dieser Stelle wurde nun das Konzept von Suppressed Demand mit dem CDM verknüpft wird. Das Konzept berücksichtigt die Emissionen, die stattfinden würden, wenn die basalen Bedürfnisse der lokalen Bevölkerung gedeckt wären. Ein Minimum Service Level (MSL) ist definiert als das Szenario, bei dem die grundlegenden Bedürfnisse z.B. für Beleuchtung gedeckt sind. Das MSL basiert in Folge auf den Emissionen, die stattfinden würden, wenn die lokale Bevölkerung genügend Ressourcen (z.B. Einkommen) zur Verfügung hätte, um ihre Grundbedürfnisse zu decken. Insbesondere in den am wenigsten entwickelten Ländern können Standardized Baselines unter Berücksichtigung ein signifikantes Minderungspotential heben und zugleich die lokale Versorgungssituation verbessern.

Vor diesem Hintergrund hat das deutsche Umweltbundesamt das Wuppertal Institut und die GFA Consulting Group mit der Durchführung des Forschungsprojekts „Nutzen von standardisierten Baselines (CDM) für das Erreichen von klimapolitischen Zielen in Entwicklungsländern (suppressed demand)“ beauftragt. Dieses Vorhaben basiert auf einem anderen UBA Forschungsprojekt mit dem Titel „Implikationen von standardisierten CDM Baselines auf Least Developed Countries (LDCs) und ihre Nutzung in nationalen „Messung, Berichterstattung und Verifizierungs (MRV)“-Systemen“.

Das Forschungsvorhaben trägt die zuvor gewonnen Erkenntnisse weiter: Eine konkrete Stanardized Baseline für ländliche Elektrifizierung wurde für Äthiopien entwickelt (Arbeitspaket 1). Weiter wurde die äthiopische DNA in der Prüfung der Standardized Baseline und deren Einreichung an das UN-Klimasekretariat unterstützt (Arbeitspaket 2). Im Gegensatz dazu wurde im Arbeitspaket 3 das aktuelle Regelwerk im Hinblick auf die Entwicklung von sektoralen benchmarks untersucht. So wurde der sog. „performance penetration“ Ansatz getestet, um einen nationalen Emissionswert für die Zementindustrie in Indonesien zu entwickeln. Da die Emissionsberechnungen des Zementsektors komplex sind (d.h. es existieren vier komplementäre CDM Methoden für den Zementsektor), wurde dies als herausforderndes Versuchsfeld betrachtet.

Um die Ergebnisse, der zuvor genannten Studie an die Gegebenheiten Äthiopiens anzupassen, wurden zwei Aktivitäten durchgeführt:

Im Mai 2013 hat der Konsulent an einem Workshop teilgenommen, um vorläufige Ergebnisse zu präsentieren, und diese mit Repräsentanten ostafrikanischer Gastländer zu diskutieren. Die Diskussion bezog sich dabei auf generelle Elemente der Studie, wie z.B. die Auswirkungen von ‚carbon finance‘ auf den Cashflow eines Programms für ländliche Elektrifizierung oder Synergien zwischen SB Entwicklung und der Erstellung von nationalen Treibhausgasemissionen. Darüber

hinaus wurde der Finanzbedarf für die zukünftige Aktualisierung von SBs thematisiert und führte zu einer hitzigen Debatte, ob DNAs eine Gebühr pro ausgestellter CER einheben dürfen, die auf einem Projekt oder Programm basiert, welches die SB nutzt.

Im September organisierte der Konsulent gemeinsam mit dem Äthiopischen Umweltbundesamt (EPA) einen weiteren Workshop, der zwei Ziele verfolgte:

- Die DNA und alle anderen Beteiligten mit den Prozeduren der SB Entwicklung und der Qualitätssicherung/-Kontrolle vertraut zu machen; und
- Lokales Wissen und Daten zu sammeln um die SB an die Bedürfnisse des Gastlandes anzupassen.

Der zweite Workshop zielte daher auf nationale Beteiligte ab, wie das äthiopische Umweltbundesamt (wo die DNA angesiedelt ist), das Ministerium für Wasser und Energie (MoWE, wo die Fazilität für *Climate Resilient Clean Economy*, CRGE, und das Sekretariat für ländliche Elektrifizierung, RES angesiedelt sind), das nationale Energieversorgungsunternehmen (EEPCo) und die äthiopische Entwicklungsbank (DBE). Die DBE setzt ein Programm für ländliche Elektrifizierung um, das von der Weltbank (WB) finanziert wird und agiert als *CDM Programme Managing Entity* (CME) *für das Übereinkommen mit der Carbon Finance Initiative for Development* (CiDev) der WB. Im Zuge der Vorbereitungen des Workshops wurden Treffen unter anderem mit allen zuvor gennannten Institutionen abgehalten.

Die Kombination aus bilateralen Treffen und einem gemeinsamen Workshop erwies sich dabei als fruchtbar insbesondere um Gastland-spezifische Daten zu sammeln, wie z.B. kalorische Brennwerte, Emissionsfaktoren, Messergebnisse für verschiedene Beleuchtungstechnologien, deren Leuchtkraft sowie des Energiebedarfs, aber auch eines umfassenden Datensatzes zum Auslastungsgrad aller nationalen Dieselgeneratoren, die von EEPCo betrieben werden. Alle Datensätze wurden ausgewertet und im Entwurf der SB aufgenommen, mit Ausnahme des Datensatzes zu den Auslastungsgraden. Die Auswertung des letzteren, obwohl sehr detailliert, zeigte Inkonsistenzen innerhalb eines Berichtsjahres auf die nicht behoben werden konnten. Daher entsprach der Datensatz nicht den Anforderungen der SB Guidelines und musste verworfen werden.

Diese Arbeitsschritte führten zur Entwicklung einer integrierten SB welche eine überarbeitete baseline und QA/QC Prozeduren enthält. Darüber hinaus wurde der Anwendungsbereich der SB erweitert, in dem eine automatische Beweisführung zur Zusätzlichkeit aufgenommen wurde. Im Zuge des September Workshops wurden auch mehrere Konsultationen mit der DBE abgehalten, die als CME für das CiDev unterstützte CDM Programm für ländliche Elektrifizierung agieren soll. Das CDM PoA wird von der WB selbst entwickelt. Um die Einbettung der SB in das CDM Programm zu unterstützen hat sich der Konsulent mit dem Team der WB in Verbindung gesetzt. Im Zuge dieses Austausches wurde die WB regelmäßig über den Status und Fortschritt der SB Entwicklung informiert und die WB hat freundlicher Weise Elemente früherer Versionen der SB kommentiert und zu dessen Weiterentwicklung beigetragen.

Der eigentliche Einreichungsprozess an das UN Klimasekretariat hat sich als zeitaufwendig herausgestellt und wurde durch Interventionen des deutschen Umweltbundesamts und des deutschen Bundesministeriums für Umwelt, Naturschutz, Bau und Reaktorsicherheit und des Regionalen Kooperationszentrums für Ostafrika des UN Klimasekretariats unterstützt. Wir nehmen an, dass die Verzögerungen des Einreichungsprozesses auf Umstrukturierungsprozesse der äthiopischen EPA zurückzuführen sind. Während dieser Periode wurde das EPA zum Status eines Ministeriums aufgewertet und nennt sich seither Ministerium für Umwelt und Wald (MoEF). In diesem Zusammenhang schied der Projektverantwortliche aus dem Dienst der EPA aus, was zu einer Leerstelle führte. Erst als diese Position wieder besetzt wurde, kontrollierte der Leiter der DNA die SB, unterzeichnete sie und reichte sie beim UN Klimasekretariat ein.

Die eigentliche Prüfung der SB wurde durch eine Anfrage der DNA an das UN-Klimasekretariat eingeleitet. Im Zuge dieser Anfrage wurde das Sekretariat aufgefordert, in Übereinstimmung mit CDM EB63, A28, §14 die Prüfung selbst durchzuführen. In einem weiteren Schritt vollzog das Sekretariat die sog. Vollständigkeitsprüfung. Im Zuge dieses Arbeitsschritts wurden zwei rasche Korrekturen und Wiedereinreichungen durchgeführt. Dieser Prozess wurde durch eine Konferenzschaltung mit einem technischen Team des Sekretariats unterstützt. Dieser rasche und effiziente Austausch führte zur Behebung aller Beanstandungen, die sonst ggf. während der eigentlichen Prüfungsphase bemängelt werden hätten können. Die Vollständigkeitsprüfung wurde am 30. Juli 2014 erfolgreich abgeschlossen.

Im Zuge der eigentlichen Prüfung wurden durch das Sekretariat zwei kleinere Informationsbedarfe aufgezeigt. Die entsprechende Anfrage wurde der DNA und dem Konsulenten am 19. August 2014 übermittelt. Eine der zwei Anfragen bezog sich auf die zugrundeliegende Methodik für die Messungen der Leuchtkraft und des Energiebedarfs für verschiedene Technoligien/Lampen. Diese Messungen wurden ursprünglich vom äthiopischen MoWE durchgeführt, das die Messergebnisse zur SB Entwicklung zur Verfügung gestellt hatte. Zur Bearbeitung dieser Anfrage, verfasste das MoWE mit technischer Unterstützung des Konsulenten ein Methodenpapier, welches am 18 Oktober an das Sekretariat übermittelt wurde. Dies führte zum erfolgreichen Abschluss der Prüfung am 7. November 2014. Zum Zeitpunkt des Schreibens bereitet das Sekretariat eine Empfehlung vor, die zur offiziellen Anerkennung der vorgeschlagenen SB führen kann.

Untersuchung sektorspezifischer Baseline Entwicklung

Stanrdized Baselines ist einer der letzten, verbleibenden Themenfelder, in denen der CDM weiterentwicklet wird, unter anderem auf Basis von technischer Unterstützung von Gebern und anderen Institutionen, dem Klimasekretariat, diversen CDM Ausschüssen und Arbeitsgruppen und dem CDM Exekutivrat. Das aktuelle Regelwerk erlaubt die Entwicklung von SBs auf der Basis der zwei folgenden Ansätze:

- Eine baseline kann auf der Basis von existierenden CDM Methoden oder CDM Instrumenten erstellt werden; oder
- Eine baseline kann auf der Basis des ‚Performance Penetration' Ansatzes entwickelt werden, wie in den SB Guidelines dargelegt *(CDM Executive Board 2011)*.

