BENCHMARKING IN THE EU

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LESSONS FROM THE EU EMISSIONS TRADING SYSTEM FOR THE GLOBAL CLIMATE CHANGE AGENDA

CEPS TASK FORCE REPORT

CHAIR: ANNA TÖRNER
Head of Section, Ministry of Enterprise, Energy and Communications, Sweden

RAPPORTEURS: CHRISTIAN EGENHOFER
Senior Research Fellow, CEPS

ANTON GEORGIEV
Research Fellow, CEPS

ADVISORY CONTRIBUTOR: HUBERT VAN DEN BERGH
Former Head of the Flemish Verification Office

CENTRE FOR EUROPEAN POLICY STUDIES
BRUSSELS

This report is based on discussions in the CEPS Task Force on "Benchmarking for the EU ETS and Beyond". The Task Force met several times over a concentrated period from June to November 2009. Participants in this CEPS Task Force included senior executives from a broad range of industries – involving energy production and supply companies along with energy-intensive industries – and representatives from business associations and non-governmental environmental organisations. A list of members and invited guests and speakers appears in appendix 2.

The members of the Task Force engaged in extensive debates in the course of several meetings and submitted comments on earlier drafts of this report. Its contents reflect the general tone and direction of the discussion, but its recommendations do not necessarily reflect a full common position agreed by all members of the Task Force, nor do they necessarily represent the views of the institutions to which the members belong.

The report would not have been possible without the solid support of a number of individuals and organisations. The rapporteurs especially wish to thank Task Force Chair Anna Törner for her commitment to this endeavour. Gratitude is also extended to Hubert van den Bergh, who contributed valuable research to the report. Appreciation is furthermore expressed to all the Task Force members, guests and speakers for excellent feedback, contributions and documentation, which have enriched the report. Finally, CEPS wishes to acknowledge the generous support of the European Climate Foundation, which has been instrumental in the launch of this Task Force.

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Centre for European Policy Studies
Place du Congrès 1, B-1000 Brussels
Tel: (32.2) 229.39.11 Fax: (32.2) 219.41.51
E-mail: info@ceps.eu
Website: http://www.ceps.eu

CONTENTS

List of Boxes

PREFACE

The EU emissions trading system (EU ETS) is the flagship climate policy tool of the EU. The objective of the EU ETS cap-and-trade system has been to create incentives for companies to reduce emissions in the most cost-effective way, to reward carbon-efficiency and to create incentives for new and innovative approaches to reduce emissions.

The new ETS Directive, applying from 2013, has set auctioning as a default allocation method. For industry, the Directive foresees transitional free allocation based on *ex ante* benchmarks, where possible, which will be phased out for sectors not exposed to carbon leakage in steps by 2027. Benchmarking as an allocation methodology has been chosen to avoid the perverse effects of grandfathering and because it has the potential to ensure a non-distorted carbon price signal, to reward early action and more generally carbon efficiency. Thus, benchmarks per se do not offer incentives to improve performance; it is ultimately the carbon price under the EU ETS that will determine the level of the incentive to improve performance.

In parallel with the Swedish presidency, it has been my privilege over the past six months to chair the CEPS Task Force on "Benchmarking for the EU ETS and Beyond" with a view to providing key messages and policy recommendations, first to the European Commission, then to the European Parliament and the Council of Ministers and also to a wider range of international stakeholders. The work has been made possible thanks to the members of the Task Force, including a wide range of business, industry, research and environmental NGOs, who gave their expertise and time, presenting the viewpoints of different interests. The Task Force is particularly indebted to Hubert van den Bergh, who by contributing his practical experience with the Dutch and Flemish energy-efficiency benchmarking covenants, set the scene for the Task Force discussions. I would also like to thank the European Commission, Ecofys, member state officials and industry representatives who generously shared their expertise and reflections, and through their contributions and advice, helped us to remain focused on what soon became a rapidly emerging agenda. Last but not least, we were fortunate enough to be able to rely on CEPS' support throughout the Task Force.

This CEPS Task Force Report is intended as a description of benchmarks and benchmarking, outlining previous experiences and lessons learned for the development of the product benchmarks under the EU ETS for its third phase. While proposing a number of key principles to which benchmarks and benchmarked-based allocation should adhere, the CEPS Task Force also identified several recommendations crucial to the European Commission's future work.

Discussions were always rich, the debate was at times intense and I believe that this Task Force has made a constructive contribution to the important work on establishing product benchmarks under the EU ETS and possibly to other international equivalents.

Anna Törner
Chair of the CEPS Task Force
Head of Section, Ministry of Enterprise, Energy and Communications, Sweden

EXECUTIVE SUMMARY

The revised EU Emissions Trading (EU ETS) Directive (2009/29/EC amending Directive 2003/87/EC) grants transitional free allocation to the industrial sector to address competitiveness questions. This has created a challenge for EU policy-makers to design a system whereby such free allocation can be implemented in a way compatible with the EU's single market and the EU's objective to achieve targets for greenhouse gas (GHG) emission reductions in the most efficient way. The revised ETS Directive has thus chosen *ex ante* benchmarks. While to date most of the focus in the EU has been on benchmark-based allocation, it has revived the interest in benchmarks more generally. In particular, it has heightened awareness of and identified lessons from previous benchmarking experiences in the EU and member states, which are considerable.

The development of benchmarks and benchmarking offers more possibilities than being just a tool for allocation under an emissions trading system. Allocation is only one – even a small – yet politically very contentious and currently most immediate application. Therefore, this CEPS Task Force report gives the principal attention to how to identify and use benchmarks. It takes a broad approach and examines the potential merits of benchmarks and benchmarking *both* for managing the transition to a low-carbon economy in national climate-change strategies *and* for the provisions of a global climate-change agreement. The latter describes the potential of benchmarks for deepening and accelerating climate change mitigation, i.e. leading to real reductions here and now, even in the absence of a comprehensive, legally binding agreement at the global level, which will eventually be required.

Finally, it must not be forgotten that benchmarks under the EU ETS per se do not offer incentives to improve performance; it is ultimately the carbon price that will determine the level of incentive to improve performance.

I. Key messages

General

1) Benchmarking is a very broad concept that has been used for a variety of purposes in different applications. Traditionally,

benchmarking processes have been tools for judging and improving industry performance. A 'benchmark' is a performance measure based on agreed and verified parameters (e.g. sector boundary, performance indicators),[1] not necessarily at the highest level of performance. 'Benchmarking' applies this benchmark to a particular purpose with the allocation of free emission rights being but one. Other possibilities for benchmarking in the context of climate change policies are its use as a regulatory scheme to set (industry) performance targets; to define (sectoral or national) GHG emission caps in a bottom-up fashion; to judge the national, EU-wide or international 'comparability' of sector efforts (both intra- and inter-sectoral); to establish the level of carbon credits that are granted under the flexible mechanisms of the Kyoto Protocol and/or of the new post-2012 period; and to calculate the carbon content of products (e.g. for carbon footprinting). Historically, numerous sectors (e.g. refining, aluminium, cement, steel and power) have used benchmarks for evaluating and comparing the performance of installations with the aim of improving such performance or that of the overall sector, or both. While companies seem to appreciate that the use of benchmarks enhances performance, independent analysis of the effectiveness of benchmarking in helping to reduce GHG emissions and overall sector performance is, however, limited if at all available.

2) Preconditions for developing benchmarks are the availability of common definitions, reliable data (including on historical production), good measurement and verification systems. Good benchmarks will require considerable efforts by all stakeholders, and in the end acceptability, as access to industry data is critical. Efforts to develop benchmarks are more likely to be successful if benchmarking is deemed crucial to achieve a political or industry objective, if it adds value or is politically relevant and if the benchmarks are developed in a practical and pragmatic way.

   Benchmarks may be derived from different sources. Those derived from arbitrary targets or the literature are easier to construct but tend to be unreliable and non-transparent. In addition, they often use

[1] Typical performance indicators are profitability, safety records and resource efficiency.

margins. Benchmarks based on calculations and practical measurements are preferable but their identification requires the most effort and can incur potentially high costs for those engaged in identifying them. The costs can be broken down into three categories: i) those related to defining the benchmark, ii) those related to data collection and iii) the running costs for measurement, reporting and verification (MRV). The most significant costs are the running costs for MRV of greenhouse gas emissions; however, these costs would generally also arise under the ETS and any other GHG regulation. Costs for data collection, which in some cases can be significant too, and for defining a benchmark, are directly related to benchmarking. The latter costs tend to be small compared with running costs and the costs for data collection. The revised EU ETS Directive foresees that benchmarks are based on products, i.e. a specific performance per unit of output, to maximise incentives for greenhouse gas reductions through each production process of the sector. The complexity of establishing a benchmark typically increases if the same products are made by different raw materials or if processes produce more than one product, in some cases requiring benchmarks for intermediate products. Benchmarks are easier if they are based solely on direct emissions.

EU benchmark-based allocation

The revised ETS Directive prescribes EU-wide *ex ante* benchmarks for transitional free allocation, "to the extent feasible" (European Parliament and Council of the European Union, 2009, p. 73). The starting point is the average of the 10% most efficient installations in sectors or sub-sectors, calculated on products. Benchmarks shall take into account "the most efficient techniques, substitutes, alternative production processes, high efficiency cogeneration, efficient energy recovery of waste gases, use of biomass and capture and storage of CO_2, where such facilities are available" (European Parliament and Council of the European Union, 2009, p. 73). In areas where benchmarks are not feasible, a combination of generic, so-called 'fallback approaches' – such as a benchmark for combustion processes and grandfathering for process emissions – will have to be applied.

The amount of free allowances per installation is intended to be established by multiplying the benchmark by the historical average production – currently being discussed is the period of either 2005–07 or 2005–08 – while the maximum total free allocation for industry is set at the industry's share of the total cap based on emissions in 2005–07. The maximum number of free allowances will decline annually in line with the decline of the emissions ceiling (the 'linear factor') by 21% between 2005 and 2020. A "uniform and cross-sectoral correction factor" (European Parliament and Council of the European Union, 2009, p. 73) will be applied if the allowances based on the benchmarks multiplied by the production factor, plus the other free allowances for industry based on fallback approaches, exceed the cap. According to the revised ETS Directive, free allocation ends in 2027 at the latest.

3) The ongoing preparation (Ecofys et al., 2009a) of benchmarks for the EU ETS has delivered a number of practical principles relating to technology and correction factors, the number of benchmarks and the relationship between energy efficiency and carbon dioxide (CO_2) performance. This Task Force has identified 'ground rules', such as to i) ensure (environmental) effectiveness, ii) incentivise GHG and energy efficiency, and iii) avoid damaging competitiveness. In addition, more operational ones have been identified, such as iv) equal treatment of all sectors, v) equal treatment of all installations in a (sub-)sector, vi) transparency (to non-specialists as well), and finally vii) practical and pragmatic (not perfect) approaches to reduce administrative complexity and minimise cost. An overall objective of the development of benchmarks is avoiding distortions to competition in the EU internal market.

4) The development of benchmarks and the benchmarking process has distributional impacts compared with the existing, predominant allocation methodology (i.e. historical grandfathering). Decisions on sector boundaries or the choice of product for the application of benchmarks could benefit some installations or companies within a sector over others, e.g. by rewarding early action, but could also restrict reduction possibilities. At the same time, the setting of the benchmark determines the total number of allowances a sector receives and how this compares with other sectors. The formulation of and adherence to *ex ante* agreed principles to guide the development and application of benchmarks is likely to be required to ensure acceptability, because it will allow stakeholders to test the benchmarks and their application against the agreed principles.

5) The revised ETS Directive provides that benchmarks for products are developed, in principle, based on data from all installations. This reflects the fact that the exclusion of installations has a significant impact on the level of the benchmark and should therefore only be applied in exceptional circumstances.

6) There are just a few key sectors or sub-sectors where benchmarks are difficult to develop. Initial estimates for the EU show that, with 50 to 60 benchmarks, 85% of the emissions in EU ETS installations that are eligible for free allocation can be covered.

7) Competitiveness is addressed in the revised ETS Directive through the free allocation of allowances (up to the benchmark). *Ex ante* benchmark-based allocation in the EU is a means to allow free allocation to take place. The *ex ante* benchmark-based allocation will not necessarily stop any change in production patterns. Yet, it is a way to offset the increased costs for industry and may act as an incentive to continue producing in the EU during the period covered. Still, there is no guarantee that the revenues from free allocation will be invested in EU installations.

8) Benchmarking for the purpose of allocation requires both a benchmark and an activity rate, by which the benchmark would need to be multiplied in order to establish the total number of allowances to be granted. The use of verified historical production levels reduces the possibility of over-allocation by avoiding projections and allowing the allocation of allowances to installations to be set in advance, except in cases where production becomes drastically lower than the historical reference, e.g. as a result of an economic crisis.

9) In the absence of full auctioning of allowances, the allocation to an operator based on a benchmark can define the incentives for emission reductions. Once the benchmarks are known, any future changes to the allocation will be the result of possible modifications to the cap as a consequence of an international agreement or to changes in the rules on closures and new entrants.

10) The availability of robust and verified data, including production data, does not appear to be an issue that would prevent EU allocation by benchmarks, largely thanks to the EU ETS always having required accurate monitoring, reporting and verification.