Insbesondere der letztere Ansatz ist von besonderem Interesse. Er erlaubt nicht nur eine Sektor-übergreifende Emissions-Benchmark zu erstellen (d.h. einen Emissions-Benchmark der über den Anwendungsbereich von anerkannten, oft fallspezifischen CDM Methoden hinausgeht), sonder erlaubt auch die Entwicklung einer Positiv-Liste von Technologien/Treibstoffen/Rohstoffen, die automatisch als zusätzlich anerkannt werden.

Erste Erfahrungen werden mit diesem Ansatz gesammelt. Bis dato wurden zwei Stanardized Baseline anerkannt, die auf dem Performance Penetration-Ansatz basieren: ASB0002 wurde für Effizienzsteigerungen in der Holzkohleproduktion mit Fokus auf einzelne Haushalte und kleine und mittlere Unternehmen in Uganda. *ASB0004* deckt den Reismühlen-Sektor in Kambodscha ab. In Summe wurden bisher wenige SBs eingereicht die auf den SB Guidelines, und nicht auf anerkannten CDM Methoden aufbauen. Beinahe alle SBs haben in gemein, dass sie relativ einfache Produktionsprozesse mit homogenen Erzeugnissen abbilden. Die einzige Ausnahme ist eine SB für Klinker-Produktion in Äthiopien *(PSB0002)*. Im Juli 2012 war wurde diese SB als weltweit zweite SB eingereicht. Aber offensichtlich ist die Entwicklung einer robusten SB so komplex, dass die SB in der Zwischenzeit bereits vier Mal eingereicht wurde und bis dato nicht vom UNFCCC anerkannt wurde. Im Zuge dieser Prozesse stellte das Sekretariat fest, dass eine neue Methodik entwickelt werden muss, um den spezifischen Anforderungen dieses Sektors gerecht zu werden. Daher forderte der Exekutivrat das Klimasekretariat in Zusammenarbeit mit dem Methoden—Ausschuss auf, diese Methode zu entwickeln *(CDM Executive Board 2014a)*.

Diese offensichtlichen Schwierigkeiten stimmen mit den Erkenntnissen eines früheren Forschungsprojektes der *DEHSt (Hermwille et al. 2013)* überein. In einer Serie von Experteninterviews zeigten sich die meisten Experten skeptisch bezüglich der Eignung und Anwendbarkeit des Performance Penetration-Ansatzes für die Abbildung komplexerer Industrien. Jedoch ist hinzuzufügen, dass diese Bedenken weniger auf eigener Erfahrung der Experten beruhten, sondern mehr auf einem generellen Verständnis der SB Guidelines und vielfältiger Erfahrungen unter dem CDM fußen.

Vor diesem Hintergrund und in enger Abstimmung mit dem Auftraggeber hat das Forschungsteam im Zuge des Arbeitspakets 3 eine Studie zu diesem Themenkreis durchgeführt. Dies zielte insbesondere auf die Untersuchung des Potentials und der Grenzen des Performance Penetration Ansatzes ab. Der Zementsektor wurde auf der Basis von zwei Gründen ausgewählt:

Der Zementsektor stellt einen Extremfall dar, er ist hoch-komplex und die Produktionsprozesse zeichnen sich durch einen hohen Grad der Integration aus. Ein spezifisches Emissionsniveau kann durch einen Vielzahl von Kombinationen von Technologien, Treibstoffen und Rohstoffen entstehen, was durch die zuvor angeführten Komplikationen in der äthiopischen Klinker SB belegt wird.

Zweitens konnte diese Studie auf erhebliche Vorarbeiten aufbauen, welche die GFA Consulting Group im Auftrag der NAMA Entwicklung/Implementierung in Indonesien leisten konnte. Insbesondere konnte auf einem Datensatz aufgebaut werden, der es erlaubte verschiedene quantitative Analysen durchzuführen.

Um komplexe Produktionsprozesse zu analysieren und um die Ergebnisse der verschiedenen Optionen einen Emissionsfaktor zu bestimmen, zu untersuchen, wurde das Konzept der Integration entwickelt. Integration wurde dabei definiert als der Grad zu dem eine Produktionskette eines Sektors (z.B. Zement) in einzelne Unter-Prozesse gegliedert ist. Ein voll-integrierter Prozess ist demnach eine Blackbox, bei dem der Emissionsfaktor ausschließlich auf Basis eines einzigen Indikators d.h. auf Basis der Gesamtemission des Enderzeugnisses bestimmt wird. Im Gegenzug, ein Ansatz mit einem niedrigen Niveau der Integration fußt auf spezifischen Indikatoren für einzelne Unter-Prozesse (z.B. Klinker zu Zement Ratio und der Emissionsfaktor der Klinkerproduktion). Die Kombination der Indikatoren erlaubt auch die Gesamtemissionen des Sektors zu bestimmen, jedoch führt dieser Ansatz unter Anwendung des Performance Penetration-Ansatzes zu unterschiedlichen Ergebnissen. Auf Basis dieser Überlegungen wurden drei Szenarien entwickelt, ein Szenario auf Basis einer kompletten Integration und Szenarien mit mittlerer- und niedriger Integration.

Das erste wichtige Ergebnis der Studie zeigte, dass es grundsätzlich möglich ist, den Zementsektor in Unter-Prozesse zu unterteilen und einen kombinierten Emissionsfaktor auf Basis der Indikatoren der Unter-Prozesse zu bestimmen. Der Emissionsfaktor des Szenarios mit niedriger Integration wurde auf der Basis der folgenden Indikatoren bestimmt:

Die Klinker zu Zement Ratio spezifiziert die Relation zwischen Zement und Klinker und bestimmt somit in erheblichem Ausmaß die Gesamtemissionen der Produktion einer Tonne Zement; der spezifischer Hitzeverbrauch (in GJ/t Klinker) beschreibt die Effizienz der Tunnelöfen, der Emissionsfaktor des Treibstoffgemisches (in kg CO2/GJ) basiert auf der Menge von herkömmlicher Kohle, alternativen fossilen Brennstoffen und von Biomasse und Biomasse-Reststoffen die im Verbrennungsprozess eingesetzt werden; schließlich wurde der spezifische Stromverbrauch (in kWh/t Zement) berücksichtigt.

Darauf aufbauend wurden die Unterschiede der drei Szenarien bestimmt und der Effekt eines abnehmenden Niveaus der Integration analysiert. Es wurde festgestellt, dass ein Ansatz mit niedriger

Integration theoretisch zu einem konservativerem Emissionsfaktor führen kann. In einem Szenario mit voller Integration kann eine Firma in einigen Bereichen effizient produzieren, verursacht aber in anderen Sektoren höhere Emissionen. Ein gutes Ergebnis in einzelnen Sektoren kann aber von schlechten Ergebnissen in anderen Sektoren kann dies (über)kompensiert werden. Daher wird ein Szenario mit niedriger Integration tendenziell zu höheren Emissionsfaktoren für den gesamten Sektor führen.

Ein Ansatz mit einem niedrigen Grad der Integration wird der Emissionsfaktor durch die Besten Firmen in einzelnen Produktionsprozessen bestimmt. Dies können unterschiedliche Unternehmen sein, was zu einem niedrigeren und konservativerem Emissionsfaktor führt.

Auf Grund einer Partikularität des Zementsektors in Indonesien, wurde dieser Effekt in der Praxis nicht festgestellt: Die Firma, welche den Emissionsfaktor des integrierten Ansatzes bestimmt, erzielte auch die besten Ergebnisse in vielen, einzelnen Unter-Prozessen und deckt zugleich 21% der nationalen Zementproduktion ab. Der einzige Benchmark, bei dem diese spezifische Firma nicht das beste Ergebnis erzielt ist der Emissionsfaktor des Brennstoffgemisches. In diesem Unter-Prozess erzielt diese spezifische Firma das zweit-beste Ergebnis. Da das Produktionsvolumen der besten Firma jedoch relativ klein ist, und da der Benchmark bei 90% der Produktion liegt, ist aus auch hier die selbe, spezifische Firma die den nationalen Benchmark bestimmt. Daher bestimmt in Summe dieselbe Firma den Emissionsfaktor eines Szenarios mit niedrigem- und hohem Grad der Integration. In Folge sind die Emissionsfaktoren beider Szenarien ident.

In weiterer Folge führte die Studie Sensitivitätsanalysen durch, um die Belastbarkeit des Performance Penetration-Ansatzes zu untersuchen. Wie auch durch die zuvor angeführte Analyse des Performance Penetration-Ansatzes angezeigt, beinflusst Marktkonzentration möglicherweise die Ergebnisse. Vor diesem Hintergrund wurde ein hypothetisches Szenario untersucht, wo die Anzahl der Firmen von 9 auf hypothetische 18 Firmen mit identischen, durchschnittlichen erhöht wurde. Im Grunde wurden eine reale Firma in zwei hypothetische Firmen unterteilt, wo bei die Performanz der Einen um 10% erhöht, die der Anderen um 10% reduziert wurde. Diese Analyse zeigt, dass die Anzahl der Marktteilnehmer (und ihr entsprechender Anteil an der nationalen Produktion) für die Bestimmung des nationalen Emissionsfaktors relevant ist.

Darüber hinaus untersucht die Studie in wie weit es möglich ist, eine Positiv-Liste für Technologien / Brennstoffe / Rohstoffe zu entwickeln, bei der bestimmte Maßnahmen automatisch als zusätzlich definiert werden. Auf Basis des aktuellen Regelwerks erscheint es nicht als möglich, solch eine Positiv-Liste zu entwickeln, da ein bestimmtes Emissionsniveau auf eine große Anzahl möglicher Kombinationen verschiedener Technologien zurückgeführt werden kann.

Vor dem Hintergrund, dass SBs das Ziel verfolgen das Wissen und die Ansätze des CDMs für weiterer Minderungsprogramme fruchtbar zu machen, diskutiert die Studie die Anwendung des SB Regelwerks zur Bestimmung einer baseline für das Zement NAMA Indonesiens. Die Analyse zeigte, dass das SB Regelwerk zu sehr ähnlichen Ergebnissen führt, wie ein ‚Best Available Techbnology‘ Ansatz, wie der World Business Council for Sustainable Development’s Cement Sustainability Initiative zu Grunde gelegt.

Abschließend untersuchte das Vorhaben das Potential für die Entwicklung von SBs in Zementsektoren in am wenigsten entwickelten Ländern. Unsere Analyse zeigt ein erhebliches Potential für die Anwendung von SBs in afrikanischen Gastländern. Länder wie Algerien, Marokko, Nigeria, Südafrika Tunesien, Kenia, Ghana und Libyen zeichnen sich durch ein großes Produktionsvolumen aus. Unter den am wenigsten entwickelten Ländern eignen sich Senegal, Äthiopien und Togo für die Entwicklung von SBs.

Schlussfolgerungen aus der Entwicklung und Einreichung der äthiopischen SB

Die SB Guidelines und das komplementäre Regelwerk wurden vor dem Hintergrund der Entwicklung der SB für ländliche Elektrifizierung in Äthiopien getestet. Die Kombination des SB Regelwerks und der Guidelines für ‚Suppressed Demand' erlaubten die Entwicklung eines Baseline Emissionsfaktors der über den Standardwerten der bereits hoch-standardisierten CDM Methodik AMS I.L liegt. Die Berücksichtigung von Suppressed Demand führte zur Anpassung von AMS I.L an die Umstände des Gastlandes. Die Ergebnisse zeigen einen höheren Emissionsfaktor an, ohne dabei die Umweltintegrität des Ansatzes zu kompromittieren.

Die Erreichung eines hohen Niveaus der Anpassung setzt einen guten Zugang zu sog. ‚Tier 2[1]' Daten voraus. Diese Daten können bei einer Reihe von nationalen Institutionen aufzufinden sein. Daher, in Analogie zur Entwicklung von Nationalen Kommunikationen und entsprechenden Treibhausgasinventaren, ist es für die Entwicklung einer SB von zentraler Bedeutung, dass das nationale Klimasekretariat gut mit anderen, nationalen Institutionen vernetzt ist. Besondere Bedeutung erwachsen hierbei nationalen Energieversorgungsunternehmen oder dem Energieministerium. Dieser Austauschprozess kann auch durch die Organisation eines nationalen Konsultations-Workshops unterstützt werden.

Seit dem Inkrafttreten des CDMs in 2001 hat die Mehrzahl der Gastländer eine Prozeduren entwickelt und verabschiedet, um die Impulse zur nachhaltigen Entwicklung von CDM Projekten und Programmen zu untersuchen und diese Projekte ggf. zu genehmigen. Das Konzept von Standardized Baselines ist im Gegenzug relativ neu und DNAs haben kein klares Mandat um SBs zu prüfen, zu genehmigen und an das Klimasekretariat einzureichen. Es wird daher empfohlen auch in Zukunft SBs in enger Kooperation mit den DNAs zu entwickeln. Dabei sollen DNAs auch unterstützt werden, nationale Prozeduren für die Prüfung und Einreichung von SBs an das Klimasekretariat zu entwickeln.

Empfehlungen zur Weiterentwicklung des SB Regelwerks

Im Zuge der Untersuchungen der SB für den indonesischen Zementsektor zeigen wir, dass es möglich ist einen detaillierten Ansatz zu entwickeln, der auf einer Serie von Benchmarks von Unter-Prozessen aufbaut. Dieser Ansatz führt zu einem konservativeren Emissionsfaktor für den Zementsektor, als dies durch einen integrierten Ansatz geleistet werden würde. Im spezifischen Fall Indonesiens war es jedoch nicht möglich diesen theoretischen Fall in der Praxis zu belegen, da alle Unter-Prozesse durch dieselbe Zementfirma bestimmt werden, die auch den Emissionsfaktor des integrierten Ansatzes vorgibt.

Diese Partikularität mag jedoch nicht so besonders sein, wie es auf den ersten Blick erscheint. Die Erfahrungen anderer SBs (z.B. SB0004 "Technology switch in the rice mill sector of Cambodia") zeigen auch die Dominanz einer Firma auf. Dies indiziert dass Skaleneffekte dazu führen können, das große Unternehmen den Emissionsfaktor eines Sektors bestimmen. Vor diesem Hintergrund mag es schwierig sein, einen kohärenten, Sektor-spezifischen Emissionsfaktor zu entwickeln, der nicht kleine Unternehmen davon ausschließt, von Kohlenstofffinanzierung zu profitieren.

Üblicherweise produzieren mittlere und größere Unternehmen wesentlich effizienter als kleine, traditionell arbeitsintensive Firmen. Jedoch sind es oft kleine und mittlere Unternehmen, die einen Großteil der Arbeitsplätze schaffe und für die Ökonomie des Gastlandes von zentraler Bedeutung sind.

[1]Tier 2 ist ein IPCC Qualitätsstandard für Treibhausgasemissionsrelevante Daten, z.B. nationale Emissionsfaktoren für Treibstoffe, mit einem durschnittlichen Grad an Komplexität

Auf Basis der Erkenntnisse dieser zwei SBs, erscheint es wahrscheinlich, dass ein Emissionsfaktor in Skalen-abhängigen Produktionszweigen nur von großen Unternehmen unterschritten werden kann. Für solche Sektoren wird daher die Dis-Aggregation des Sektors auf der Basis von a) Alter der Fabriken, b) kleine vs. große Produktionskapazitäten oder c) Eigentümerstrukturen empfohlen. Dies ist in Übereinstimmung mit dem aktuellen Regelwerk für Standardized Baselines zu leisten und würde es erlauben auch Anreize für kleine und mittlere Unternehmen zu strukturieren, wobei die Umweltintegrität des Mechanismus nicht beeinträchtigt wird.

Wie besprochen führt ein dis-integrierter Ansatz zu einem konservativen Emissionsfaktor. Darüber hinaus bietet dieser Ansatz eine Reihe weiterer Vorteile:

- Dies erlaubt eine detaillierte Analyse des Sektors sowie auch der Performanz der einzelnen Firmen. Die zahlreichen Unter-Prozesse erlauben es den Produzenten und politischen Entscheidungsträgern gleichermaßen, bestimmte Bereiche, ggf. mit großem Minderungspotential zu identifizieren und auf Basis informierter Entscheidungsfindung gezielte Minderungsmaßnahmen und –Politiken zu verabschieden.
- Ein höheres Maß an Detailgenauigkeit erweitert den Anwendungsbereich einer SB und erschließt neue Instrumente. Ein hoch-detaillierter Benchmark kann ein zentrales Element für Neue Marktmechanismen oder NAMAs sein.
- In einer integrierten SB mag es schwierig sein, automatische Zusätzlichkeit zu etablieren. Auf Basis eines weniger integrierten Ansatzes kann jedoch die Zusätzlichkeitsbeweisführung für Teilbereiche der SB erbracht werden.

Vor dem Hintergrund der Daten, die für diese Studie genutzt wurden, zeigte sich, dass ein Datensatz, der auf der Ebene eines Unternehmens (das in diesem Fall mehrere Produktionsstätten beinhaltet), nicht der Best- geeignete Ansatz ein mag. So konnten wir zeigen, dass die Aggregation der Daten auf Unternehmensebene zu einen Emissionsfaktor führt, die es kleineren/weniger effizienten Unternehmen nicht ermöglicht von entsprechenden Finanzierungsmechanismen zu profitieren.
Für die Entwicklung von baselines und damit verbunden Monitoring Konzepten, die über den CDM hinausgehen, bietet das SB Regelwerk einen guten und soliden Ausgangspunkt. Vor einer möglichen Anerkennung durch die UNFCCC wird die SB durch einen unabhängigen Prüfungsprozess evaluiert. Auf Basis einer offiziellen Registrierung durch UNFCCC erlangt die SB und damit die NMM/NAMA baseline internationale Anerkennung. Jedoch, in spezifischen Fällen, wo die Emissionen in einem BAU Szenario im Laufe der Zeit abnehmen, zeigen sich Einschränkungen der Anwendbarkeit dieses Konzeptes, da die Transition einer SB über die Zeit nicht durch das aktuelle SB Regelwerk abgedeckt ist.
Aus dieser Perspektive lässt sich schlussfolgern, dass SBs so detailliert als möglich entwicklert werden sollen. Die Machbarkeit eines detaillierten Ansatzes ist jedoch an die Verfügbarkeit von geeigneten Daten gebunden. Die Kalkulation eines detaillierten Emissionsfaktors mag sich für andere Sektoren jedoch als große Herausforderung erweisen. Der Zementsektor ist typischerweise durch eine kleine Anzahl von unternehmen ausgezeichnet und daher sehr überschaubar. Für andere Sektoren mit vielen Marktteilnehmern mag es jedoch nicht möglich sein, detaillierte und konsistente Datensätze aufzubauen. Daher sollte das SB Regelwerk auch kein spezifisches Niveau der Integration vorschreiben; ggf. wäre es aber sinnvoll diese Hintergründe in den SB Guidelines zu verankern und damit DNAs in die Lage zu versetzen informierte Entscheidungen über ein adäquates Niveau der Integration zu treffen.

Speziell vor dem Hintergrund einer Vielzahl von Möglichkeiten der Entwicklung von SBs, versteht sich diese Studie als erster Schritt um die Komplexität von integrierten Produktionsprozessen zu erschließen, und zielt vor allem darauf ab, weiterführende Fragestellungen aufzuwerfen.