II. Recommendations

The experience of benchmarking in the current EU ETS trading period shows that benchmarking is a feasible and useful allocation tool. The first estimations following the EU ETS benchmarking exercise indicate that, with a limited number of benchmarks, a large amount of emissions can be covered. Emissions that cannot be covered by benchmarks need to be subject to fallback approaches. Against this background, this CEPS Task Force has formulated the following recommendations:

1) The development of benchmarks must be tailored to their application, such as allocation, crediting under flexible mechanisms or the comparability of industry performance.
2) The EU should take a practical and pragmatic approach to benchmark-based allocation in a collaborative manner with stakeholders, to allow for rapid and efficient implementation from both an environmental and economic perspective.
3) Benchmarking should provide incentives to reduce GHG intensity through technology and fuel neutrality; there should be no differentiation between old and new plants, or correction factors for plant age, size, raw material quality or climate circumstances.
4) Where a fallback methodology is used for allocation instead of a benchmark, it must be fully transparent – also to the non-specialist. Furthermore, fallback options must be fair and stringent, and should not result in any undue disadvantage to any of the sectors covered by the ETS.
5) Exclusions of installations from benchmarks (and thereby the benchmark curve) should be minimised and should only be accepted against pre-determined and transparent criteria.
6) Benchmarks for more than one product in a sector should be considered if this offers the possibility to achieve significant, additional GHG reductions.
7) The EU should use its experience with the ETS benchmark-based allocations to inform benchmarking efforts in other countries, especially within the context of international climate-change negotiations, e.g. a reformed Clean Development Mechanism or sectoral crediting.

INTRODUCTION & BACKGROUND

The new EU Emissions Trading Scheme (ETS) Directive[2] has set auctioning as a default allocation method. As of 2013, 100% of allowances are to be auctioned in the power sector, although limited and optional derogations are available for the 10 new member states.[3] For industry, the Directive foresees transitional free allocation based on *ex ante* benchmarks, where possible, which will be phased out for sectors not exposed to carbon leakage in steps by 2027 (starting at 80% in 2013 and decreasing to 30% in 2020). There will be 100% free allocation up until 2020 for the exposed sectors that were identified by the European Commission in September 2009.

Free allocation will be based on benchmarks, determined *ex ante* at least where possible. Allocation will also be determined *ex ante* (i.e. no *ex post* adjustment for actual or recent production except in cases of closures and partially ceased production, yet to be defined). The performance curve from which the benchmark will be derived must take into account among other factors the most efficient techniques, high efficiency cogeneration, efficient energy use of waste gases, and carbon capture and storage (CCS). The starting point is the average of the 10% most efficient installations in sectors or sub-sectors, in terms of greenhouse gases (GHGs). In areas where

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[2] See Directive No. 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community, OJ L 140/63, 05.06.2009; see also the article "EU ETS post-2012" on the European Commission's website, last updated 23.03.2010 (http://ec.europa.eu/environment/climat/emission/ets_post2012_en.htm).

[3] Derogations are linked to the requirement to modernise the electricity sector and subject to *ex ante* approval by the European Commission.

benchmarks are not feasible, there is a need for a generic approach such as grandfathering, an efficiency improvement factor or a benchmark for combustion processes. The amount of free allowances per installation is intended to be established by multiplying the benchmarks by the historical average production, for example for the period 2005–07, whereby the maximum total free allocation for industry is set at the industry's share in the total cap based on emissions in that period. The maximum number of free allowances will decline annually in line with the decline of the emissions cap (by 21% between 2005 and 2020). A uniform correction factor will be applied if the allowances based on the benchmarks multiplied by the production factor exceed the cap.

In addition, the European Commission, led by the Directorate-General (DG) for Competition, is revising the EU's state aid guidelines to define the maximum level of financial support allowed by member states in favour of those sectors determined to be exposed to a significant risk of carbon leakage owing to indirect costs, as foreseen in the Directive. The level of support is equally established on the basis of *ex ante* benchmarks, the most efficient available technologies and the relevant European electricity production mix.

To ensure technical or other input by the relevant sectors and stakeholders, the European Commission has been undertaking numerous stakeholder meetings and bilateral consultations to ensure transparent and effective consultation. In addition, the European Commission has contracted a consultant (Ecofys et al., 2009a) to assist in designing the allocation rules for free allocation for all relevant activities and to assess (additional) data requirements. The Directive requires the allocation methodologies and by extension the benchmarks to be adopted before the end of 2010.

Benchmarking can be a tool that goes beyond allocation alone. Benchmarking processes have traditionally been tools for judging and improving performance in industry. Benchmarking and ranking exercises in refining and other industries have proven to be able to enhance the 'price' signal, which in many instances has allowed a situation to persist where (sometimes large) differences in performance have continued to exist. Ranking can point to these differentials, inducing (self-interested) actions by industry. Benchmarking also offers a possibility to inform EU and member state industrial policy (e.g. give indications of performance, potential and technological challenges).

Internationally, benchmarking is likely to become increasingly important.

- While countries such as the US, Australia or Japan develop cap-and-trade systems, initial allocation – such as in the EU – is likely to be for free. It is argued that benchmarking offers the prospect of fairness, effectiveness and efficiency. Existing experiences with benchmarking in Japan, the EU and member states could prove valuable for policy design in other countries.
- Benchmarks are likely to become useful tools for managing the transition to a low-carbon economy by, for example, helping industry to identify technology or performance opportunities, or providing information on best practice and how to achieve it. The Asia-Pacific Partnership has been focusing on this in a limited number of countries. Increasingly, emerging economies are interested in benchmarks for their domestic climate-change and low-carbon development strategies. Benchmarks can work even in the absence of a carbon price. Improved performance can reduce GHG emissions and energy consumption and therefore has a low payback period from the perspective of both a company and a government.
- At the level of international climate-change negotiations, there are equally numerous areas where benchmarks may play a role. To name but some, sectoral crediting, the sectoral Clean Development Mechanism (CDM), the development of monitoring, reporting and verification rules and standards, the comparability of effort among parties, the comparability of efforts among sectors or the setting of party or sector caps.

Benchmarks can create transparency, reinforce predictability and possibly allow for 'transposability' from an industry in one country to another. Ultimately, benchmarking could prove to be an asset for the global climate-change agenda while being beneficial for (well-performing) industry, especially in the absence of a robust carbon price signal. There might even be a possibility to 'transfer' the EU or parts of the EU benchmarking exercise internationally.

Against this background, the EU ETS benchmarking exercise has additional importance beyond allocation; 'getting it right', i.e. developing benchmarks in a pragmatic, practical and fair way within this very tight time frame could be crucial to how benchmarks will be perceived within the EU and externally.

This CEPS Task Force Report addresses EU-specific questions as well as issues that are relevant to the global discussions. Written for a non-specialist audience, it simultaneously attempts to clarify what benchmarks are and what potential they hold for both the domestic and international discussions. It includes definitions and a description of historical experiences. Central to the report, however, are the EU-specific questions related to EU ETS benchmark-based allocation.

Chapter 1 presents definitions, reviews the history of benchmarks and draws some tentative lessons for the EU ETS. It also forms an introduction to benchmarking for non-experts.

Chapter 2 analyses in some depth a selection of the principal controversial topics that are currently being debated among the EU, member states and stakeholders. Topics include i) principles, ii) identification of the 10% most efficient, iii) competitiveness, iv) intra-sectoral product substitutability, v) design options to incentivise GHG reductions, vi) benchmarks and technology development, vii) market visibility, viii) inter-sectoral allocation issues, and ix) data collection and measurement systems.

Chapter 3 briefly reviews existing initiatives outside the EU and Europe before chapter 4 offers short concluding remarks.

The report is completed with a number of boxes and appendices. For more technical analysis it often makes reference to the analysis of Ecofys et al. (2009a, 2009b, 2009c, 2009d and 2009e).

1. BENCHMARKS AND BENCHMARKING: DEFINITIONS AND EXPERIENCES

Benchmarks and benchmarking are widely used terms in many different circumstances, entailing some sort of comparison of performance based on agreed indicators. Typically this leads to some form of ranking or scoreboards. Such benchmarking can be used to assess the performance of governments (national, regional, local, agencies or government services), within industry to compare the performance of different business divisions or between companies and installations. Therefore, indicators may be as diverse as profitability, human resource satisfaction and the number of accidents, as well as energy and resource efficiency and emissions per unit of output – the subject matter of this report.

1.1 Application of benchmarks

This report understands benchmarking broadly as the 'comparison of the performance of industry' against an agreed set of indicators. There is a 30-year history of industrial benchmarking, starting in the US refining sector, which has led to the development of the Solomon index (see Box 1.1). The origins of benchmarking, i.e. the Solomon index, involve a data comparison of large processes (costs, production efficiency, maintenance and energy consumption) as a tool for evaluating installations in an economic way. This evaluation, while respecting confidentiality, is expressed in a ranking that allows an objective comparison, because it is based on agreed criteria. Typically, a recognised international consultant collects data from all the participating industries, using a validated method. This comparison has been designed as a tool for managers for taking business and investment decisions. Soon after the refinery work, Solomon also developed benchmarking for crackers. Other benchmark consultants exist, such as

Phillip Townsend Associates Inc., Plant Surveys International and the Process Design Center.

Although not a benchmark programme, the "Getting the Numbers Right" (GNR) work under the Cement Sustainability Initiative (CSI) of the World Business Council for Sustainable Development (WBCSD) is a similar exercise. It collects data on agreed parameters that would eventually allow evaluation of the performance of installations both within a continent and between continents, yet respecting confidentiality.

Benchmarking is also being undertaken by the International Aluminium Institute (IAI) for a number of key indicators such as safety, energy use or GHG emissions. The performance of all the reporting installations is plotted against the performance of all other (de-identified) installations in the same class. In this way, installations can see the current best level of performance they could achieve. This allows installations to be compared with the best performers. At industry level, it is hoped that industry improves its collective performance through the sharing of information among peers, while maintaining the confidentiality of facility data.

Box 1.1 The Solomon index

CONCAWE, a European association of oil companies, started working in 2008 on behalf of the European refining sectors on a methodology to characterise refinery CO_2 emissions in anticipation of the finalisation of the ETS Directive. Refiners have experience with Solomon Associates for more than 25 years, so CONCAWE naturally turned to them to adapt their existing energy and CO_2 emission measures to the needs of the ETS Directive. Below is a brief history of the Solomon experience.

HSB Solomon Associates LLC (Solomon) conducted its first *Fuels Refinery Performance Analysis (Fuels Study)* of approximately 45 US refineries in 1980. Study participation and the resulting database have grown substantially since then. Solomon now conducts the *Fuels Study* on a regional basis, with separate studies for the following areas:

- North and South America
- Europe, Africa, and the Middle East
- Asia/Pacific/Indian Ocean

More than 350 refineries, which make up approximately 85% of worldwide capacity, were benchmarked in the 2008 *Fuels* and *Lube Studies*. Solomon's proprietary database includes detailed data on more than 500 refineries worldwide.

Box 1.1 cont'd

In addition to improving the statistical validity of study results, the database's growth has enabled Solomon to continually improve its study design and data validation techniques. Since the mid-1990s, the database has supported an analysis of refinery performance that extends far beyond simple benchmarking.

Solomon's refinery efficiency methodologies are the standard within the worldwide refining industry.

Top performing Solomon *Fuels Study* participants use Solomon's Energy Intensity Index (EII®) as the definitive metric for assessing the energy efficiency of the overall refinery and the individual process units on a daily basis.

Building upon the credibility and broad acceptance of EII, Solomon adopted the EII concept to greenhouse gases (GHG) with the development of the Carbon Emissions Intensity (CEI™) metric in 2003. CEI is a complex and proprietary GHG benchmarking methodology that refiners use to drive internal GHG emissions improvement efforts.

CEI lacks the simplicity and transparency needed in regulatory and compliance conversations. Solomon responded to the request of *Fuels Study* participants need for simple, credible and transparent GHG metrics by developing Solomon's Complexity Weighted Barrels (CWB™) methodology. CWB, or its metric variation "complexity weighted tonne" (CWT), is being promoted in multiple world regions for use in developing global greenhouse gas (GHG) intensity metrics and allocation methodologies.*

The Solomon performance metrics have thus become widely accepted within the industry as important measures of relative performance. Indeed, many have incorporated the metrics into their own continuous performance analysis.

CONCAWE agreed to buy the rights to adapt and use the Solomon CWB/CWT approach for the ETS Directive and the methodology has now been reviewed and recommended as suitable by Ecofys, the Commission's consultants on benchmarking.

Note: Refer to the following link for the proper use of Solomon's marks: http://solomononline.com/intellectual-property/.

Source: Contribution by EUROPIA.

Yet, 'benchmark*ing*' does not yet define 'bench*marks*'. Benchmarks are performance measures based on agreed parameters and verification, i.e. verified metrics. Benchmarks do not need to be set at the highest level of performance. It is up to the users (industry or policy-makers) to derive benchmarks serving their specific objectives. Benchmarks and benchmark methodologies will vary, depending on their use (see Box 1.2).

Benchmarking in a generic way, i.e. used to compare performance of installations, has played a role in a number of different areas – such as identifying opportunities for improvement, helping to distinguish and eventually transfer best practices or measuring advances in enhancing performance. From a company perspective, benchmarking can (indirectly) provide a stimulus to improve performance. This has been the case for example for the Solomon index (Box 1.1). Benchmarking methodologies used to compare the performance of installations can also be used in comparing sector efforts as this specific application reveals the best available (proven) technologies, provided the benchmark is based on practical benchmarks – using real data – as opposed to theoretical ones.

Benchmarking can be used for not only comparing various targets at the country, sector or installation level but also for setting a cap in a bottom-up fashion or in calculating the carbon content to establish the carbon footprint.