Als Folgeaktivität schlagen wir vor, andere Sektoren unter Berücksichtigung unterschiedlicher sozio-ökonomischer Rahmenbedingungen zu untersuchen. Weiter schlagen wir vor, alternative Ansätze zur Prüfung der Zusätzlichkeit im Rahmen des SB Regelwerks zu testen. Ein möglicher Ansatz wäre die Entwicklung eines ‚halb-standardisierten' Ansatzes, bei dem Positivlisten für einzelne Benchmarks erstellt werden. Andere Sektoren, die auf stetigen Veränderungen basieren (z.B. verstärkte Nutzung von Biomasse-Reststoffen) könnten von dem halb-standardisierten Ansatz ausgeschlossen- und der herkömmlichen Zusätzlichkeitsprüfung überlassen werden

Glücklicherweise ist das aktuelle SB Regelwerk nicht auf ewig festgeschrieben. Eine Revision der SB Guidelines ist für das 81. Treffen des CDM Exekutivrates vorgesehen. Im Entwurf der Revision schlagen das Sekretariat und der Methoden-Ausschuss vor, die Guideline in einen Standard zu überführen und einige der Erkenntnisse dieses Vorhabens aufzugreifen:

- Der Entwurf schlägt einen neuen Ansatz für baseline- und Zusätzlichkeits-Grenzwerte vor. Dabei werden zwei Optionen angeregt. Bei dem stringenterem der beiden Ansätze (basierend auf einem Grenzwert von 90%, bei dem der Emissionsfaktor bestimmt wird), wird eine Positivliste ohne weitere Prüfung der Zusätzlichkeit erstellt. Alternativ kann die DNA auch einen Grenzwert von 70% ansetzen. Dieser Grenzwert wäre jedoch mit einer Prüfung der Zusätzlichkeit in Analogie zu den aktuellen SB Guidelines, zu leisten. Diese Regelung kann die Komplexität der Prüfung erheblich reduzieren und eröffnet neue Möglichkeiten auch für die Bestimmung der Zusätzlichkeit in solch komplexen Sektoren wie Zement. Jedoch ist diese neue Regelung deutlich weniger restriktiv und es ist zu erwarten, dass dieser Vorschlag zu einer angeregten Diskussion im CDM Exekutivrat führen wird. Die endgültige Entscheidung sollte mit großer Sorgfalt getroffen werden.
- Unseres Ermessens ist die neu eingeführte Sektion zu den wesentlichen Überlegungen der DNA überaus hilfreich. Die DNA spielt eine zentrale Rolle in der Entwicklung der SBs, sind verantwortlich für deren Einreichung an UNFCCC, und sind schließlich verantwortlich für die Sammlung und das adäquate Management der Daten.
- Ein großer Entwicklungsschritt ist auch die Einführung der Definition von ‚Anlage' als Standort mit Arbeitsgerät um die Arbeitsleistung zu erbringen. Diese Definition deckt sich mit den Erkenntnissen der Zementstudie.
- Die vorgeschlagenen Überarbeitung sehen eine genauere Anleitung vor, in wie fern ein Sektor zu aggregieren ist. Unter dem aktuellen Regelwerk wird diese Entscheidung den DNAs überlassen. Der nun eingebrachte Vorschlag verlangt nun von DNAs einen Sektor zu dis-aggregieren, falls "significantly dissimilar performance exist among groups of facilities [...] because of differences in criteria such as production scale (or installed capacity) or age of the facilities." Dies deckt sich mit den Erkenntnissen dieser Studie im Hinblick auf Marktkonzentration.

Summary

The unequitable distribution of CDM was one of the reasons for the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol in Cancun 2010 (CMP6) to decide upon the introduction of Standardized Baseline and monitoring methodologies under the CDM. The decision was made „[n]oting that the use of standardized baselines could reduce transaction costs, enhance transparency, objectivity and predictability, facilitate access to the clean development mechanism, particularly with regard to underrepresented project types and regions, and scale up the abatement of greenhouse gas emissions, while ensuring environmental integrity“ (UNFCCC 2010).

Least developed countries, especially rural areas, are confronted with the fact that the vast majority of local population does not have access to electricity. The CDM in principle offers the possibility to provide for elements of such basic supply. However, developing the baseline based on historical emissions is not possible, as there are no historic emissions due to a lack of resources. Such a situation is referred to as ‘Suppressed Demand’.

This is where the concept of suppressed demand comes into play for CDM projects in LDCs. The concept allows for crediting the abatement of emissions that would occur if a certain development took place. A minimum service level (MSL) is defined as a service level which meets basic human needs e.g. for lighting and electricity. This MSL is then considered as the baseline consumption level even if e.g. households do not have the financial capacities to realize the MSL in the business as usual scenario. Particularly in LDCs, Standardized Baselines that incorporate suppressed demand could therefore tap significant mitigation potential while improving the local population’s livelihood.

Against this background, the German Emissions Trading Authority commissioned GFA Consulting Group and the Wuppertal Institute to conduct a research project ‚Using Standardized Baselines (CDM) for Achieving Climate Policy Goals in Developing Countries (suppressed demand)’. The project takes up research conducted in the context of yet another UBA project entitled ‚Implications of Standardized CDM Baselines for Least Developed Countries (LDCs) and their Use in National ‘Measuring, Reporting and Verification (MRV)‘-Systems’ (FKZ 3712 41 502). One of the outcomes of that project was the desktop study ‘Standardized Baselines and their Implications for a National Monitoring, Reporting and Verification System: A Case Study for Rural Electrification in Sub-Saharan Africa’.

This project builds on that study by taking the outcomes one step further: a concrete Standardized Baseline on rural electrification in Ethiopia was developed (work package 1) and the Ethiopian DNA was supported in the assessment as well as the submission to UNFCCC (work package 2). In work package 3, by contrast, the project team tested the current SB framework for the development of sectoral benchmarks. The performance penetration approach was assessed for covering the emissions of Indonesia’s cement sector. As the emissions of the cement sector are rather complex (i.e. covered through four complementary CDM methodologies), this was found to be an appropriate testing ground for the performance penetration approach.

In order to amend the findings of the aforementioned desk study to the circumstances of Ethiopia, two activities were conducted:

In May 2013, the Consultant participated in a workshop which served as a platform to present the preliminary findings of the desktop study, consult and discuss with participants from East African host countries the more general findings (e.g. the impact of carbon finance on the cash flow of a rural electrification program, synergies between SB development and MRV). The needs and related costs for future updating of SBs was also stressed leading amongst other to a heated debate on whether DNAs should claim a fee on each CER issued by a project/programme making use of a SB.

In September, a second workshop was organized jointly by the Consultant and Ethiopia's Environmental Protection Agency (EPA) following the double objective to

- Familiarize the DNA and other stakeholders with the procedures of SB development, Quality Assurance/Quality Control (QA/QC), as well as to
- Gather and structure the knowledge and information available to adopt the SB to the circumstances of the host country.

The second workshop focused on key national stakeholders such as the Environmental Protection Agency (EPA) of Ethiopia (hosting the Designated National Authority, DNA), the Ministry of Water and Energy (MoWE, hosting the Climate Resilient Clean Economy facility, CRGE, and the Rural Electrification Secretariat, RES), the national power utility, EEPCo, and the Development Bank of Ethiopia (DBE) which implements the rural electrification program funded by the World Bank (WB) and which acts as CDM Programme Managing Entity (CME) for the agreement with the WB's Carbon Finance Initiative for Development (CiDev). For the preparation of the workshop, bilateral meetings were conducted inter alia with all key stakeholders.

The combination of bilateral meetings with a joint workshop proved to be fruitful especially for gathering country specific data, such as national Net Calorific Values (NCVs), Emission Factors (EFs), national measurement results on lighting technologies lumen output and respective fuel consumption data, as well as a very comprehensive data set on the load factors of all diesel generators operated by EEPCo. These datasets were assessed and included into the draft SB with the exception on the load data for diesel generators, which, despite being very detailed, showed inconsistencies within one year of reporting and which did not match the requirements of the SB Guidelines (i.e. requiring a data set covering the most recent three years).

The above work steps lead to the development of an integrated SB document including a revised baseline, and QA/QC procedures. Moreover, the scope of the SB was extended to comprise the establishment of 'additionality' at the level of the SB. In the context of the September workshop, several consultations were conducted with DBE which shall act as CME for a CDM PoA for rural electrification, supported by CiDev. The CDM PoA development is conducted by the WB itself. Hence to support the application of the proposed SB, the Consultant established contact and updated the WB on all relevant developments throughout the implementation of this assignment. In this context, the WB kindly conducted a review of selected SB elements providing strong technical input.

The actual submission process was found to be time consuming and was facilitated by greatly appreciated interventions of the German Federal Environmental Agency, the German federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety and UNFCCC's Regional Cooperation Centre for East Africa. We assume that this delay was related to some extent to local developments in Ethiopia. During this time period, Ethiopia's EPA was upgraded to the status of 'Ministry' becoming the 'Ministry of Environment and Forestry' (MoEF). In this context, the direct counterpart of this assignment quit the EPA leaving a capacity gap. Once this position was filled, the appointed head of the DNA reviewed, signed and submitted the proposed SB to UNFCCC.

The actual assessment was initiated by the DNA requesting the UNFCCC Secretariat to conduct the assessment itself in line with CDM EB63, A28, §14. As next step, the Secretariat conducted the completeness check. In the course of the check, two quick 'loops ' were conducted, facilitated by a conference call with a team of technical members of the Secretariat. This quick and efficient exchange with the Secretariat lead to the correction of issues which otherwise would have been raised under during the assessment phase and was completed by the 30th July 2014.

In course of the assessment, the Secretariat raised two minor issues which were submitted to the DNA by the 19th August 2014. Despite being a minor issue, one clarification request required information on the underlying methodology for measuring data on fuel consumption and lumen output for various technologies, collected by Ethiopia's MoWE. In the follow up, the MoWE, with technical support provided by the Consultant, drafted a methodology brief. The amended SB along with the methodology brief were re-submitted on the 18th October 2014 and lead to the successful completion of the assessment report by the 7th November 2014.

At the time of writing the Secretariat is preparing a recommendation which may lead to the approval of the proposed SB by UNFCCC.

Exploring Sector-Specific Baseline Setting

Standardized Baselines remain one of the last frontiers at which the CDM is being advanced including with support from donors and other actors outside the UNFCCC Secretariat, the various CDM panels and working groups, and the CDM Executive Board. The current framework allows for developing SBs along two approaches:

- A baseline may be established based on an approved CDM methodology or tool, or
- A baseline maybe established following the performance-penetration approach as stipulated in the SB Guidelines (CDM Executive Board 2011).

It is the latter approach that is of particular interest for many as it not only allows to establish a sector-wide benchmark emission factor (i.e. exceeding the scope of often case specific methodologies to cover the emissions of whole sectors) but in principal also allows for the development of a positive list of technologies/ fuels/ feedstocks that are automatically deemed additional.

First experiences are being gained with this approach. Currently there are two approved Standardized Baselines that make use of the performance-penetration approach: ASB0002 covers improved efficiency in charcoal production for consumption in households and small and medium enterprises in Uganda and ASB0004 covers the rice mill sector of Cambodia. Quite a few SBs that build on the SB Guidelines have been proposed. Almost all of these proposed and approved SBs have in common that they cover relatively simple production processes with homogeneous output. The only exemption to this is the proposed SB for clinker production in Ethiopia (PSB0002). In July 2012 this was only the second SB to be proposed. Apparently, the development of a robust SB was so complex and improvements so difficult that the SB was already re-submitted four times and is not approved by the UNFCCC. In fact, in the course of the review of the proposed SB, the Board realized that a new methodology had to be developed for the specific needs of the sector. Consequently, the EB asked the UNFCCC Secretariat in cooperation with the Meth Panel to develop this methodology in a top-down manner (CDM Executive Board 2014a).