This application differs again from a regulatory scheme in which installations are required to achieve an absolute or specific (i.e. relative) target. Here the level of benchmarks set the goal and therefore will tend to converge on the best available technology. In regulatory schemes, installations are forced to achieve a certain objective but there is no additional incentive to go beyond.

Benchmarks do not reveal emerging technologies as they are based on existing technologies.

Benchmark-based allocation is a different matter. The benchmark here is also a tool to measure performance and achieve a 'fair' distribution of burden. But benchmarks used for allocation in *themselves* do not provide incentives to improve performance. This stems from the CO_2 price under the EU ETS. As all installations receive the same amount of allocations – based on the benchmark – the efficient installation will need to buy fewer than the inefficient. Furthermore, benchmarks add value by avoiding possible perverse incentives related to the 'updating' problem of historical grandfathering. Under historical grandfathering, those companies that have reduced emissions receive fewer allowances in the next phase, as their emissions are lower.

For allocation purposes, there is a need to multiply the benchmark by an activity rate to establish the total number of allowances. This could be based on recent or forecasted production, standard load factors or historical production levels. The activity rate can contain a margin of error if it is based on some kind of justifiable estimation or business plan.

Box 1.2 Different applications of benchmarks

Benchmarks can be used

- for free allocation in a cap-and-trade system (e.g. in the EU ETS for allocation to industry post-2012; for allocation to new entrants in the EU ETS phases I and II);
- as a regulatory scheme, such as setting an absolute or relative emissions or performance target to be achieved (e.g. the Energy Efficiency Benchmarking Covenant in the Netherlands (1999) and Flanders (2003), the Japanese target to improve energy efficiency by 1% annually);
- for setting a sectoral or national GHG emissions cap in a bottom-up fashion, ensuring that targets are doable domestically (e.g. the Japanese national target proposed by then Prime Minister Taro Aso in June 2009);
- for judging ‘comparability’ – however it is defined – among national or sectoral targets;
- for establishing the level of carbon credits that a project can obtain under the Kyoto Protocol’s flexible mechanisms or the post-2012 period (e.g. CDM, sectoral CDM or sectoral crediting);
- for comparing the carbon content of imported products with the benchmark in the case of border measures (e.g. the obligation for importers to buy allowances if production has not been covered by a carbon price); and
- as a tool for evaluating and comparing the performance of installations in terms of economic or environmental performance with the aim of improving performance (e.g. Solomon index, “Getting the Numbers Right”, the IAI’s Global Performance Data, the World Steel Association’s Global CO_2 Data Collection Methodology, the initial Japanese benchmarking schemes focused on fair evaluation of energy efficiency improvements in industry consistent with international developments and the Asia-Pacific Partnership on Clean Development and Climate).

1.2 Essential elements for benchmarking

There is significant experience in the EU and member states with benchmarking.

In the context of implementing the IPPC Directive (96/61/EC, codified in Directive 2008/1/EC), the EU developed so-called ‘best available techniques’ reference documents (BREFs).

In phases I and II of the EU ETS, member states used benchmarking in setting the allocation, which was done mainly for new entrants – although other member states had already used it for existing installations – and principally in the second phase. For instance, the application of benchmarking to N_2O allocations in the EU ETS originated in the Netherlands.

The most comprehensive application has been the development of the Energy Efficiency Benchmarking Covenant in the Netherlands (1999) and Flanders (2003). These particular experiences have helped identify possible key elements for successful benchmarks (see Box 1.3).

Box 1.3 Key elements for successful EU ETS benchmarks

- Built upon existing benchmarking schemes
- An independent consultant is involved (preferably own initiative)
- All input data are gathered directly from participants
- A regular participants’ conference is held
- A sufficient number of participants is attained (> 50% sector volume)
- Geographical coverage is adequate

Source: Adapted from a presentation by E. van Efferink, “Lessons from Benchmarking: Experience from the Netherlands”, third meeting of the CEPS Task Force on “Benchmarking for the EU ETS and Beyond”, CEPS, Brussels, 10 September 2009.

There is no broadly accepted definition of the technical content or method for how to derive benchmarks for the purpose of energy or CO_2 efficiency policy. In reality, benchmarks may be derived from various sources. These could be practical measurements, theoretical calculations, arbitrary targets or the literature. The former is the most accurate, yet also the most complex to establish, while especially the latter is generally an unreliable and non-transparent source as the origin is not always known and margins are often used. There is now a consensus among benchmark consultants that benchmarks are best based on real measurement of performance, thus generating the performance curve.

These experiences have yielded a number of lessons in several areas, as outlined below.

Developing benchmarks. A precondition for a benchmark is an inventory of the products (and processes if applicable) to be benchmarked, taking into account that the benchmarking method, boundaries, random conditions, problems, solutions and verification need to be laid out.

The Energy Efficiency Benchmarking Covenant has used the industrial benchmarking method by setting benchmarks based on the highest performance in the best decile,[4] requiring that the installations be improved to reach the benchmark. Fallback positions in cases where a 'full benchmark' has not been possible have been 'best practice', where the Covenant has required achieving a performance of +10% compared with the world best, or theoretical benchmarks. Fallbacks are easy for (simple and standardised) energy conversion such as boilers, power stations or even combined heat and power (CHP). They are very difficult for final energy consumers (industrial processes), especially if one aims at reaching a level playing field for all participants.

Complexity also increases with the number of participants and in cases where the same products are made by different raw materials in a varying balance or where processes produce more than one product at the same time. Experience suggests that benchmarks *in principle* can be avoided for most products but not necessarily for all intermediate products, such as paper and pulp manufacturing (for details, see Ecofys et al., 2009a, pp. 27-34).

Generally speaking, CO_2 benchmarking is more difficult than that for energy. On the other hand, the ETS work is facilitated by only including direct emissions. Still, difficulties start if direct emissions can be replaced by indirect ones, e.g. in cases where energy carriers are interchangeable. For example, glass furnaces can be and are heated by fuel (natural gas or

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[4] This is not to be confused with the average performance of the 10% most efficient installations in EU ETS (sub-)sectors.

oil) or electricity. In crackers, process compressors can be and are driven by turbines (heat), gas turbines (natural gas) or electric motors. Drying in a polymer manufacturing process is done with natural gas, steam or even electricity (for details, see Ecofys et al., 2009e).

Experiences from previous benchmarking exercises have been that benchmarking can always be done, irrespective of how complex it is. Establishing benchmarks can be time consuming, especially when setting them up for the first time. This has similarly been experienced in the case of the BREFs developed under the IPPC Directive.

Depending on the overall complexity, there is a rationale for focusing on the major emitting product when developing benchmarks. For example, in the ETS phase I, around 7% of the installations were responsible for 80% of all emissions. Some 7,400 (small) installations of a total of 10,280[5] installations accounted for around 5% of emissions.

The development of benchmarks can face a number of additional challenges that are discussed in chapter 2 (for details, see also Ecofys et al., 2009a).

- The area of CHP in sectors other than the power-generation sector necessitates a decision on a distribution key – essentially about how to deal with the export of electricity, i.e. electricity that is not consumed onsite and the treatment of contractual requirements with the grid operator (even in the case of a breakdown of production, the installation might be required to produce power with the steam being let off).
- The determination of the 10% most efficient has brought to attention the matter of how to deal with 'outliers', i.e. the possible exclusion of certain installations because of so-called 'non-reproducible random conditions' such as a unique heat-recovery opportunity nearby, the availability of renewable energy or CHP.
- Benchmarking is also complicated in cases where too few installations are included in a sector or sub-sector.

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[5] See e.g. the European Commission's press release, "Emissions trading: 2007 verified emissions from EU ETS businesses", IP/08/787, 23.08.2008 on its website (http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/787).

- Product benchmarks do not always fit the sub-sector division, because in many cases a sector produces several products, and some use recycled materials while others do not.
- Finally, lack of product uniformity can also render the determination more difficult. Benchmarks are relatively easy for uniform processes, for example in the case of ammonia. Yet problems can arise for instance in textile finishing or propylene. These can be produced from either product streams by purification in refineries, which requires little energy, or in crackers, which is far more energy-intensive (see Ecofys et al., 2009e).

Data collection and availability. Data availability and collection as well as the reliability of data have been overarching concerns in all previous benchmarking exercises. Data from existing literature statistics have not always been useful, especially for specific emissions and load factors. Ultimately, it is essential that the series of data for the benchmark value are consistent and reliable, especially with regard to process boundaries and related issues such as the scope of the ETS or process outsourcing. The lack of transparency could undermine the system and provoke litigation.

Acceptance can be a problem as industry cooperation is necessary to develop practical benchmarks. In the case of EU ETS allocation, this risk is reduced given that the alternatives to benchmark-based allocation appear far less acceptable to governments, business and other stakeholders. Grandfathering – with some sort of improvement factor – does not reward efficient installations or early movers, and has been shown to have a strong potential to distort competition within the internal market and may not be acceptable to governments. Auctioning – the other principal alternative – does away with free allowances altogether. This approach, it can be argued, has provided sufficient incentives for industry to engage in the benchmarking process. Companies accept that free allocation requires some system of benchmarks if the level playing field is to be preserved. As a result, ETS participants tend to accept benchmarks even if not every ETS participant agrees that they are 100% correct. Further inducements to accept benchmarks are provided by the possibility to create a theoretical instead of a practical benchmark.

Verification. Good data depends on good measurement systems (measurement, reporting and verification, or MRV), which might or might not be there. Any benchmarking process inevitably needs verification, a highly technological process. The development of MRV can be complex, especially if it requires a high level of accuracy. This is especially true if the benchmarks are on products. A new benchmarking process needs to develop procedures and accumulate knowledge about different industrial processes. In previous benchmarking exercises, one of the initial problems has been the lack of independence of the verifiers. Most of these challenges have disappeared for the ETS in its third phase as MRV methodologies and procedures are well established and codified, and highly experienced verifiers are now available. Therefore, the availability of robust and verified data by and large is no longer a major issue for ETS benchmark-based allocation. It is nonetheless an emerging issue for some areas, for example for the measurement of heat and for waste gases from steel production for electricity generation and downstream processes.

It has been argued that costs can quickly accrue in benchmarking. This risk can be mitigated by keeping the numbers of benchmarks limited but also by keeping benchmarks practical and simple to the extent possible. Cost can be broken down into i) the definition of the benchmarks, ii) data collection and iii) the running costs for MRV. According to Schyns (2005, p. 10), the cost of defining the benchmarks in the Dutch Covenant has been around €20,000 to €40,000 per benchmark, usually to be paid by several companies. This would amount to less than €0.01 per tonne of CO_2 of the Dutch total number of allowances for the first EU ETS trading period. This has been the figure for operating with existing benchmarks. For entirely new benchmarks the costs are much higher, depending on the desired accuracy in relation to the economic impact. The typical costs for a new benchmark, as currently needed for the EU ETS because the benchmarks are now CO_2 benchmarks, will be around €100,000 for the consultancy work. With a lot of preparatory work done in the Dutch and Flemish Benchmarking Covenant as well as in phases I and II of the EU ETS, the costs are likely to be lower. The most significant costs are running costs for MRV. Still, these are not a direct result of benchmarking but of the fact that GHG emissions are related, i.e. they would also occur for another regulatory scheme. Data collection costs can be significant as well but as Solomon and other benchmarking exercises show, such data can provide useful indicators for company managers to improve the performance of installations.

Developing benchmarks for allocation. Allocation requires both a benchmark and an activity rate. While a benchmark can be set in an accurate (based on an agreed methodology), transparent and verified way, there remains a margin of error for the activity rate, which is based on some kind of justifiable estimation including historical production or a business plan.

Production in the benchmarking formula can be introduced in diverse ways. One option is to consider the production capacity times a standard load factor for the sector. Although this simple method is a common one for new entrants' allocations, the application of it to incumbents has some disadvantages. It introduces an unequal consideration of the characteristics strongly affecting the load factor, such as the age or the role of the installation. A more conservative option is to use historical production corrected with projections, introducing sector and country-specific growth factors.

In the EU ETS, historical production is proposed and has been used in the past as a proxy for an activity rate of incumbent installations. The justification was that historical production generally reflects installation features, and if applied long enough and without changes in capacity, historical series guarantee a representative outlook of future production for the specific installation. The assumption of this option is that the main production growth in the medium term will be from new entrants.

Some experts challenge benchmarks that entail historical production[6] on the basis that there can be very large variations of production by incumbents in a short period.[7] They argue that although in a five-year period most or all of the production growth is probably related to capacity increases by existing installations, this might not be addressed by allocations from a new entrants' reserve because of the application of capacity-extension thresholds. Such 'capacity creep' has been witnessed especially in the steel, chemical and refining sectors, and more generally in process industries including the food industry.

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[6] See for example, Schyns and Loske (2008).

[7] See for example, Entec UK Ltd and NERA Economic Consulting (2005), which found significant variations in the production of incumbents in only six years.

2. IMPLICATIONS FOR EU ETS ALLOCATION

This chapter discusses the main issues surrounding benchmarks related to allocation in the EU ETS. The analysis is based on experiences from allocation in phases I and II, as well as previous exercises in as much as relevant.

2.1 The crucial role of allocation principles

Some of the key parameters for allocation have been written down in the EU ETS Directive. These include the choice of the activity rate, that benchmarks should be used only where deemed feasible or that allocation will be determined *ex ante*, and that the starting point is the 10% most efficient installations in (sub-)sectors. Moreover, allocation must take into account among other factors the most efficient techniques, high efficiency cogeneration, efficient energy use of waste gases and CCS.