These apparent difficulties correspond with the findings of an earlier research project sponsored by DEHSt (Hermwille et al. 2013). In a series of expert interviews most respondents expressed their doubts about the applicability or suitability of the performance-penetration approach for more complex industries. However, in most cases this concern was not based on first hand experience but rather on a general understanding of the SB Guidelines and their rich experience in the CDM.

The project team, in close consultation with the client, proposed to substantiate this issue by conducting a scoping study in the course of work package 3 of this research, further investigating the potential and the limits of the performance-penetration approach. The cement sector was chosen for two reasons. Firstly, it represents an extreme case in that the cement production process is a highly complex and highly integrated production process with a long list of options to increase efficiency and decrease emissions. The troublesome work on the clinker SB in Ethiopia exemplifies this. Secondly, substantial preliminary work had been carried out by one of the project partners (Burian et al. 2013) and detailed data was available allowing to run quantitative analyses.

In order to be able to unpack the integrated production process and derive and compare different options of calculating a benchmark emission factor, the concept of ‘level of integration’ was developed. The ’level of integration‘ is defined as the degree to which the production chain of the sector’s final product (i.e. cement) is broken down into sub-processes. A fully integrated approach conceives a complex production process as one black box. The benchmark emission factor is solely calculated on the basis of one indicator, i.e. the total emissions per final output. An approach with a low level of integration, on the other hand, specifies separate performance indicators for sub-processes (e.g. the Clinker to Cement Ratio and the emissions per tonne clinker production) and calculate a combined benchmark emission factor on the basis of these performance indicators. Based on this concept three scenarios were developed representing full, medium and low integration for which to calculate benchmark emission factors.

The first important result of the study was to find that is feasible to break down the cement production process into sub-processes and calculate a combined benchmark emission factor on the basis of a series of indicators with reasonable effort. The benchmark emission factor for this scenario (‘low level of integration’) was based on the following indicators: The clinker to cement ratio, which covers the relation of clinker to cement and hence indirectly the overall emissions of one tonne of cement; the specific heat consumption in GJ/t clinker, which is based on the efficiency of the kiln; the emission factor of the kiln fuel mix in kg CO_2/GJ, which also accounts for the use of alternative fossil fuels and biomass and biomass residues; and the specific electricity consumption in kwh/t cement.

Subsequently the differences in the scenarios and the effect of decreasing the level of integration, i.e. breaking down the integrated production process in a larger number of sub-processes, were discussed. We found that theoretically, the less integrated approach would lead to more conservative results. In a fully integrated approach one company may perform well in one specific process, but may perform badly in others. The good performance in one sub-process is then compensated by the bad performance in other sub-processes. This will lead to a higher combined emission factor relatively to a low level of integration approach. Under this scenario different companies will lead each specific process and set the respective sub-benchmarks. The emission factor would be the sum of the best performers and hence will be lower than the integrated approach above.

However, due to a particularity of the Indonesian cement sector, we were not able to show this effect in practice. Apparently, one company is a top performer in all sub-processes of cement production and also contributes a significant share (21%) of the sectors total output. The only benchmark in which this particular company is not the top performer is the CO_2 emission factor of kiln fuel mix. In this benchmark the company comes second but due to the small production share of the top performer in this benchmark, it is again the same company that does set the baseline at an accumulated production share of 90 per cent. Consequently, all three approaches to calculate a combined benchmark emission factor produced identical results.

In addition to this core element of the study, we conducted sensitivity tests in order to assess the robustness of the performance-penetration approach to a couple of indicators. As the example of the analysis of different levels of integration indicates, the performance-penetration approach may be sensitive to the market concentration of the sector. We developed a hypothetical scenario which doubled the number of cement producers (18 instead of 9) but with identical average emission factors. Essentially, all firms were evenly split into two hypothetical firms, one performing ten per cent better than the actual firm and the other performing ten per cent worse. In doing so, we were able to show that the number of market participants (and their respective market shares) is highly important for the determination of the benchmark emission factor. Similarly, the level of aggregation – i.e. the scope of the sector that is subject to the SB – is highly important as it directly affects the market structure (number of participants and respective market shares).

Furthermore, the study discusses the possibility to develop a positive list of automatically additional technologies/ fuels/ feedstocks. Under the current guidance, we find that it is not feasible to develop such a list as the different mitigation options strongly interact.

As SBs are supposed to allow to transfer the know how of the CDM into a wider range of mitigation instruments, we also discussed the applicability of SBs such as for the Indonesian cement sector for the development of NAMAs. We found that the performance-penetration approach produces very similar results as the benchmark based on the best available technology approach as used by the World Business Council for Sustainable Development's Cement Sustainability Initiative.

Last but not least, we investigated the potential applicability of SBs for the cement sector in least developed countries (LDCs). Our analysis shows that there is significant potential for the application of SBs in the African cement sector. The data suggests that the markets of Algeria, Morocco, Nigeria, South Africa, Tunisia, Kenya, Ghana and Libya deserve a closer look. With regards to LDCs the prospects are less favourable. Our first rough analysis suggests that only Senegal, Ethiopia and Togo bear sufficient potential to justify the investments necessary to establish a standardized baseline.

Lessons learnt from developing and supporting the approval process of an SB

The SB Guidelines and Procedures were tested using the development of a SB for rural electrification in Ethiopia as a test case. Combining the SB framework with the Guidelines for the consideration of suppressed demand allowed for establishing a SB with emission factors above the default emission factors included in the highly standardized Small Scale methodology AMS I.L. This lead to the adoption of the methodology to the circumstances of a Ethiopia. The results were found to involve higher baseline emission compared to the standard setup, as stipulated in AMS I.L while ensuring environmental integrity.

To achieve such an adoption, good access to Tier 2 data[2] is considered to be essential. Such data is likely to be gathered and managed by various institutions in the host country. Hence, similar to the development of National Communications or Biennial Update Reports, it is important for SB development that national climate change focal points are well-linked with various other institutions such as national power companies. This process may be further supported by national consultation workshops.

Since the establishment of the CDM in 2001, the vast majority of host countries established procedures for assessing CDM projects' contribution to the sustainable development of the host country and for approving CDM projects. The concept of Standardized Baselines, however, is comparably new and many DNAs may not have a clear mandate for assessing, approving and submitting SBs to the UNFCCC.

It is therefore recommended that future SBs are developed in close consultations with the respective DNA, starting at the earliest point of time. Furthermore, DNAs should be encouraged to develop internal procedures for the submission of SBs to UNFCCC. This might require related technical support, as needed.

Recommendations with respect to further developing the SB guidelines

In the case study for an SB for the Indonesian cement sector, we have shown that a highly detailed approach with a series of sub-benchmarks is feasible and that it leads to a more conservative baseline

[2] Tier 2 data is an IPCC quality standard for GHG relevant data (i.e. fuel consumption and emission factors) with a medium level of complexity and may refer to e.g. country specific net calorific values, oxidation factors, or emission factors for e.g. kerosene (as used in the SB for rural electrification).

emission factor than a fully integrated approach. In the case under consideration, due to the particular configuration of the Indonesian power sector, it was not possible to demonstrate this theoretical advantage in practice. The Indonesian cement sector is dominated by one very efficient firm that contributes more than 20 per cent of the total output of the sector.

However, this particularity may, in fact, be not as particular as it seems at first sight. Experience with other SBs (e.g. ASB0004 "Technology switch in the rice mill sector of Cambodia") suggests that dominance by one or a small number of firms may be a common feature in many emerging industrial sectors in developing countries. Developing a coherent sector-wide benchmark emission factor may be problematic in cases in which emerging industrial-scale production competes with manufacturing in traditional small-scale enterprises in one and the same sector.

Usually, modern large-scale industries dramatically outperform traditional labour-intensive small-scale manufacturing in terms of efficiency. Still, these manufacturing processes might provide income to thousands of people and therefore are important to the host country's economy. Covering these two by one SB would most likely result in an emission benchmark that is impossible to achieve for small-scale activities and would thus rule out any CDM activity for that part of the sector. Disaggregating the sector based on the a) age of facilities, b) production capacities or c) ownership structures is therefore recommended. This would ensure appropriate incentive structures also for the less performing market players while ensuring environmental integrity.

Apart from being the most conservative approach, there are other advantages of a more detailed, disintegrated approach:

- It allows for a more detailed assessment of the sector as well as of each company's performance. The various sub-benchmarks can help cement producers and policy makers alike to identify in which sub-processes the highest mitigation potentials remain. This supports making informed investment decisions and facilitates the development and monitoring of tailor-made policies.
- The increased level of detail of such an approach also expands the usability of the SB concept for other instruments. A highly detailed benchmark may prove a more valuable resource for applications such as the NMM or NAMAs than a fully integrated one.
- In a completely integrated SB, automated additionality may be difficult to establish. With a larger set of sub-benchmarks there could be the basis for a 'semi-standardized' approach to additionality demonstration in which positive lists of technologies/fuels/feedstock are established for some sub-processes while the requirements for project proponents to demonstrate additionality would be limited to those processes where a sectoral approach to additionality demonstration is not feasible.

With respect to the data that was used for the study, we found that a data set aggregated at company level is not appropriate to establish a robust and conservative benchmark. We were able to demonstrate that the aggregation of data on a company level already leads to an 'averaging out' of top performances with low performances. As a result, the baseline emission factor determined on company aggregates is likely to be less conservative than one that would use the data of individual production lines or production sites.

For the development of baselines and related monitoring schemes beyond the CDM, the SB framework offers a suitable building block. The SB must undergo an independent third party assessment and get accepted by the UNFCCC, bringing international recognition and acknowledgement to a NAMA/NMM baseline. However, in specific cases (i.e. if BAU emissions decrease over time), there are constraints for NAMA/NMM baseline development which cannot be covered by the current SB framework (e.g. approximation to SB benchmark over 10 years).