This report has identified a number of 'ground rules', such as i) the avoidance of damage to competitiveness, ii) equal treatment of all sectors whether exposed to carbon leakage or not, iii) equal treatment of all installations in a (sub-)sector without differentiation according to their actual CO_2 efficiency, iv) transparency (also for the non-specialist), and v) practical and pragmatic (not perfect) approaches. Especially the latter principle has been reiterated several times.

Allocation will need to deal with tradeoffs and will eventually entail the implementation of hard choices[8] for the EU. Because benchmarks will

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[8] The Ecofys and Fraunhofer ISI (2009) report identifies in the summary (pp. iii-iv) the following choices in relation to benchmark-based allocation: the number of

affect the distribution of allowances among installations within sectors (intra-sectoral allocation), as well as among sectors (inter-sectoral allocation), political tensions are inevitable. To ensure political acceptability, a high level of transparency and a fair degree of predictability, it will be important to spell out the overall objectives of allocation. This should also keep the discussions focused, avoiding a situation whereby allocation rules are twisted towards special interests.[9]

Agreement on allocation principles is equally important to guide allocation in cases where a benchmark is not feasible, i.e. where a fallback rule will need to be applied. While a fallback rule will always create difficulties in comparing the actual allocation between installations with and without a benchmark, adherence to the principles should avoid significant differences in treatment. Moreover, the formulation of allocation principles should also ensure that the ultimate objective, reducing GHG emissions in a "cost-effective and economically efficient manner"(European Parliament and Council of the European Union, 2009, p. 63), will be achieved.

Previously, a number of principles have been identified, for example by Ecofys and Fraunhofer ISI (2009, p. iv), as outlined in Box 2.1.

Box 2.1 Possible allocation principles to serve as the basis for a benchmark-based allocation methodology

1. Base the benchmark level on the most energy-efficient technology.*
2. Do not use technology-specific benchmarks for technologies producing the same product.
3. Do not differentiate between existing and new plants.

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products to distinguish; the emissions from electricity use to which the benchmark relates (i.e. only direct emissions or also the indirect emissions); the benchmark for the specific energy consumption for a certain product; the benchmark for the fuel mix that is used to produce a certain product; the inclusion of correction factors, such as the different technologies used or the size of the installation; and the production (activity) levels that are used to convert the benchmarks (specific emission per unit of production) to an absolute emission allowance.

[9] Please see also Ecofys et al. (2009a), which has attempted to link each option to the allocation principles.

Box 2.1 cont'd

4. Do not apply corrections for plant age, plant size, raw material quality or climatic circumstances.
5. Only use separate benchmarks for different products if verifiable production data are available based on unambiguous and justifiable product classifications.
6. Use separate benchmarks for intermediate products if these products are traded between installations.
7. Do not use fuel-specific benchmarks for individual installations or for installations in specific countries.
8. Take technology-specific fuel choices into account in determining benchmarks.
9. Use historical production to allocate allowances for existing installations.
10. Use product-specific capacity utilisation rates in combination with verifiable capacity data to allocate allowances to new installations.
11. Use a heat production benchmark combined with a generic efficiency-improvement factor for heat consumption in processes where no output-based benchmark is developed.

* This principle was dropped by Ecofys et al. (2009a, p. 28) to reflect the final version of the revised EU ETS Directive.

Source: Ecofys and Fraunhofer ISI (2009, p. iv).

2.2 Considerations for identifying the '10% most efficient'

The EU ETS Directive requires that the starting points for the benchmarks are set at the level of the "average performance of the 10% most efficient[10] installations" (European Parliament and Council of the European Union, 2009, p. 73). This has a number of implications and consequences. First, benchmarks will need to be practical – as opposed to theoretical – and based on measurements and a conceptually-sound benchmarking methodology. Second, this approach achieves a level playing field for all sectors, provided that the benchmarks are assessed with sufficient quality and proper verification. Third, sectors where the minimum/maximum

[10] The study by Ecofys et al. (2009a) considers this to mean the "most GHG efficient".

span is high will on average have a stronger incentive to reduce emissions than those where this span is lower. Fourth, as in all benchmarking exercises, the potential of emerging technology is not covered. Inclusion of this aspect would require scientific input, which goes beyond the scope of benchmark-based allocation. Similarly, for the most part the potential of product change is not covered.

Politically most difficult is the possible exclusion of certain installations because of so-called 'non-reproducible random conditions' (such as a unique heat-recovery opportunity nearby, the availability of renewable energy or CHP), i.e. outliers.[11] The decision of including or excluding outliers, more specifically very efficient installations, may have a significant impact on the level of the benchmark. For instance, a spread factor of 2 of all benchmarked installations – an extremely good figure, which might not be achieved by most if not all sectors[12] – would mean that the worst performer only receives half of the allowances that it would need. In the event that there are limited or only very costly possibilities for upgrading, if the installation is very emissions-intensive it may even have to close. This may be in line with the introduction of a carbon price, the application of the polluter-pays principle and the ETS objective of reducing emissions, notably from the less-efficient plants, but causes concern about carbon leakage (see Box 2.2). Especially the steel, aluminium and refining industries have highlighted the difficulty of identifying the 10% most efficient because of the heterogeneity of the installations (see also Ecofys et al. 2009c and 2009d). A particular example of the broad heterogeneity of installations is the EU refining sector, with some 110 EU refineries ranging from 2 to 20 million tonnes of output, with variations in the product output.

To address complex 'co-production' processes, Solomon has developed the complexity weighted tonne (CWT) parameter to represent the total production of a particular refinery. The single, common

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[11] A big spread factor of the performance of installations per se does not necessarily mean non-reproducible random conditions. It could equally mean that many inefficient installations with inefficient technological choices operate. Only if the spread factor is the result of unique and non-reproducible conditions can exclusion be justified.

[12] Refineries worldwide have a spread factor of 5.

'production' parameter CWT has been reviewed and endorsed by CONCAWE and is applicable to virtually all EU refineries across the 27 EU member states, and thus most EU refineries are included (see Box 1.1; see also Ecofys et al., 2009d). It takes into account the product mix produced by each refinery, reduces competitive distortion and the complexity of using several parameters. The alternative to a high spread factor could only be an alternative allocation methodology ('grandfathering').

Determination of the 10% most efficient installations can also be rendered difficult owing to a lack of product uniformity. For example, this can be the case for different oil qualities. Another example pertains to the differences that arise from variations in emissions from re-melting, which has an overall environmental gain from a lifecycle perspective in having much lower emissions than the production of the virgin product. Hence, the average of the 10% most efficient installations could well be the re-melting. This can be a reason for a separate benchmark.

Box 2.2 Aluminium case study

A. Outliers for alumina plants

I. There are only five major operating alumina plants in the EU, with one recently closed. One of them is based on a different technology for hydrate production, which leads to clearly lower emissions than the four other plants.

This alternative technology was considered experimental at the time it was built in 1972, and still today out of seventy alumina refineries worldwide, only two plants use it (one in Europe and one in Australia).

All other plants built in Europe since then have used traditional technology. The main reasons are that (a) it was not considered proven technology (the Australian plant also experienced a long period of operating problems at the time of launch), (b) it is technically more complicated and requires highly qualified operators, and (c) it requires higher investments.

This technology being fundamentally different from the regular technologies in use for hydrate production, it is not feasible to convert existing plants to it without demolishing and rebuilding major parts of the plant.

II. Another consideration for the benchmark is the fuel use. Most plants have access to gas. However, two plants use fuel oil as there is no gas network close to their locations and consequently no possibility to switch to gas. Using a benchmark based on gas only would lead to increased costs and the closure of the two plants with no access to gas.

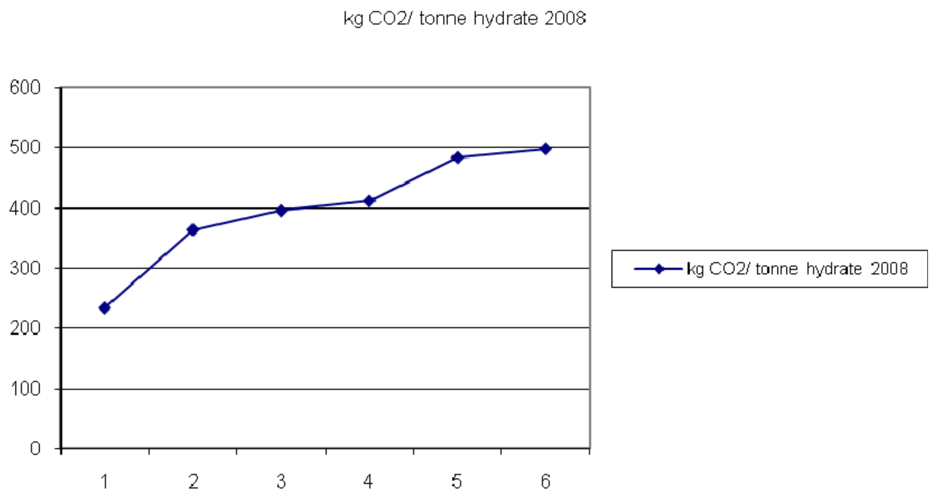
Box 2.2 cont'd

The calculation of the economic impact of both cases is as follows:

- If the lowest emitting plant was set as the benchmarks, the total cost for the remaining plants would be about €45 million per year (CO_2 at €30/t).
- If the heat production and fuel mix benchmarks were used as fallback solutions, the cost for two plants with only oil available would be about €12-14 million per year for each.

Two proposals for a fallback position:

- To consider the lowest operating plant as an outlier based on the fact that it was not a fully proven technology at the time when the European plants were built and still is not the chosen technology for new plants.
- Set a fallback heat benchmark for the hydrate production and fuel mix benchmark for calcination based on gas, but for the plants with no gas availability set a benchmark based on fuel oil with the provision of reverting to a gas benchmark when gas becomes available.



Box 2.2 cont'd

B. Recycling activities

The recycling of aluminium consists of refining and re-melting metal scrap in order to produce new metal, using a large variety of different quality input materials and finishing operations. Recycling can be done without any loss of quality and requires much less energy than the production of primary metal (i.e. from bauxite).

Recycling plants can use fossil fuels – in most plants, gas – or electricity for the melting and finishing operations. However, once a plant is built, switching from one technology to the other is not possible, unless the facility is completely refurbished.

The energy consumption is also different between re-melting plants, based mainly on clean scrap, and refining plants based mainly on post-consumer scrap as the treatment required is different.

Benchmark curves for direct emissions could be dominated by the most electricity-intensive instead of the most energy-efficient installations. The construction of any benchmark needs to take this fact into account, so as environmentally beneficial processes, such as aluminium recycling, are not discouraged.

It has therefore been a proposed solution for these plants to use a fuel-mix fallback position due to the large variety of raw materials, finishing operations and different products produced.

Source: Contribution by Alcoa and Hydro with no revision or significant editing by the rapporteurs. For more information, see www.alcoa.com and www.hydro.com.

2.3 Impact on competitiveness

One of the reasons for applying benchmarks has been the actual or perceived advantage for the competitiveness of European industry. The EU ETS Directive has chosen to address competitiveness through the free allocation of allowances (up to the benchmark). It is the use of *ex ante* benchmark-based allocation that makes such free allocation possible without distorting competition while rewarding the efficient. Benchmark-based allocation will not necessarily stop any change in production patterns. But it is a way to offset the increased costs for industry and may act as an incentive to continue producing in the EU during the period covered.

The objectives of the EU ETS cap-and-trade system have been to create incentives for companies to reduce emissions in the most cost-effective way, to reward carbon efficiency and to foster new and innovative approaches to reducing emissions. The incentive for efficient abatement arises from the 'opportunity cost' of using allowances. Passing through the GHG costs in the form of an allowance price will create a consumer incentive to reduce the use of GHG-intensive goods. At the same time, it will increase producers' cash flow to invest in abatement technologies. The price signal will be distorted, however, if GHG costs cannot be passed through domestically or globally. In this case, the market structure, especially the price elasticity of demand, inhibits the ability of globally trading industries to pass through fully or even partially. As a result, (European and global) product prices will not reflect the opportunity costs of allowances and therefore the EU cost of carbon. For example, if firms in a European industry cannot pass through the allowance price partly or fully, they eventually end up 'paying' for the costs of the allowance price. Failure to pass through would erode benefits from CO_2 abatement as well as producers' competitiveness, transfer allowance value abroad and ultimately lead to carbon leakage.

Free allocation addresses this. It constitutes compensation or as some argue, a subsidy,[13] potentially creating an incentive to continue producing in Europe. The amount of the compensation or subsidy is set by the level of the benchmark. This is also where the level of the benchmark matters for competitiveness.

Yet, even if the additional costs in an industry were 100% compensated by either free allowances or higher revenues or both,[14] free

[13] A subsidy is generally defined as a benefit usually given by the government to groups or individuals generally in the form of a cash payment or tax reduction. The subsidy is typically given to remove some kind of burden and is often considered to be in the interest of the public.

[14] Allocating the majority of the CO_2 allowances for free, combined with the potential of industries to pass a smaller or larger share of the costs on to consumers,

allocation per se may not fully prevent industries in global competition from shifting their production, and thereby emissions, abroad. The reason is that production decisions are not based on average industry margins, but on marginal costs for the last unit. In practical terms, two effects are at work: operational (i.e. reducing production in existing installations) and structural (i.e. postponing or abandoning investment or actively pursuing divestment). The evaluation of the structural effect depends very much on the perspective one takes and the assumptions made about the post-2012 situation – how fast a global agreement is forged and how it will look. Project mechanisms such as the CDM, which can bring down overall compliance costs, remain important elements.