From this perspective, SBs should be as detailed as possible. However, the feasibility of the disintegrated approach is bound to the availability of data. Calculating combined emission factors from a larger set of indicators may prove more difficult or even impossible for other sectors. Consequently, the SB framework should not prescribe a specific level of integration. Yet it should provide guidance and make explicit the consequences of integration but ultimately leave it to the DNAs and project developers to define the level of integration as appropriate.

In order to enable DNAs to take an informed decision, it is necessary to provide them with the required information. The case study carried out under this research project can only be a first step in understanding the complexities of highly integrated production process with respect to developing a robust baseline emission factor.

As a follow-up we recommend to explore other sectors and under different socio-economic circumstances. Furthermore, we propose to investigate alternative approaches to determining additionality within the CDM SB framework. One way forward would be to explore the idea of 'semi-standardized' approaches in which positive lists of mitigation activities are determined for some sub-processes. Only for the remaining sub-processes where this is not feasible, project proponents would be obliged to demonstrate additionality using conventional tools.

Fortunately, the current SB framework is not set in stone. The SB guidelines are due for revision at the 81st meeting of the CDM Executive Board[3]. The draft revisions of the SB Guidelines – in fact the Secretariat and Meth Panel propose to convert the guideline into a standard – addresses some of the findings of this project (CDM Executive Board 2014b):

- The draft proposes a new approach to baseline and additionality thresholds. It foresees two different options. With the more stringent of the two approaches in terms of performance-penetration (i.e. 90 per cent threshold at which the baseline technology is determined) a positive list can be derived without testing for additionality by means of financial evaluation or barrier analysis in a second step. Alternatively, DNAs can choose to use a 70 per cent threshold and demonstrate additionality in a separate step as practiced under the current SB Guideline. While these provisions may reduce the complexity significantly and could open an avenue for automatic additionality also for the cement sector, the newly proposed approach is certainly less restrictive than the current provisions and therefore entails the potential of putting environmental integrity at risk. This decision should be taken with great care.
- We consider the newly introduced section on key considerations for DNAs very helpful. DNAs play a central role in the development of an SB as they are in charge of submitting the SB and have responsibility of the collection and adequate management of data.
- A great step forward is also the newly introduced definition of 'facilities' as a set of equipment and associated processes to provide the output for the sector. This classification falls in line with the recommendations derived from the cement sector case study to build the SB based on plant-specific data instead of firm-level data (see above).
- The proposed revisions provide further guidance on how to set the level of aggregation of the sector. Under the current framework, it is principally left open to DNAs to decide on the scope of the sector subject to the SB. The newly proposed approach requires DNAs to make adjustments to the level of aggregation if "significantly dissimilar performance exist among groups of facilities [...] because of differences in criteria such as production scale (or installed capacity) or age of the facilities." (UNFCCC 2014b) This addresses the issue of market concentration that we also have identified in the case study.

---

[3] At the time of writing this report, the results and decisions of EB 81 were still outstanding

1 Background

The unequitable distribution of CDM projects has been discussed for a long time. Least Developed Countries (LDCs), especially on the African continent, have been and still are underrepresented in the global distribution of the CDM pipeline. This was one of the reasons for the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol in Cancun 2010 (CMP6) to decided upon the introduction of Standardized Baseline and monitoring methodologies under the CDM. The decision was made „[n]oting that the use of standardized baselines could reduce transaction costs, enhance transparency, objectivity and predictability, facilitate access to the clean development mechanism, particularly with regard to underrepresented project types and regions, and scale up the abatement of greenhouse gas emissions, while ensuring environmental integrity“ (UNFCCC 2010).

Least developed countries, especially rural areas, are confronted with the fact that the vast majority of local population does not have access to electricity. The CDM in principle offers the possibility to provide for elements of such basic supply. However, developing the baseline based on historical emissions is not possible, as there are no historic emissions due to a lack of resources. Such a situation is referred to as 'Suppressed Demand'.

This is where the concept of suppressed demand comes into play for CDM projects in LDCs. The concept allows for crediting the abatement of emissions that would occur if a certain development took place. A minimum service level (MSL) is defined as a service level which meets basic human needs e.g. for lighting and electricity. This MSL is then considered as the baseline consumption level even if e.g. households do not have the financial capacities to realize the MSL in the business as usual scenario. Particularly in LDCs, Standardized Baselines that incorporate suppressed demand could therefore tap significant mitigation potential while improving the local population's livelihood.

Against this background, the German Emissions Trading Authority commissioned GFA Consulting Group and the Wuppertal Institute to conduct a research project ‚Using Standardized Baselines (CDM) for Achieving Climate Policy Goals in Developing Countries (suppressed demand)'. The project takes up research conducted in the context of yet another UBA project entitled ‚Implications of Standardized CDM Baselines for Least Developed Countries (LDCs) and their Use in National 'Measuring, Reporting and Verification (MRV)'-Systems' (FKZ 3712 41 502). One of the outcomes of that project was the desktop study 'Standardized Baselines and their Implications for a National Monitoring, Reporting and Verification System: A Case Study for Rural Electrification in Sub-Saharan Africa'.

This project builds on that study by taking the outcomes one step further: a concrete Standardized Baseline on rural electrification in Ethiopia was developed (work package 1) and the Ethiopian DNA was supported in the assessment as well as the submission to UNFCCC (work package 2). In work package 3, by contrast, the project team tested the current SB framework for the development of sectoral benchmarks. The performance penetration approach was assessed for covering the emissions of Indonesia's cement sector. As the emissions of the cement sector are rather complex (i.e. covered through four complementary CDM methodologies), this was found to be an appropriate testing ground for the performance penetration approach.

The different work packages are outlined in detail in the chapters below, chapter 2 taking up work packages 1 + 2, while chapter 3 describes work package 3. Chapter 4 summarizes the results and presents recommendations.

This assignment largely profited from the exchange and advice from other institutions/programs:

- The implementation of work packages 1 and 2 profited from a fruitful exchange with Perspectives Climate Change and UNEP Risø Centre for Climate and Energy including exchanges on the scope of the SB and GFA's participation in a workshop in Addis Ababa in May 2013. Moreover, the SB

development was implemented in consultation with the World Bank, which is developing a CDM Programme of Activities (PoA) for rural electrification in Ethiopia.
- Work package three aims at the drafting recommendations for the advancement of the Stanardized Baseline framework. Against this background, the preliminary findings were reviewed by the Standard Setting Unit of the UNFCCC Secretariat.

The study team is thankful for these exchanges and acknowledges the related inputs into the overall results of this assignment.

2 Developing a country-specific SB for rural electrification in Ethiopia

In the context of a previous study, 'Standardized Baselines and their Implications for a National Monitoring, Reporting and Verification System: A Case Study for Rural Electrification in Sub-Saharan Africa', the potential impacts of a generic SB for rural electrification were evaluated on a desk basis. The development of a country specific SB for rural electrification in Ethiopia, undertaken as part of this assignment, strongly builds on the findings of the previous study. In detail this includes work package 1 'Development of SB for rural electrification in Ethiopia' and work package 2 'Technical support to the DNA of Ethiopia in the development of an assessment report as well as the submission to UNFCCC'. The subsequent chapter discusses problems, achievements and lessons learned of both work packages jointly.

In order to amend the findings of the desk study to the circumstances of Ethiopia, two activities were conducted:

In May 2013, the Consultant participated in a workshop organized by Perspectives Climate Change and by the UNEP Risø Centre for Climate and Energy. This workshop served as platform to present the preliminary findings, consult and discuss with participants from East African host countries more general findings of the desk study (e.g. the impact of carbon finance on the cash flow of a rural electrification program, synergies between SB development and MRV). The needs and related costs for future updating of SBs was also stressed leading amongst other to a heated debate on whether DNAs should claim a fee on each CER issued by a project/programme making use of a SB.

In September, a second workshop was organized jointly by the Consultant and Ethiopia's Environmental Protection Agency (EPA) following the double objective to

- Familiarize the DNA and other stakeholders with the procedures of SB development, Quality Assurance/Quality Control (QA/QC), as well as to
- Gather and structure the knowledge and information available to adopt the SB to the circumstances of the host country.

Against this background, the second workshop focused on national key stakeholders such as the Environmental Protection Agency (EPA) of Ethiopia (hosting the Designated National Authority, DNA), the Ministry of Water and Energy (MoWE, hosting the Climate Resilient Clean Economy facility, CRGE, and the Rural Electrification Secretariat, RES), the national power utility, EEPCo, and the Development Bank of Ethiopia (DBE) which implements the rural electrification program funded by the World Bank (WB) and which acts as CDM Programme Managing Entity (CME) for the agreement with the WB's Carbon Finance Initiative for Development (CiDev). For the preparation of the workshop, bilateral meetings were conducted inter alia with all key stakeholders.

The combination of bilateral meetings with a joint workshop proved to be fruitful especially for gathering country specific data, such as national Net Calorific Values (NCVs), Emission Factors (EFs), national measurement results on lighting technologies lumen output and respective fuel consumption data, as well as a very comprehensive data set on the load factors of all diesel generators operated by EEPCo. These datasets were assessed and included into the draft SB with the exception on the load data for diesel generators, which, despite being very detailed, showed inconsistencies within one year of reporting and which did not match the requirements of the SB Guidelines (i.e. requiring a data set covering the most recent three years).

The above work steps lead to the development of an integrated SB document including a revised baseline, and QA/QC procedures. Moreover, the scope of the SB was extended to comprise the establishment of 'additionality' at the level of the SB. The was achieved using the 'Guidelines on the

Demonstration of Additionality of Small-Scale Project Activities' (Version 9.0, CDM EB68, Annex 27). These guidelines determine that the demonstration of additionality is not required, for a positive list of technologies and project types. The additionality guidelines stipulate that rural electrification activities are included in the positive list, if the rural electrification rate in the host country is less than 20%. Hence, the Consultant assessed the number of households supplied by EEPCo and national census data to determine Ethiopia's electrification rate at 8.97%. Based on this assessment, any CDM project or PoA applying the proposed SB will be deemed automatically additional.

Moreover, in the context of the September workshop, several consultations were conducted with DBE which shall act as CME for a CDM PoA for rural electrification, supported by CiDev. The CDM PoA development is conducted by the WB itself. The related findings were documented in a short summary 'The Rural Electrification Sector in Ethiopia'. Hence to support the application of the proposed SB, the Consultant established contact and updated the WB on all relevant developments throughout the implementation of this assignment. In this context, the WB kindly conducted a review of selected SB elements providing strong technical input.