2.4 Intra-sectoral product substitution, system boundaries and distributional impacts

One of the politically most sensitive issues is distributional impacts both between and within sectors. This section deals with intra-sectoral distribution questions while inter-sectoral implications are covered in section 2.8.

This report has addressed intra-sectoral distributional effects for the case of the cement industry. This discussion at the same time highlighted the importance of sector boundaries, i.e. how far to go up or downstream and the extent to which product substitution should be included in the benchmarking exercise. Depending on the production structure in the sector, the choice of sector boundary can lead to very important distributional consequences. The ETS Directive does not prescribe any view on this. At the same time, sector boundaries can also include or exclude substitution potential in a given sector. Determining the exact nature of this substitution potential will need to be assessed case by case. A crucial element in this assessment is the levers to reduce GHG emissions. For cement (see also Ecofys, 2009b), there are four principal levers to reduce CO_2 emissions: energy efficiency, alternative fuels/biomass, clinker substitution/blending and CCS (if it exists).

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limits the economic loss entailed for most industries or can even represent an upside for some of them.

For the use of benchmarking in national allocation plans for phase I and II, Öko Institut and Ecofys (2008; p. 36) analyse a non-exhaustive list of NAPs and state,

> various countries have experience with benchmarking in the cement industry, of which a few have also used benchmarking as an allocation tool during Phase II of the EU ETS (e.g. Germany, Netherlands, and the United Kingdom) in one form or another. Most of the MS have referred to the BAT (Best Available Technique) level as a basis for the distribution of allowances for new entrants. ...Only a small number of MS actually developed and presented their benchmarking approach for new entrants.
>
> Regarding existing plants, an even smaller number of member states (Netherlands, Hungary, Italy, Poland and in Belgium Flanders) decided to use the benchmarking approach for the distribution of free allowances to the cement sector. While the allocation procedures in the Netherlands built on an energy-efficiency benchmark (as developed in the national Benchmarking Covenant), Germany and the United Kingdom have developed a special allocation system based on a GHG benchmark for new entrants *['based on clinker', rapporteurs' comment],* using correction factors in the benchmark. While some of these factors are applied using plant-specific data, most of them are standard factors... Some other member states have also used "benchmark" type approaches for allocation, but a lack of a comprehensive description in the NAP made it difficult to provide an accurate description in this report. In Italy, the allocation methodology for NAP I for incumbents in the cement sector was based on an output-based distribution of a predefined cap, equivalent to a clinker-benchmark. The same output based allocation was applied to new entrants.

The case for a clinker benchmark[15]

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[15] Supported by CEMBUREAU and recommended by Ecofys. The decision by the CEMBUREAU Board in favour of this clinker benchmark was taken in April 2008 at a majority of 97.44% of the votes which were cast in full compliance with CEMBUREAU governance rules which state that a common position is reached when supported by at least 70% of the votes.

The case recommended by Ecofys,[16] which states in their report (Ecofys et al., 2009b, p. 8), "In particular, based on the...issue [of] clinker trade between installations, we conclude that a benchmarking methodology based on clinker is the most practical approach for the cement sector" and consists simply of calculating a clinker benchmark on the basis of the 10% most efficient installation average performance. It does not entail correction factors for technologies and moisture content of raw materials.

This approach is seen by its proponents as most in line with the EU ETS directive and the simplest approach. Simplicity is assured through clear boundaries, good data and consistency with the ETS Monitoring Guidelines (MRG). It is also argued that this approach would provide incentives to reduce GHG emissions beyond clinker. This is because, if clinker is substituted in cement production, the operator would be able to sell the allowances.

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[16] Ecofys et al. (2009b; p. 8) state,

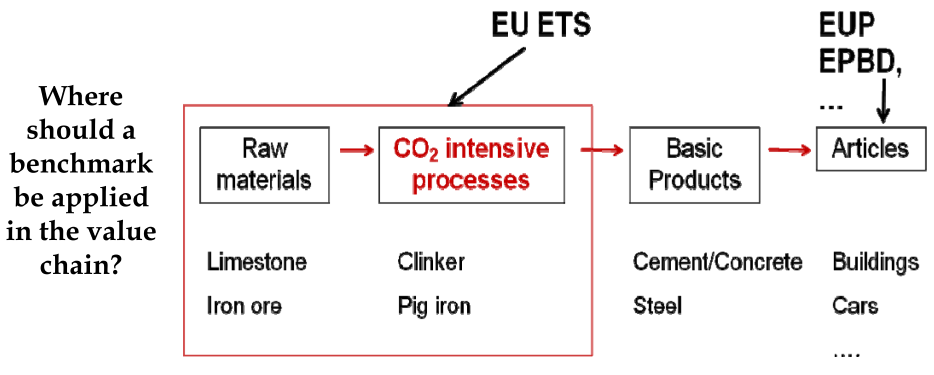
> Intermediate products that are traded between installations could be given separate benchmarks, because otherwise the allocation to installations producing only the intermediate would become very difficult.
>
> The solutions (conceptually described in table 3 and a bit further discussed in Section 4.3 [of Ecofys et al., 2009b]) to solve these practical difficulties in case of cement benchmark either result in a hybrid system in which for a single product (clinker), two different benchmark methodologies are developed or in a situation that a new entity (the company) is introduced in the allocation methodology. *[A footnote adds that "in addition, the problem of clinker trade between companies would not be solved in this methodology".]* Both are not in line with the approach as outlined in the report on project approach and general issues.
>
> We do realize that with clinker benchmarking, clinker substitution is not incorporated as such in the benchmarking methodology. Assuming that benchmarking will also be applied for the allocation in trading periods after 2020, clinker benchmarking could give a negative incentive for blending in the sense that increased blending could result in lower allowances in the next trading period (an update problem). *[The added footnote reads as follows "Of course, cement benchmarking would also result in a different distribution of initial allowances between the various cement companies. As such, the real costs for buying allowances and the distribution of these costs over installations and companies will be different than with clinker benchmarking."]* Regarding new installations, a clinker benchmark could distort incentives to invest in blended cement. However, in view of the practical difficulties associated with cement benchmarking (issue 3, 4 and 5) and in view of the ambiguity regarding the scope of the amended Directive (1, 2), we regard this as acceptable."

Box 2.3 CEMBUREAU's arguments for a clinker benchmark

CEMBUREAU is convinced that the clinker benchmark is both most in line with the ETS legislation and the best way to create a simple and practical benchmark.

- CO_2 is directly emitted only in the clinker manufacturing process which is the activity listed in Annex I (ETD). Therefore, the clinker benchmark is in line with the scope of the ETS Directive, as well as the guidelines recently issued by the European Commission in its non-paper on "Quality and verification criteria for benchmarking data for the EU ETS".
- A clinker benchmark offers a single – simple – EU-wide benchmark.
- A clinker benchmark triggers reductions equivalent to those of a cement benchmark in terms of clinker to cement ratio. A cement benchmark may give the appearance of a CO_2 reduction, but it is investment in kiln efficient technology that will deliver real emission reductions and energy efficiency. In a nutshell, a clinker benchmark rewards early movers in terms of technology.
- A clinker benchmark does not raise boundary issues as a cement benchmark does. A cement benchmark would significantly increase the complexity of the ETS with no additional emissions covered and no environmental benefit.
- The clinker benchmark would not generate complexities or potential loopholes in relation to international trade. A cement benchmark would allow the bypassing of Article 10a, paragraphs 18 and 19 of the directive (no allocation to installations that ceased operation, adjustment of allocation to installations that partially cease operation). As the measure of activity would be production of cement, producers could simply switch to imported clinker and shut down domestic kilns without losing allowances. This would obviously be politically unacceptable.
- The European Commission's official policy is to have benchmarks calculated based on official CITL data. A clinker benchmark can be established on the basis of CITL, whereas a cement benchmark cannot.
- A clinker benchmark is fully in line with the Monitoring and Reporting Guidelines established by the European Commission.
- A clinker benchmark would minimise distortions of competition. A cement benchmark would introduce significant distortions of competition as the use of additions (slag, fly ashes etc) directly at the concrete mixer would not be taken into account under the existing EU-ETS Directive.

Box 2.3 cont'd



For more detailed information, please visit www.cembureau.eu.

Source: Contribution by CEMBUREAU with no revision or significant editing by the Rapporteurs.

The case for a cement benchmark [17]

The case for a cement benchmark as advocated by its proponents is based on three principal arguments. First, a cement benchmark generally will incentivize both energy and CO_2 reductions and innovation throughout all processes and products because of large sector boundaries. Second, a cement benchmark will provide different incentives to improve and innovate. Ecofys et al. in their final report (2009b, p. 8) state that "assuming that benchmarking will also be applied for the allocation in trading periods after 2020, clinker benchmarking could give a negative incentive for blending in the sense that increased blending could result in lower allowances in the next trading period". A third argument has been that a cement benchmark would improve the reputation of the industry because it includes more levers for improvement than clinker.

[17] Supported by Holcim and Climate Action Network (CAN) Europe.

Box 2.4 Holcim's arguments for a cement benchmark

Holcim argues that the cement benchmark will change business-as-usual in cement companies whilst providing both environmental and economic advantages to the sector. The main reasons/arguments are:

Cement is within the scope of the ETS Directive: Cement is the core product of the cement industry. Customers buy cement, not clinker. Clinker is but an intermediate substance used in the production of cement. It is, however, the industry's main source of CO_2 emissions. The most effective and least costly way to reduce absolute CO_2 emissions from the cement sector is by lowering the content of clinker in cement during the cement grinding process. Cement grinding is a directly associated activity with a significant effect on emissions from the cement clinker activity. As such, clinker substitution in cement is within the scope of the Emissions Trading Directive.

Benchmarking criteria in Article 10: Cement benchmarking complies with each criterion listed in Article 10a (1) of the Directive. Clinker benchmarking, however, does not take into account substitutes and alternative production processes, nor does it maximize CO_2 emissions throughout each production process of the sector.

Environmental effectiveness and economic efficiency: Cement benchmarking includes all levers to reduce emissions in the benchmark, such as energy efficiency, fuel mix and biomass, clinker substitution, product development and consumer choice. That it includes levers that are least costly increases its economic efficiency.* As a result, cement benchmarking stimulates research and innovation not only in the cement clinker process, but also in cement product development and associated applications.

Leakage: Leakage is a consequence of *ex ante* allocation and the cost of CO_2. Excluding the least costly CO_2 reduction lever, as in clinker benchmarking, increases the risk of leakage. A well-designed cement benchmark takes due account of international trade in clinker and cement and does not stimulate leakage.

Feasibility/practicability: A single EU-wide cement benchmarking is feasible: all parameters necessary for the benchmarking are identified and defined and are already used in the existing EC Monitoring, Reporting and Verification guidelines. Data are available through the CITL supplemented by the installation's EU ETS reports and the cement industry's GNR (Getting the Numbers Right) database.

Box 2.4 cont'd

Future orientation: Benchmarking is more than a tool for distributing CO_2 allowances within a trading system. It goes to the fundamental question of what the future of the cement industry ought to be and the appropriate CO_2 performance metric for stimulating improvement and innovation. In Holcim's opinion, that metric must capture the full potential for emission reductions in our sector. Cement benchmarking is most in line with such long-term view and is therefore in the best interest of the industry and the environment in which it operates.

* If two companies produce the same amount of cement but use different levels of clinker, the company using less clinker (thus emitting less CO_2) to produce the same amount of cement will benefit with a cement benchmark.

For more information, please visit www.holcim.com.

Source: Contribution by Holcim with no revision or significant editing by the Rapporteurs.

2.5 Design options to incentivise the greatest possible emission reductions

Benchmarking as an allocation methodology has been chosen to make free allocation possible, notably by avoiding the perverse effects of grandfathering and because it has the potential to ensure a non-distorted carbon price signal, including the reward of early action and more generally carbon efficiency.

That is why the ETS Directive has mandated "Community-wide *ex ante* benchmarks" (Art. 10a). The same article also prescribes that benchmarks are calculated on products rather than inputs, which ensures that they solely cover direct emissions and do not reflect different feed properties. Another precondition to meet the environmental objective is to avoid differentiation according to technologies. A technology-neutral benchmark will incentivise the most carbon-efficient product. Technology-based differentiation would continue to provide incentives for less carbon-efficient products. The same can be said of correction factors, for example for the fuel mix, age or size of the plant. In addition, a proliferation of benchmarks or correction factors increases complexity and costs while reducing transparency, an important element of a market-based instrument.

Benchmarking for the purpose of allocation not only requires the establishment of a benchmark but also an activity rate with which the benchmark will need to be multiplied in order to establish the total number of allowances. Theoretically, there is a choice between historical data, projections, standard load factors or recent or actual production. Standard load factors generally have too high a margin of error and do not represent the actual situation. They would in many cases allocate generously to inefficient installations. Such inefficiencies go beyond carbon and tend to extend to energy consumption and other inputs as well. Nevertheless, they could be used for new entrants, which typically will use advanced technology, justifying a standard load factor. NAPs for phase I in most countries were based on projections. It turned out that most if not all the projections were inflated, leading to over-allocation in many sectors. That is why historical production data has been seen as a more suitable option. The European Commission is considering using the average of 2005–07 activity data.

By and large, this approach has arisen out of experiences from NAPs for phases I and II some of which were presented to the CEPS Task Force and have been the subject of CEPS' and other research. Lessons learned from national experiences include avoiding historical projections for setting the activity rate. Historical production has turned out to be the best proxy of expected trends, possibly to be adjusted by a standard growth rate if appropriate. For exceptional cases, such as deep market restructuring (e.g. in the power sector), the Italian NAP has used a pre-determined model.[18] As for new entrants, for which no historical data are available, standard load factors can be used.

2.6 Benchmarks and technology development

The EU has proposed to reduce its GHG emissions by 30% provided that other countries undertake comparable efforts. The current ETS Directive addresses only the independent commitment of 20%. It provides for a

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[18] See C. Di Mambro, "Benchmarking as an allocation method: The experience from Italian NAP I and NAP II", Presentation at the third meeting of the CEPS Task Force on "Benchmarking for the EU ETS and Beyond", CEPS, Brussels, September 2009.

continuous, annual, linear reduction of 1.74% from 2013 to 2020,[19] leading to a 21% reduction of covered emissions by 2020 (compared with 2005). This continuous linear reduction will persist beyond 2020 when the allocation for the third phase finishes, leading to approximately another 17% reduction from 2020 levels by 2030 (-38% compared with 2005), a 35% reduction from 2020 levels by 2040 (56% compared with 2005) and so on.[20] EU member states have supported the objective of reducing their joint GHG emissions by somewhere between 80% and 95% by 2050 compared with 1990 (Council of the European Union, 2009, p. 3). While the 2020 and possibly the 2030 targets can and will need to be reached by the deployment of existing technologies, beyond that new and breakthrough technologies will be required.

Do benchmarks drive technology? In a regulatory scheme like the Dutch and Flemish Benchmarking Covenant, participants have been obliged to reach certain targets. Once attained, there has been no additional incentive to go beyond, i.e. develop new technologies. The situation is different in the EU ETS, where the CO_2 price determines the level of incentive to improve performance. Emission reductions allow installations to sell additional allowances on the market. These incentives could be reinforced by two potential effects.

First, theoretically there would be an incentive to develop new technologies if there is expectation that there might be a new benchmark for the following period based on a new technology. But this would by no means be certain.

Second, incentives for the development of new technologies may also be provided by setting a sufficiently wide sector boundary, as this allows for different technological solutions. This would need to be decided on a case-by-case basis.

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[19] The starting point is in fact the average total quantity of allowances for the 2008–12 period (phase II) and thus the linear reduction begins from the midpoint in 2010. The final allowance quantity will be adjusted for the inclusion of new sectors (e.g. aviation) and for any opt-outs by separate installations.

[20] These are CEPS' estimates, based on the 1.74% gradient and the 21% reduction under the ETS by 2020 compared with 2005.

2.7 Benchmarks can increase market visibility and enhance predictability

A previous CEPS Task Force Report (Egenhofer and Fujiwara, 2007, p. 15) concluded that predictability rather than certainty is a key requirement for the EU ETS. There can be no absolute certainty. Uncertainty[21] is a normal factor for many investment decisions. As aiming at absolute allocation certainty is not realistic, what can realistically be achieved is increased predictability in the total allocation and the allocation rules for individual installations. The former relates to the EU's and (in some cases) member states' long-term targets, such as the EU ETS linear reduction commitment. The latter concerns allocation methodologies. Full auctioning to the power sector provides a high degree of predictability. For the industrial sectors, benchmarks can have a similar effect. Although it is likely that after an allocation period the benchmarks would be adapted, benchmarks still offer a relatively high degree of predictability and also market visibility for new entrants because the incentive to reduce emissions is independent of the level of the benchmark, in contrast with historical grandfathering. Additional predictability is provided by the fact that until 2027 at the latest there would also be full auctioning for the industrial sectors that are not exposed to carbon leakage.

2.8 Benchmark values freeze the inter-sectoral allocation with implications for cap-setting, expansions and the move to the 30% target

The setting of the benchmarks defines the total sector emissions cap as a result of the activity rate, i.e. production, being fixed by historical data. At the same time, this defines the distribution within the sector. That being the case, the boundary conditions of the benchmarks can make a difference for intra-sectoral distribution – a topic that has also been discussed in section 2.4.

For the overall and sectoral caps benchmarks can be used but it is not necessary to do so. Such an approach may even have disadvantages. Basing

[21] Uncertainty relates to demand, prices for electricity and other products, factor prices (primary energy, feedstock, labour, transport, etc.), technological progress, competitors' strategies as well as regulatory risks, under which the EU ETS falls.

the sectoral or the overall caps on benchmarks will tend to lead to a race to the bottom concerning the level of the cap, more specifically towards an argument for high benchmark values, which define the inter-sectoral burden-sharing. Some sectors may be better in arguing for high benchmark values than others. Typically, benchmark values can be modified by including or excluding outliers, i.e. very efficient installations. This topic is most important where there is a high spread between the performance levels of installations in the same sector. The topic is analysed in greater detail in section 2.2 on considerations for the identification of 10% most efficient. Another way of setting total sector allocation, i.e. the sectoral cap, would be to base it on a percentage reduction (e.g. 21%) of historical emissions and apply benchmarks only thereafter to settle the intra-sectoral allocation (distribution). On the other hand, an equal reduction effort per sector in the future trading period might discourage companies from undertaking reduction efforts as they would potentially receive a more ambitious benchmark value.

Benchmark values of different ambitions among sectors can distort the inter-sectoral distribution. This could happen in the case of the EU moving to a higher target than the current 20% reduction target. A uniform cross-sectoral correction factor to ensure a reduced cap would in many cases have a more significant impact on costs in those sectors that have already started from a more ambitious benchmark value.

Similar issues arise in the case of EU ETS expansion. The benchmark values chosen for the newly introduced sector will most likely have impacts on inter-sectoral allocation, although only for the following trading period, should a uniform reduction figure be applied. Those sectors that argue successfully for high benchmark curves will fare comparatively better than those with higher values. This will put significant pressure on the European Commission and member states when defining the benchmark values for new sectors.

2.9 Data collection and measurement systems

Ultimately, benchmarking depends on reliable and credible measurement systems and verification. In the EU ETS, monitoring, reporting and verification are based on the MRGs for GHG emissions. Art. 14 of the ETS Directive requires member states to ensure that operators of installations and aircraft operators monitor and report their GHG emissions in accordance with these guidelines, which are legally binding. The MRGs were revised on 18 July 2007 for the second phase. The main changes were to improve cost-effectiveness, for example by

- relying more on common industrial practices regarding the monitoring and reporting done by operators (e.g. use of standard factors for commercial fuels);
- allowing lighter monitoring requirements for small installations or small emitters with less than 25,000 tonnes of CO_2 annually, for installations using biomass fuels, and for the development of electronic templates and monitoring plans; or
- aligning the guidelines better with reporting made by member states under national GHG inventory requirements.

Strengthening the verification procedures of the monitoring and reporting, originally an area for concern, was meant to increase environmental integrity. During 2008 and 2009, several amendments were added: MRGs for activities emitting nitrous oxide (N_2O from the production of nitric acid, adipic acid, glyoxal and glyoxylic acid); MRGs for emissions and tonne–kilometre data from aviation activities; and MRGs for emissions from capturing, transport and geological storage of CO_2. For the third phase, the European Commission will adopt a regulation that will monitor emissions as well as (where relevant) activity data. Member states and the Commission are required to maintain the secrecy of commercially sensitive data.

With emissions per installation being published on the CITL, the publication of activity data would automatically reveal the production of a plant. But at most sites several products are produced. This means that individual production data will remain hidden (e.g. in the chemical or paper industries). Within the EU ETS, such data remains restricted to use by the member states and the European Commission. In private (industry-driven) benchmarking exercises, databases are managed by a third party, typically a consultant, which publishes the data in a de-identified format. The consultant develops the database system, collates the reported data, analyses the results of various statistical queries, and produces consolidated (de-identified) data and reports. Another possibility for single product sites is to make production data available with a delay. Generally, data collection can be a time- and resource-consuming process.

Another reporting approach, for example, is the one used by the UNFCCC for country-level emissions data, as outlined in Box 2.5.

Box 2.5 Reporting at the level of the United Nations Framework Convention on Climate Change

Parties to the United Nations Framework Convention on Climate Change (UNFCCC) must submit national reports on implementation of the Convention to the Conference of the Parties (COP). The required contents of national communications and the timetable for their submission are different for Annex I and non-Annex I parties. This is in accordance with the principle of "common but differentiated responsibilities" enshrined in the Convention.

The core elements of the national communications for both Annex I and non-Annex I parties are information on emissions and removals of GHGs and details of the activities a party has undertaken to implement the Convention. National communications usually contain information on national circumstances, vulnerability assessment, financial resources and transfer of technology, and education, training and public awareness; but the ones from Annex I parties additionally contain information on policies and measures.

Annex I parties that have ratified the Kyoto Protocol must include supplementary information in their national communications and their annual inventories of emissions and removals of GHGs to demonstrate compliance with the Protocol's commitments.

Annex I parties are required to submit annual information on their national inventories, and to submit national communications periodically, according to dates set by the COP. There are no fixed dates for the submission of national communications of non-Annex I parties, although these documents should be submitted within four years of the initial disbursement of financial resources to assist them in preparing their national communications.

Data reliability and quality

Decision-making within the Convention is based upon the use of accurate, consistent and internationally comparable data on GHG emissions. Since 1994, there have been major efforts in the preparation, collection and validation of data on GHG emissions, as well as efforts to improve the quality and consistency of the data, which are ensured by established guidelines for reporting. Non-Annex I parties receive financial and technical assistance in preparing their national communications, facilitated by the UNFCCC secretariat.

Box 2.5 cont'd

Each national communication of an Annex I party is subject to an 'in-depth' review conducted by an international team of experts and coordinated by the secretariat. The review of each national communication typically involves a desk-based study and an in-country visit, and aims at providing a comprehensive, technical assessment of a party's implementation of its commitments. The in-depth review results in an in-depth review report, which typically expands on and updates the national communication. The reports also allow easier comparison of information among the national communications of parties, although no common indicators are employed. The in-depth review of the fourth round of national communications is due to be finished in 2009. National communications from non-Annex I parties are not subject to such a review, but they are considered by the expert group set up by the Subsidiary Body on Implementation. Inventories are subject to an annual technical review process.

Submission of reports

Parties submit their national communications to the UNFCCC secretariat and the most important information from submitted national communications is synthesised into separate reports for Annex I and non-Annex I parties, which are considered by the subsidiary bodies and the COP.

Reporting guidelines

National communications

For comparability in reporting, in preparing their national communications, Annex I parties are expected to follow reporting guidelines. These guidelines have been revised twice, at COP 2 (Geneva, July 1996) for the preparation of the second round of communications, and again at COP 5 (Bonn, October/November 1999), where revised reporting guidelines were adopted for the preparation of the third national communications.

Annual national inventories

Parties should submit their annual inventories using comparable methodologies agreed upon by the COP and any good practices agreed upon by the COP at a future session. The Intergovernmental Panel on Climate Change (IPCC) develops guidance on good practices as part of its work related to uncertainties in inventories. Guidance on good practices may include, inter alia, advice on the choice of methodology, emission factors, activity data and uncertainties, and on a series of quality assessment

Box 2.5 cont'd

and quality control procedures that may be applied during the preparation of inventories.

The quality and credibility of GHG inventories rely on the integrity of the methodologies used, the completeness of reporting and the procedures for the compilation of data. To promote the provision of credible and consistent GHG information, the COP has developed standardised requirements for reporting national inventories.

The UNFCCC Reporting Guidelines on Annual Inventories require Annex I parties, by 15 April each year, to provide annual national GHG inventories covering emissions and removals of direct GHGs (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6) from six sectors (energy, industrial processes, solvents, agriculture, land use, land use change and forestry (LULUCF) and waste), and for all years from the base year or period to the most recent year. The sectors are very broad and would require substantial sub-division to encompass, sector crediting, sector trading or benchmarking.

Under the UNFCCC reporting guidelines for Annex I parties, inventory submissions are in two parts:

- a common reporting format (CRF) – a series of standardised data tables containing mainly numerical information and submitted electronically; and
- a National Inventory Report – a comprehensive description of the methodologies used in compiling the inventory, the data sources, the institutional structures and quality assurance and control procedures.

The most recent reporting requirements for GHG inventories were adopted in 2005 to include IPCC good practice guidance for LULUCF. Annex I parties were also asked to use the CRF Reporter software for the submission of their annual greenhouse gas inventories due from April 2006.

Source: Contribution by Nick Campbell, Environment Manager, Fluorinated Products, Arkema S.A. For more information, see also the UNFCCC website (www.unfccc.int).

3. LOOKING BEYOND THE EU – INTERNATIONAL EXPERIENCE WITH BENCHMARKING IN SUPPORT OF CLIMATE POLICY

As this report has shown, benchmarks can create transparency and reinforce predictability. Thus, benchmarking could feature in the global climate-change negotiations while at the same time being a tool to improve the performance of industry, especially in the absence of a robust carbon price signal.

There are a number of areas where benchmarking could play a role.

It is very likely that the initial allocation of newly established cap-and-trade systems will be for free, at least partially. Benchmark-based allocation is a tool for ensuring a high degree of fairness and effectiveness, and for rewarding the carbon-efficient firm. Benchmarks will be applied by definition if an intensity-based system is introduced.

Benchmarks can become useful tools in identifying technology or performance opportunities or providing information on best practice. This has been one of the objectives of the Asia-Pacific Partnership. There is interest in benchmarks in emerging economies, provided they are applied in a purely domestic and voluntary context.

At the level of international climate-change negotiations, benchmarks may be an aspect of sectoral approaches, including sectoral crediting, the sectoral CDM, the development of monitoring, reporting and verification rules and standards, the comparability of effort among parties and among sectors or the setting of caps for parties or sectors.