The actual submission process was found to be time consuming and was facilitated by greatly appreciated interventions of the German Federal Environmental Agency, the German federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety and UNFCCC's Regional Cooperation Centre for East Africa. The actual submission process lasted from the completion of the SB development by 17th November 2013 to the 23rd June 2014 leading to substantial delays of the subsequent work steps.

We assume that this delay was related to some extent to local developments in Ethiopia. During this time period, Ethiopia's EPA was upgraded to the status of 'Ministry' becoming the 'Ministry of Environment and Forestry' (MoEF). In this context, the direct counterpart of this assignment quit the EPA leaving a capacity gap. Once this position was filled, the appointed head of the DNA reviewed, signed and submitted the proposed SB to UNFCCC.

The actual assessment was initiated by the DNA requesting the UNFCCC Secretariat to conduct the assessment itself in line with CDM EB63, A28, §14. As next step, the Secretariat conducted the completeness check. In the course of the check, two quick 'loops ' were conducted, facilitated by a conference call with a team of technical members of the Secretariat. This quick and efficient exchange with the Secretariat lead to the correction of issues which otherwise would have been raised under during the assessment phase and was completed by the 30th July 2014.

In course of the assessment, the Secretariat raised two minor issues which were submitted to the DNA by the 19th August 2014. Despite being a minor issue, one clarification request required information on the underlying methodology for measuring data on fuel consumption and lumen output for various technologies, collected by Ethiopia's MoWE. In the follow up, the MoWE, with technical support provided by the Consultant, drafted a methodology brief. The amended SB along with the methodology brief were re-submitted on the 18th October 2014 and lead to the successful completion of the assessment report by the 7th November 2014.

At the time of writing the Secretariat is preparing a recommendation which may lead to the approval of the proposed SB by UNFCCC.

3 Exploring Baseline Establishment in sectors with a wide range of mitigation options

Standardized Baselines remain one of the last frontiers at which the CDM is being advanced including with support from donors and other actors outside the UNFCCC Secretariat, the various CDM panels and working groups, and the CDM Executive Board. Most other 'construction sites' of the CDM do not receive as much attention as the CDM faces a lack of demand for CERs leading to a decline of CER prices at levels which barely allow for recovering CDM transaction costs. However, Standardized Baselines continue to receive attention, as many hope that sectoral approaches foster a transfer know how and instruments from the CDM into future climate change mitigation mechanisms.

The current framework allows for developing SBs along two approaches:

- A baseline may be established based on an approved CDM methodology or tool, or
- A baseline maybe established following the performance-penetration approach as stipulated in the SB Guidelines (CDM Executive Board 2011).

It is the latter approach that is of particular interest for many as it not only allows to establish a sector-wide benchmark emission factor (i.e. exceeding the scope of often case specific methodologies to cover the emissions of whole sectors) but in principal also allows for the development of a positive list of technologies/ fuels/ feedstocks that are automatically deemed additional.

First experiences are being gained with this approach. Currently there are two approved Standardized Baselines that make use of the performance-penetration approach: ASB0002 covers improved efficiency in charcoal production for consumption in households and small and medium enterprises in Uganda and ASB0004 covers the rice mill sector of Cambodia. Quite a few SBs that build on the SB Guidelines have been proposed. Almost all of these proposed and approved SBs have in common that they cover relatively simple production processes with homogeneous output. The only exemption to this is the proposed SB for clinker production in Ethiopia (PSB0002). In July 2012 this was only the second SB to be proposed. Apparently, the development of a robust SB was so complex and improvements so difficult that the SB was already re-submitted four times and is not approved by the UNFCCC. In fact, in the course of the review of the proposed SB, the Board realized that a new methodology had to be developed for the specific needs of the sector. Consequently, the EB asked the UNFCCC Secretariat in cooperation with the Meth Panel to develop this methodology in a top-down manner (CDM Executive Board 2014a).

These apparent difficulties correspond with the findings of an earlier research project sponsored by DEHSt (Hermwille et al. 2013). In a series of expert interviews most respondents expressed their doubts about the applicability or suitability of the performance-penetration approach for more complex industries. However, in most cases this concern was not based on first hand experience but rather on a general understanding of the SB Guidelines and their rich experience in the CDM.

The project team, in close consultation with the client, proposed to substantiate this issue by conducting a scoping study, further investigating the potential and the limits of the performance-penetration approach. The cement sector was chosen for two reasons. Firstly, it represents an extreme case in that the cement production process is a highly complex and highly integrated production process with a long list of options to increase efficiency and decrease emissions. The troublesome work on the clinker SB in Ethiopia exemplifies this. Secondly, substantial preliminary work had been carried out by one of the project partners (Burian et al. 2013) and detailed data was available allowing to run quantitative analyses.

At the very start of the research the project team met for a two day workshop in Hamburg at GFA Consulting Group head offices in order to brainstorm and conceptualise the layout of the study.

Luckily it became clear that it was necessary to develop a new concept in order to be able to section the integrated cement production process into its sub-processes to accommodate the wide range of different mitigation options in the sector. Paragraph 46 of the SB Guidelines gives some indication that it may be necessary to take into account information such as baseline fuel/ feedstock and its carbon emission factor and net calorific value, baseline technology particularly its specific fuel/ feedstock/ electricity consumption per its design and the grid emission factor of the electricity (CDM Executive Board 2011, §46).

In order to be able to unpack the integrated production process and derive and compare different options of calculating a benchmark emission factor, the concept of 'level of integration' was developed. The 'level of integration' is defined as the degree to which the production chain of the sector's final product (i.e. cement) is broken down into sub-processes. A fully integrated approach conceives a complex production process as one black box. The benchmark emission factor is solely calculated on the basis of one indicator, i.e. the total emissions per final output. An approach with a low level of integration, on the other hand, specifies separate performance indicators for sub-processes (e.g. the Clinker to Cement Ratio and the emissions per tonne clinker production) and calculate a combined benchmark emission factor on the basis of these performance indicators. Based on this concept three scenarios were developed representing full, medium and low integration for which to calculate benchmark emission factors.

The first important result of the study was to find that is feasible to break down the cement production process into sub-processes and calculate a combined benchmark emission factor on the basis of a series of indicators with reasonable effort. The benchmark emission factor for this scenario ('low level of integration') was based on the following indicators: The clinker to cement ratio, which covers the relation of clinker to cement and hence indirectly the overall emissions of one tonne of cement; the specific heat consumption in MJ/t clinker, which is based on the efficiency of the kiln; the emission factor of the kiln fuel mix in kg CO_2/GJ, which also accounts for the use of alternative fossil fuels and biomass and biomass residues; and the specific electricity consumption in kwh/t cement.

Subsequently the differences in the scenarios and the effect of decreasing the level of integration, i.e. breaking down the integrated production process in a larger number of sub-processes, were discussed. We found that theoretically, the less integrated approach would lead to more conservative results. In a fully integrated approach one company may perform well in one specific process, but may perform badly in others. The good performance in one sub-process is then compensated by the bad performance in other sub-processes. This will lead to a higher combined emission factor relatively to a low level of integration approach. Under this scenario different companies will lead each specific process and set the respective sub-benchmarks. The emission factor would be the sum of the best performers and hence will be lower than the integrated approach above.

However, due to a particularity of the Indonesian cement sector, we were not able to show this effect in practice. Apparently, one company is a top performer in all sub-processes of cement production and also contributes a significant share (21%) of the sectors total output. The only benchmark in which this particular company is not the top performer is the CO_2 emission factor of kiln fuel mix. In this benchmark the company comes second but due to the small production share of the top performer in this benchmark, it is again the same company that does set the baseline at an accumulated production share of 90 per cent. Consequently, all three approaches to calculate a combined benchmark emission factor produced identical results.

In addition to this core element of the study, we conducted sensitivity tests in order to assess the robustness of the performance-penetration approach to a couple of indicators. As the example of the analysis of different levels of integration indicates, the performance-penetration approach may be sensitive to the market concentration of the sector. We developed a hypothetical scenario which doubled the number of cement producers (18 instead of 9) but with identical average emission factors. Essentially, all firms were evenly split into two hypothetical firms, one performing ten per cent better than the actual firm and the other performing ten per cent worse. In doing so, we were able to show that the number of market participants (and their respective market shares) is highly important for the determination of the benchmark emission factor. Similarly, the level of aggregation – i.e. the scope of the sector that is subject to the SB – is highly important as it directly affects the market structure (number of participants and respective market shares).

Furthermore, the study discusses the possibility to develop a positive list of automatically additional technologies/ fuels/ feedstocks. Under the current guidance, we find that it is not feasible to develop such a list as the different mitigation options strongly interact. Any emission factor can be explained by a large number of different combinations of mitigation options as applied in the different sections of the production process. Given that some of these can also be introduced gradually (e.g. co-firing biomass), it is hard to imagine how one could argue that one combination of options is additional but not another. The complexity of interacting production options simply does not allow discussing additionality case by case as indicated in the SB Guidelines.

As SBs are supposed to allow to transfer the know how of the CDM into a wider range of mitigation instruments, we also discussed the applicability of SBs such as for the Indonesian cement sector for the development of NAMAs. We found that the performance-penetration approach produces very similar results as the benchmark based on the best available technology approach as used by the World Business Council for Sustainable Development’s Cement Sustainability Initiative.

Last but not least, we investigated the potential applicability of SBs for the cement sector in least developed countries (LDCs). Indonesia is a relatively advanced developing country and as such beyond the core interest of the wider research project. However, the availability of data and preliminary work by the project partners provided a precious opportunity to investigate the technical questions quantitatively and in great detail. However, our analysis shows that there is significant potential for the application of SBs in the African cement sector. The data suggests that the markets of Algeria, Morocco, Nigeria, South Africa, Tunisia, Kenya, Ghana and Libya deserve a closer look. With regards to LDCs the prospects are less favourable. Our first rough analysis suggests that only Senegal, Ethiopia and Togo bear sufficient potential to justify the investments necessary to establish a standardized baseline.

4 Conclusion and Recommendations

This research project dealt with Standardized Baselines in two different areas, i.e. by developing and supporting the approval process of an SB, and by road-testing the SB guideline approach using a theoretical example. The combination of practical experiences and desktop work yielded several insights for further developing the concept. These will be laid out in the following.