3.1 Use of benchmarks in domestic emissions-reduction legislation

Benchmarks contribute to a number of areas in domestic climate-change policies in several countries.

US

At a federal level, there are two major legislative proposals currently under discussion by the US Congress. The Waxman–Markey bill[22] was passed by the House of Representatives and is now in the Senate, while the Kerry–Boxer bill[23] was introduced in the Senate at about the same time. Both bills aim at establishing cap-and-trade systems that cover around 85% of US GHG emissions and provide specific portions of the total allowances under the cap for free to particular industrial sectors, including energy-intensive, trade-exposed businesses, oil refiners and certain electricity generators. Electricity and natural gas distributors will receive free allowances for the sole purpose of passing on their value to consumers in the form of low prices. Under both bills, in all cases the allocation principle[24] is grandfathering, i.e. the formulas use pre-determined percentages of historical emissions, or in some instances electricity use, and thus benchmarking is not employed.

The two bills mention benchmarking outside the area of industry. The Kerry–Boxer bill utilises the Energy Star benchmarking tool of the US Environmental Protection Agency (EPA) under a new EPA Efficient Buildings Program that it establishes (Pew Center, 2009). The latter initiative would reward owners of buildings that achieve a minimum score

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[22] See the American Clean Energy and Security Act (ACESA) of 2009, also known as H.R. 2454 or the Waxman–Markey bill, as passed by the US House of Representatives on 26 June 2009.

[23] See the Clean Energy Jobs and American Power Act (CEJAPA), S. 1733, sponsored by Senators John Kerry and Barbara Boxer, as passed out of the Senate Environment and Public Works Committee on 5 November 2009.

[24] The Kerry–Boxer bill goes into further detail to allocate rebates to all emitters in an eligible sector that cover fully the cost of direct and indirect (from electricity use) emissions. The eligibility of a sector depends on its trade intensity (the value of exports being above 15% as a proportion of total revenue) and the energy or GHG intensity (with the energy bill or emissions being above 5% as a proportion of total revenues), or solely on its energy or GHG intensity if it exceeds 20%.

of 75 on the EPA's Energy Star. Similarly, the Waxman–Markey bill includes a definition of measurement protocols for benchmarks of building energy performance. Such protocols are to serve as a methodology for defining a benchmark for the energy performance of a specific building type and for measuring that performance against the benchmark.

Under the Regional Greenhouse Gas Initiative (RGGI), 10 states in the north-eastern US have put into operation a mandatory cap-and-trade programme that reduces 2009 CO_2 emissions from electricity generation by 10% by 2018. The annual budget of allowances is distributed to each state in proportion to its historical emissions. All 10 states have decided to auction the vast majority of allowances available to them. Small amounts[25] are given for free, e.g. to power generators with long-term agreements for the purchase of electricity in the states of New York and Maryland. New York has made eligibility for this free allocation conditional on the installation having an emissions rate at or below a benchmark of 1,100 lbs (or ca. 499kg)/MWh (ENE, 2009).

California is considering the use of benchmarks for allowance allocation in the design of a future cap-and-trade programme under the Global Warming Solutions Act of 2006, but discussions are still underway, involving reports and opinions from several state policy and planning agencies along with numerous committees. For example, the Market Advisory Committee (2007) has recommended that, to the extent used, any free allocation should be based on environmental performance benchmarks. The California Public Utilities Commission (2008) and California Energy Commission jointly recommended differentiated allocation rates for coal-fired and gas-fired power plants based on fuel-differentiated benchmarks. If emitters can reduce the carbon content of their power, the saved allowances can be sold to other entities in the market.

Australia

The proposed Carbon Pollution Reduction Scheme (CPRS) was reintroduced with amendments to the Australian parliament in February 2010 after it was defeated twice in the Senate in 2009. This scheme provides for free emission allocations to the so-called 'emissions-intensive trade-

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[25] The state of Delaware allocates for free a declining percentage of its allowances to all covered emitters in proportion to their emission levels (ENE, 2009).

exposed' industry sectors. The programme employs benchmarks for two purposes. The first is to determine whether the 'emissions intensity' level of a sub-sector is high enough to deem the activity eligible for free allowances. The second is to establish the 'intensity-based allocative baselines' for each activity, i.e. the baseline quantity of allowances available per unit of production. By comparing an activity's emissions intensity with two thresholds, companies would receive 0%, 66% or 94.5% of the baseline permits for each unit of output they produce. The baseline level will shrink by 1.3% per annum starting in 2013, a practice that is termed 'carbon productivity contribution'.

The emissions intensity level is the sector-wide historical average[26] of emission units per revenue. The 'allocative baseline' is a similar ratio but uses units of production instead of revenue. Where the activity is too recent to establish a domestic benchmark, i.e. lacking historical data or consisting of too small a sample of participating firms, the benchmark would be informed by a combination of an international best-practice benchmark and the international emissions-intensity level. For indirect industrial emissions through electricity use, a fixed allocation factor at 1 tonne of carbon dioxide equivalent (tCO_2-e) per MWh nationwide is used, which is a kind of benchmark, allowing for coal-based power production to continue.

Benchmarks have also been used at a state level for cap-setting since 2003 in the Greenhouse Gas Reduction Scheme (GGAS) of New South Wales. This scheme is closer to the baseline-and-credit kind, such as the CDM, since actual reductions come from projects. The constraint is not at the level of power-generating installations but on electricity retail companies that do not reduce emissions themselves. Instead, they purchase tradable abatement certificates, i.e. offset credits, from accredited domestic providers for the emissions beyond the amount assigned to the electricity that each company has sold in a year. The total available emissions amount for the state is based on a mandatory GHG emissions factor or benchmark expressed in tonnes of carbon dioxide equivalent (tCO_2-e) per capita from electricity consumption in that state. In 2007, this factor was 7.27 tCO_2-e per capita (GGAS, 2008) and will stay at that level until 2021. This is 5% below the state's per capita emissions in the Kyoto Protocol baseline year of 1990.

[26] The formula uses the total production output over a two-year period as a weight. For details, see Australian Government (2009).

New Zealand

The New Zealand Emissions Trading Scheme started operation in 2008 and is to be fully phased in by 2013. Then it will cover GHG-emitting activities in all major sectors of the economy: forestry, stationary energy, industrial processes, transport fuels, agriculture, synthetic gases and waste, reflecting the principal sources of emissions (Emissions Trading Scheme Review Committee, 2009).

The 2009 amendment foresees benchmarks to govern the free allocation granted to assist emissions-intensive sectors that are seen at risk of losing competitiveness (New Zealand Government, 2009). This clause is also aimed at aligning the New Zealand ETS design with the CPRS in Australia. Similar to the CPRS, the baselines will be based on the industry average emissions and electricity use per unit of production output. Australian baselines may be used instead of domestic ones, but the electricity allocation factor will be determined domestically. The New Zealand design differs in the portion of assistance, set at 60% and 90% of the baseline permits from 2013. The assistance rate will only be half of the above, i.e. 30% and 45%, during the generally less-demanding phase-in period 2010–12.

In principle, the scheme operates with absolute caps but it foresees a possibility to switch over to an intensity-based system if international climate-change agreements in the future include intensity-based approaches, e.g. through sectoral agreements in sectors such as steel, cement and aluminium or other intensity-based methods. Then, firms would have to surrender allowances if their emissions per unit of output were above the agreed sector- or firm-specific intensity benchmark.

Japan

Benchmarks have recently been introduced in Japan[27] under the existing Energy Efficiency Law,[28] which aims at improving annual energy intensity

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[27] Information in this section is primarily based on the presentation by Akihiro Matsuta, Deputy Director of the Energy Efficiency and Conservation Division, Agency for Natural Resources and Energy at the Japanese Ministry of Economy, Trade and Industry, "Introduction of Benchmarks under the Energy Efficiency Law in Japan", at the meeting of the CEPS Task Force on "Benchmarking for the EU ETS and Beyond", Brussels, September 2009.

by 1% on average or sometimes more. The purpose is to ensure fair evaluation for the progress of energy efficiency in domestic industries and consistency with international discussions in the UNFCCC, the Asia-Pacific Partnership (APP) and industry associations under the Keidanren Voluntary Action Plan on the Environment (see also the next section) or potential future sectoral approaches. Among other aspects, the principles for employing benchmarks entail evaluating total energy consumption, including indirect energy use (of electricity, for instance) and reporting the benchmark value for the entire company rather than individual facilities. Sector benchmarks for the iron and steel industry, the cement industry (with a denominator based on clinker) and thermal power plants have been introduced so far. Expansion to other industries is foreseen.

The benchmark indicator is energy intensity in terms of energy consumed per unit of production. The target benchmark level in each sub-sector is set at the average energy intensity minus the standard deviation, thus around 10% to 20% of companies perform better than the benchmark.

Japan would like to apply benchmarks in the future domestically at first, i.e. using them as a basis for a domestic climate-change regulation. The Advisory Committee on the Emissions Trading Scheme[29] is considering benchmarks based on industry-specific emissions intensity as one of the methods for possible free allocation under a future Japanese ETS, but discussions are continuing. Internationally, there is interest in future CDM methodologies based on benchmarks and in benchmarks as a comparative tool for energy or carbon-saving efforts. Relevant activities underway include extending their use through the APP and bilateral cooperation with developing countries, such as the data collection by the APP Steel Task Force and the APP Cement Task Force founded on a common methodology under Japan's initiative, and international standardisation for CO_2 intensities through the ISO.

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[28] The law itself has been in force since 1979.

[29] The committee was set up by the Japanese Ministry of the Environment to explore concrete scheme designs taking into account the actual situation of Japan and with a view to examining the effectiveness of and the need for an emissions trading scheme as a policy tool (Advisory Committee on the ETS, 2008).

3.2 Domestic programmes and initiatives with benchmarking elements

A number of domestic initiatives involve benchmarking elements at least in the area of reporting energy use and GHG emissions from participating companies. Some of them incorporate the development of performance indicators and comparisons among participants. Table A.1 in appendix 1 provides an overview of the benchmarking elements for different sectors under a number of initiatives worldwide.

US

The US EPA Energy Star for Industry is a voluntary programme for manufacturing sectors. It involves industry-specific energy management tools and resources that help improve energy performance. An energy performance indicator (EPI) is one such tool for evaluating the energy efficiency of plants relative to that of the industry (Newman, 2009). So far, there are EPI modules for cement, corn refining and motor vehicle manufacturing.

Japan

The Keidanren [30] Voluntary Action Plan on the Environment has coordinated since 1996 the action plans of 35 industry sectors that have developed their own numerical targets based on performance indicators, including gross CO_2 emissions, CO_2 emissions per output, energy consumption and energy input per unit of output. The Japanese Iron and Steel Federation, for example, has set a target of reducing energy consumption in 2010 by 10% from the 1990 level (Global Environmental Subcommittee and Expert Committee, 2008).

China

For the cement sector in China, the Benchmarking and Energy Saving Tool (BEST) Cement takes into account the energy performance of cement production. Using this tool for self-assessment, the plants benchmark their energy use against best-practice levels and evaluate energy efficiency measures. Newman (2009) mentions it as a possible model for benchmark-

[30] Nippon Keidanren is the Japan Business Federation – see the Nippon Keidanren website at http://www.keidanren.or.jp/.

based sectoral approaches because it is complete and flexible in its calculation of the performance indicators and metrics. It has been developed by the (US-based) Lawrence Berkeley National Laboratory with collaborating institutes.

Mexico

The "Program GHG Mexico"[31] is a voluntary GHG inventory-reporting initiative that also provides technical tools and training, using the accounting and reporting principles of the World Resources Institute/WBCSD Greenhouse Gas Protocol. The government sees it as a step towards sectoral emissions trading in the future, followed by an economy-wide cap.

3.3 Multilateral benchmarking initiatives and exercises

UNFCCC progress on sectoral approaches

The Bali Action Plan noted the consideration of "cooperative sectoral approaches and sector-specific actions" (para. 1 (b)(iv)), as well as "various approaches to enhance the cost-effectiveness of, and to promote, mitigation actions" (para. 1 (b)(v)). These two topics are within the scope of work of the Ad Hoc Working Group on Long-term Cooperative Action (AWG-LCA) under the UNFCCC. Work is likely to continue.

Under market-based mechanisms and existing mechanisms in particular, the AWG-LCA has been considering the establishment of benchmarks for baseline setting and the determination of additionality for specific CDM project types as one of the revisions of the CDM aimed at ensuring environmental integrity (AWG-LCA, 2009).

Methodologies under the Clean Development Mechanism and Joint Implementation

The CDM in its current form is not benchmark-based since it compares performance with project baselines rather than sectoral best practice. Nevertheless, performance indicators and measurement methodologies are applied, which provides lessons for benchmarking. CDM methodologies are a useful starting point for addressing measurement issues, for instance

[31] See the Programa GEI México website at http://www.geimexico.org/.

setting system boundaries and correcting for leakage (Newman, 2009). Various CDM methodologies have been developed, e.g. those for cement, iron and steel, and aluminium.

Sectoral benchmarking is relevant to the CDM, to the revision of the CDM that is underway and to the development of a future sectoral CDM and other sectoral crediting mechanisms. It involves a dynamic baseline that is based on a pre-determined benchmark indicator (e.g. for emissions per tonne of production) for an entire sector or sub-sector in a country or a region (Fujiwara, 2009). Such a benchmark is particularly useful for demonstrating project additionally and thus ensuring environmental integrity. For example, a recent CDM methodology for refrigerators uses benchmarking.