Lessons learnt from developing and supporting the approval process of an SB

The SB Guidelines and Procedures were tested using the development of a SB for rural electrification in Ethiopia as a test case. Combining the SB framework with the Guidelines for the consideration of suppressed demand allowed for establishing a SB with emission factors above the default emission factors included in the highly standardized Small Scale methodology AMS I.L. This lead to the adoption of the methodology to the circumstances of a Ethiopia. The results were found to involve higher baseline emission compared to the standard setup, as stipulated in AMS I.L while ensuring environmental integrity.

To achieve such an adoption, good access to Tier 2 data[4] is considered to be essential. Such data is likely to be gathered and managed by various institutions in the host country. Hence, similar to the development of National Communications or Biennial Update Reports, it is important for SB development that national climate change focal points are well-linked with various other institutions such as national power companies. This process may be further supported by national consultation workshops.

Since the establishment of the CDM in 2001, the vast majority of host countries established procedures for assessing CDM projects' contribution to the sustainable development of the host country and for approving CDM projects. The concept of Standardized Baselines, however, is comparably new and many DNAs may not have a clear mandate for assessing, approving and submitting SBs to the UNFCCC.

It is therefore recommended that future SBs are developed in close consultations with the respective DNA, starting at the earliest point of time. Furthermore, DNAs should be encouraged to develop internal procedures for the submission of SBs to UNFCCC. This might require related technical support, as needed.

Recommendations with respect to further developing the SB guidelines

In the case study for an SB for the Indonesian cement sector, we have shown that a highly detailed approach with a series of sub-benchmarks is feasible and that it leads to a more conservative baseline emission factor than a fully integrated approach. In the case under consideration, due to the particular configuration of the Indonesian power sector, it was not possible to demonstrate this theoretical advantage in practice. The Indonesian power sector is dominated by one very efficient firm that contributes more than 20 per cent of the total output of the sector.

However, this particularity may, in fact, be not as particular as it seems at first sight. Experience with other SBs (e.g. ASB0004 "Technology switch in the rice mill sector of Cambodia") suggests that dominance by one or a small number of firms may be a common feature in many emerging industrial sectors in developing countries. Developing a coherent sector-wide benchmark emission factor may

[4] Tier 2 data is an IPCC quality standard for GHG relevant data (i.e. fuel consumption and emission factors) with a medium level of complexity and may refer to e.g. country specific net calorific values, oxidation factors, or emission factors for e.g. kerosene (as used in the SB for rural electrification).

be problematic in cases in which emerging industrial-scale production competes with manufacturing in traditional small-scale enterprises in one and the same sector.

Usually, modern large-scale industries dramatically outperform traditional labour-intensive small-scale manufacturing in terms of efficiency. Still, these manufacturing processes might provide income to thousands of people and therefore are important to the host country's economy. Covering these two by one SB would most likely result in an emission benchmark that is impossible to achieve for small-scale activities and would thus rule out any CDM activity for that part of the sector. Disaggregating the sector based on the a) age of facilities, b) production capacities or c) ownership structures is therefore recommended. This would ensure appropriate incentive structures also for the less performing market players while ensuring environmental integrity.

Apart from being the most conservative approach, there are other advantages of a more detailed, disintegrated approach:

- It allows for a more detailed assessment of the sector as well as of each company's performance. The various sub-benchmarks can help cement producers and policy makers alike to identify in which sub-processes the highest mitigation potentials remain. This supports making informed investment decisions and facilitates the development and monitoring of tailor-made policies.
- The increased level of detail of such an approach also expands the usability of the SB concept for other instruments. A highly detailed benchmark may prove a more valuable resource for applications such as the NMM or NAMAs than a fully integrated one.
- In a completely integrated SB, automated additionality may be difficult to establish. With a larger set of sub-benchmarks there could be the basis for a 'semi-standardized' approach to additionality demonstration in which positive lists of technologies/fuels/feedstock are established for some sub-processes while the requirements for project proponents to demonstrate additionality would be limited to those processes where a sectoral approach to additionality demonstration is not feasible.

With respect to the data that was used for the study, we found that a data set aggregated at company level is not appropriate to establish a robust and conservative benchmark. We were able to demonstrate that the aggregation of data on a company level already leads to an 'averaging out' of top performances with low performances. As a result, the baseline emission factor determined on company aggregates is likely to be less conservative than one that would use the data of individual production lines or production sites.

For the development of baselines and related monitoring schemes beyond the CDM, the SB framework offers a suitable building block. The SB must undergo an independent third party assessment and get accepted by the UNFCCC, bringing international recognition and acknowledgement to a NAMA/NMM baseline. However, in specific cases (i.e. if BAU emissions decrease over time), there are constraints for NAMA/NMM baseline development which cannot be covered by the current SB framework (e.g. approximation to SB benchmark over 10 years).

From this perspective, SBs should be as detailed as possible. However, the feasibility of the disintegrated approach is bound to the availability of data. Calculating combined emission factors from a larger set of indicators may prove more difficult or even impossible for other sectors. Consequently, the SB framework should not prescribe a specific level of integration. Yet it should provide guidance and make explicit the consequences of integration but ultimately leave it to the DNAs and project developers to define the level of integration as appropriate.

In order to enable DNAs to take an informed decision, it is necessary to provide them with the required information. The case study carried out under this research project can only be a first step in understanding the complexities of highly integrated production process with respect to developing a robust baseline emission factor.

As a follow-up we recommend to explore other sectors and under different socio-economic circumstances. Furthermore, we propose to investigate alternative approaches to determining additionality within the CDM SB framework, as we found that the technology-specific approach stipulated in the current SB Guidelines is not feasible in complex production processes. One way forward would be to explore the idea of 'semi-standardized' approaches in which positive lists of mitigation activities are determined for some sub-processes. Only for the remaining sub-processes where this is not feasible, project proponents would be obliged to demonstrate additionality using conventional tools.

Fortunately, the current SB framework is not set in stone. Quite the contrary, it is work in progress and with first practical experiences being made, the SB guidelines are due for revision at the 81st meeting of the CDM Executive Board[5]. The draft revisions of the SB Guidelines – in fact the Secretariat and Meth Panel propose to convert the guideline into a standard – addresses some of the findings of this project (CDM Executive Board 2014b):

- The draft proposes a new approach to baseline and additionality thresholds. It foresees two different options. With the more stringent of the two approaches in terms of performance-penetration (i.e. 90 per cent threshold at which the baseline technology is determined) a positive list can be derived without testing for additionality by means of financial evaluation or barrier analysis in a second step. Alternatively, DNAs can choose to use a 70 per cent threshold and demonstrate additionality in a separate step as practiced under the current SB Guideline. While these provisions may reduce the complexity significantly and could open an avenue for automatic additionality also for the cement sector, the newly proposed approach is certainly less restrictive than the current provisions and therefore entails the potential of putting environmental integrity at risk. Whether or not this move towards a more feasible but less stringent approach can be justified is ultimately a political rather than a technical question. This decision should be taken with great care.
- We consider the newly introduced section on key considerations for DNAs very helpful. DNAs play a central role in the development of an SB as they are in charge of submitting the SB and have responsibility of the collection and adequate management of data. The new section will aid DNAs and provide orientation in the political process of prioritizing and tailoring the SB to meet these priorities.
- A great step forward is also the newly introduced definition of 'facilities' as a set of equipment and associated processes to provide the output for the sector. This classification falls in line with the recommendations derived from the cement sector case study to build the SB based on plant-specific data instead of firm-level data (see above).
- Last but not least, the proposed revisions provide further guidance on how to set the level of aggregation of the sector. Under the current framework, it is principally left open to DNAs to decide on the scope of the sector subject to the SB. The newly proposed approach is framed requires DNAs to make adjustments to the level of aggregation if "significantly dissimilar performance exist among groups of facilities [...] because of differences in criteria such as production scale (or installed capacity) or age of the facilities." (UNFCCC 2014b) This addresses the issue of market concentration that we also have identified in the case study.

[5] At the time of writing this report, the results and decisions of EB 81 were still outstanding

The proposed revisions of the SB Guideline take into account some of the most important conclusions of our previous research and represent in the view of the project team a significant improvement over the existing regulations. What is still lacking is clearer guidance on how to deal with complex integrated production processes. The concept of 'level of integration' as developed in this research project could provide a vantage point to further elaborate the SB framework.

References

CDM Executive Board (2014a): Concept note: Top-down development of standardized baselines. EB78, Annex 7. Available online at https://cdm.unfccc.int/filestorage/R/2/Q/R2QXP8KJOWSUI0GLC1AZTNEF4V6573/eb78_propan07.pdf?t=ak18bmZjZnE3fDB8aIuSKzZjoSyNcdRIXqeR [accessed 20 November 2014].

CDM Executive Board (2014b): Revision of guidelines for establishment of sector-specific standardized baselines. Document CDM-EB81-AA-A05. Available online at http://cdm.unfccc.int/filestorage/W/T/M/WTMY0QHJ2IPAD4L8B5VC69XS7ZE3UG/eb81_propan05.pdf?t=VEl8bmZqcTF3fDBHIlKCbz_8dXzTwE1frjvV [accessed 24 November 2014].

CDM Executive Board (2012): Guidelines on the Demonstration of Addionality of Small-Scale Project Activities. EB68, Annex 27. Available online at https://cdm.unfccc.int/filestorage/c/p/I5FZTH0DK3O2QLA1VRWU9X7SE6MBY8.pdf/eb68_repan27.pdf?t=djV8bmZwZzllfDCOMxjaxV3l3Cf_ZaOrIHDH [accessed 20 November 2014]

CDM Executive Board (2011): Guidelines for the Establishment of sector specific Standardized Baselines – Version 2.

Hermwille, L., Arens, C., & Burian, M. (2013): *Recommendations on the Advancement of the CDM Standardized Baselines Framework*. Berlin: DEHSt.

Burian, M., Haake, F., Widowati, L., Janssen, J., Berndt, K., et al. (2013): *Policy Advice for Environment and Climate Change (PAKLIM) – Component 3 – Greenhouse Gas Mitigation and Energy Efficiency in Industry and industrial Estates*. Hamburg.

UNFCCC (2010): Decision 3/CMP.6– Further Guidance relating to the clean development mechanism. FCCC/KP/CMP/2010/12/Add.2. Available at: http://unfccc.int/resource/docs/2010/cmp6/ eng/12a02.pdf#page=2