The Cement Sustainability Initiative under the WBCSD, together with Ecofys, has developed a benchmarking CDM methodology for the cement sector. It was submitted to the CDM Executive Board in April 2009 after having been tested in existing CDM projects and having received feedback from stakeholders. The methodology uses benchmarks based on the carbon intensity per cement or clinker tonne in a given region and is used to calculate baseline scenario emissions and demonstrate additionality (Fujiwara, 2009). The reference data is based on the local and global performance indicators, sourced from the CSI Cement Industry Database under the GNR initiative (see chapter 1) and is consistent with the Cement CO_2 Protocol. Apart from demonstrating additionality, the environmental integrity is enhanced owing to the dynamic nature of the baseline, adjusted for business-as-usual improvements.

The joint implementation (JI)[32] track II may apply an approved CDM baseline methodology or develop its own approach (Fujiwara, 2009). In February 2009, the JI Supervisory Committee decided to develop a determination and verification manual, to include guidance on baseline setting, monitoring and additionality.

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[32] JI is another flexible mechanism under the Kyoto Protocol, similar to the CDM but generating offset credits in developed (Annex I to the UNFCCC) countries.

Asia-Pacific Partnership on Clean Development and Climate

The APP,[33] a public–private partnership that consists of seven partner countries (Australia, Canada, China, India, Japan, the Republic of Korea and the US), represents international sectoral cooperation through sector-specific task forces that seek to identify and share experiences along with best practices, indicate possible performance benchmarks and collaborate on research activities. APP task forces cover data-gathering and benchmarking exercises for three energy supply sectors (cleaner fossil energy, renewable energy and distributed generation, power generation and transmission) and five energy-intensive sectors (steel, aluminium, cement, coal mining, buildings and appliances). The Steel Task Force has produced a *State-of-the-Art Clean Technology Handbook* containing information on energy-saving technologies and practices in the iron and steel industry, and has evaluated the potential for CO_2 emission reductions for each selected technology. The Cement Task Force has moved on to data collection using common boundaries, indicators and investigation methods after agreeing on a benchmark for CO_2 intensity. BEST Cement for China was one of the deliverables of the Cement Task Force. The Aluminium Task Force has established benchmarking indicators (IAI, 2009) and indices that will support, inter alia, perfluorocarbon emissions management, fluoride emissions management and recycling.

International Energy Agency activities

The benchmarking exercise by the International Energy Agency (IEA) has developed a comprehensive overview of existing and potential efficiency performance indicators for industry. The IEA was asked by the Gleneagles G8 summit to identify best practices and indicate the potential for improvements in energy efficiency in buildings, appliances, transport and industry. As a result, the IEA conducted an in-depth analysis of indicators and provided state-of-the-art data and analysis on energy use, efficiency developments and good policy practices (see IEA, 2008).

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[33] See the Asia-Pacific Partnership website at www.asiapacificpartnership.org; see also Fujiwara (2007).

4. CONCLUDING REMARKS

This report has sought to highlight some of the key issues arising from the current benchmarking exercise under the EU ETS, in the context of determining the temporary free allocation for 2013–20. These issues have been discussed and analysed in chapter 2, leading in some cases to recommendations. Earlier, chapter 1 examined the origins, the roles and experiences of existing benchmarking exercises to draw some general conclusions about the main elements and challenges common to all exercises, but also to show the different objectives that benchmarks and benchmarking can have. These conclusions and illustrations in turn have consequences for the design and implementation of both benchmarks and benchmarking. It is hoped that this chapter has helped to clarify both the definitions and terminology. Finally, chapter 3 has illustrated the role of benchmarking for mitigation actions worldwide. Exercises and initiatives outside the EU at the national, industry and UNFCCC levels provide the EU process with a context and further relevance for the international efforts to tackle climate change.

The EU's experience with the NAPs in phases I and II of the EU ETS and that gathered from other national practices has provided a wealth of information and lessons upon which the EU can draw. For the future we would expect that other countries would grapple with the same issues as the EU, for example when making free allocations, setting the distribution of the burden among sectors and establishing national caps in a bottom-up fashion, but also for the purpose of crediting within a new sectoral crediting mechanism or a revamped CDM (or both). Some of the issues that have been discussed likewise emerge in benchmarking approaches that aim at measuring performance with a view to improving it and cutting out waste. The focal points for discussion in these areas are the benchmarks as such, far more than benchmarking, which has the additional complication of adding activity rates to the benchmarks, a field that has its own complications.

GLOSSARY OF ABBREVIATIONS

ACESA	American Clean Energy and Security Act of 2009 (H.R. 2454)
APP	Asia-Pacific Partnership on Clean Development and Climate
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action under the UNFCCC
BEST	Benchmarking and Energy Saving Tool
BREFs	Best-available techniques reference documents
CCS	Carbon capture and storage
CDM	Clean Development Mechanism
CEI™	Carbon emissions intensity
CEJAPA	Clean Energy Jobs and American Power Act (S. 1733)
CEMBUREAU	European Cement Association
CH_4	Methane
CHP	Combined heat and power
CITL	Community Independent Transaction Log for the EU ETS
CO_2	Carbon dioxide
CONCAWE	Oil companies' European association for environment, health and safety in refining and distribution
COP	Conference of the Parties
CPRS	Carbon Pollution Reduction Scheme (Australia)
CRF	Common reporting format
CSI	Cement Sustainability Initiative (under the auspices of the World Business Council for Sustainable Development)
CWB™	Complexity weighted barrel
CWT	Complexity weighted tonne
DG	Directorate-General of the European Commission
EII®	Solomon's Energy Intensity Index
EPA	US Environmental Protection Agency
EPBD	Energy Performance of Buildings Directive (2002/91/EC)
EPI	Energy performance indicator
ETS	Emissions trading system/scheme
EU ETS	European Union Emissions Trading System

EuPs	Energy-using products regulated by the Ecodesign Directive
GGAS	Greenhouse Gas Reduction Scheme (Australia)
GHG	Greenhouse gases
GNR	"Getting the Numbers Right" – a CSI initiative
HFCs	Hydrofluorcarbons
IAI	International Aluminium Institute
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated pollution prevention and control
ISO	International Organization for Standardization
JI	Joint implementation
LULUCF	Land use, land use change and forestry
MRGs	Monitoring and Reporting Guidelines
MRV	Measurement, reporting and verification
MWh	Megawatt hour
NAPs	National allocation plans
N_2O	Nitrous oxide
NGO	Non-governmental organisation
PFCs	Perfluorocarbons
RGGI	Regional Greenhouse Gas Initiative
SF_6	Sulphur hexafluoride
t	Metric tonne
tCO_2	Metric tonne of carbon dioxide
tCO_2-e	Metric tonne of carbon dioxide equivalent (quantities of GHGs)
UNFCCC	United Nations Framework Convention on Climate Change
WBCSD	World Business Council for Sustainable Development

BIBLIOGRAPHY

Ad Hoc Working Group on Long-Term Cooperative Action under the Convention (AWG-LCA) (2009), *Report of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention on its seventh session, held in Bangkok from 28 September to 9 October 2009, and Barcelona from 2 to 6 November 2009*, FCCC/AWGLCA/2009/14 20, UNFCCC, Bonn, November.

Advisory Committee on the Emissions Trading Scheme (2008), *Approach to Japanese Emissions Trading Scheme*, Interim Report (Executive Summary), Ministry of the Environment, Tokyo, May.

Australian Government, Department of Climate Change and Energy Efficiency (2009), *Establishing the eligibility of activities under the emissions-intensive trade-exposed assistance program*, Canberra, December.

California Public Utilities Commission (2008), *Final Opinion and Recommendations on Greenhouse Gas Regulatory Strategies*, Joint Agency final opinion adopted on October 16, 2008 by the California Energy Commission and Public Utilities Commission, Publication No. CEC-100-2008-007-F, San Francisco.

Council of the European Union (2009), Presidency Conclusions of the Brussels European Council of 29/30 October, 15265/09 CONCL 3, Brussels, October.

Ecofys and Fraunhofer Institute for Systems and Innovation Research (ISI) (2009), *Developing benchmarking criteria for CO_2 emissions*, Study ordered by European Commission (Service contract ENV.C.4/SER/ 2007/0059), Ecofys and Fraunhofer ISI, Utrecht and Karlsruhe, February.

Ecofys, Fraunhofer ISI and Öko-Institute (2009a), *Methodology for the free allocation of emission allowances in the EU ETS post 2012: Report on the project approach and general issues,* by order of the European Commission (Study contract: 07.0307/2008/515770/ETU/C2), Ecofys, Fraunhofer ISI and Öko-Institute, Utrecht, Karlsruhe and Freiburg, November.

———— (2009b), *Methodology for the free allocation of emission allowances in the EU ETS post 2012: Sector report for the cement industry,* by order of the European Commission (Study contract: 07.0307/2008/ 515770/ETU/C2), Ecofys, Fraunhofer ISI and Öko-Institute, Utrecht, Karlsruhe and Freiburg, November.

———— (2009c), *Methodology for the free allocation of emission allowances in the EU ETS post 2012: Sector report for the aluminium industry,* by order of the European Commission (Study contract: 07.0307/2008/ 515770/ETU/C2), Ecofys, Fraunhofer ISI and Öko-Institute, Utrecht, Karlsruhe and Freiburg, November.

———— (2009d), *Methodology for the free allocation of emission allowances in the EU ETS post 2012: Sector report for the refinery industry,* by order of the European Commission (Study contract: 07.0307/2008/ 515770/ETU/C2), Ecofys, Fraunhofer ISI and Öko-Institute, Utrecht, Karlsruhe and Freiburg, November.

———— (2009e), *Methodology for the free allocation of emission allowances in the EU ETS post 2012: Sector report for the chemical industry,* by order of the European Commission (Study contract: 07.0307/2008/ 515770/ETU/C2), Ecofys, Fraunhofer ISI and Öko-Institute, Utrecht, Karlsruhe and Freiburg, November.

Egenhofer, C. and N. Fujiwara (2007), *Shaping the Global Arena: Preparing the EU Emissions Trading Scheme for the Post-2012 Period*, CEPS Task Force Report, CEPS, Brussels, March.

———— (2008), *Global sectoral industry approaches to address climate change: The way forward*, CEPS Task Force Report, CEPS, Brussels, April.

Emissions Trading Scheme Review Committee (2009), *Review of the Emissions Trading Scheme and related matters,* Report of the Emissions Trading Scheme Review Committee, Forty-ninth Parliament, New Zealand House of Representatives, August.

Entec UK Ltd and NERA Economic Consulting (2005), *EU Emissions Trading Scheme Benchmark Research for Phase 2,* Final Report for the UK government, Entec UK Limited and NERA Economic Consulting, London, July.

Environment Northeast (ENE) (2009), *RGGI Allowance Allocations & Auction Proceeds Distribution Plans*, ENE, September.

European Parliament and Council of the European Union (2009), Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emissions allowance trading scheme of the Community, OJ L 140/63, 5.6.2009, pp. 63-87.

Fujiwara, N. (2007), *The Asia-Pacific Partnership on Clean Development and Climate: What it is and what it is not*, CEPS Policy Brief No. 144, CEPS, Brussels.

——— (2009), *Flexible Mechanisms in Support of a New Climate Change Regime: The Clean Development Mechanism and Beyond*, CEPS Task Force Report, CEPS, Brussels, November.

Global Environmental Subcommittee of the Environmental Committee at the Industrial Structure Council and the Expert Committee for Follow-up to the Voluntary Action Plan on the Environment at the Central Environment Council (2008), *FY 2008 Evaluation and Verification of the Voluntary Action Plan on the Environment: Results and Future Issues*, Ministry of Economy, Trade and Industry, Tokyo, December.

Greenhouse Gas Reduction Scheme (GGAS) (2008), *Introduction to the Greenhouse Gas Reduction Scheme*, GGAS, Sydney, September (www.greenhousegas.nsw.gov.au).

International Aluminium Institute (IAI) (2009), *Aluminium Measuring & Benchmarking 2008*, report prepared for the Australian Government as part of the Asia-Pacific Partnership on Clean Development & Climate Aluminium Task Force, IAI, London, August.

International Energy Agency (IEA) (2008), *Energy Efficiency Policy Recommendations in Support of the G8 Plan of Action*, IEA, Paris.

Market Advisory Committee (2007), *Recommendations for Designing a Greenhouse Gas Cap-and-Trade System for California*, prepared for the California Air Resources Board, Sacramento, 30 June.

New Zealand Government, Ministry for the Environment (2009), "Industrial allocation update", *Emissions Trading Bulletin*, No. 12, INFO 441, Wellington, September.

Newman, J. (2009), "Benchmarking – Global Sectoral Approaches as Part of a Post-2012 Framework", Background Paper, Center for Clean Air Policy, Washington, D.C.

Pew Center on Global Climate Change (2009), "Pew Center Summary of Clean Energy Jobs and American Power Act (Kerry-Boxer)", Pew Centre, Arlington, VA (www.pewclimate.org).

Schyns, V. (2005), "Climate change challenges and the search for a sustainable policy", Paper presented at the "8th International Conference on Carbon Dioxide Utilisation (ICCDU-VIII)", held in Oslo, 20-23 June, p. 10.

Schyns, V. and A. Loske (2008), *The benefits and feasibility of an ETS based on benchmarks and actual production*, in collaboration with IFIEC Europe, 27 October (http://www.akoestischeisolatie.be/documents.htm).

United Nations Framework Convention on Climate Change (UNFCCC) (2010), *Work undertaken by the Conference of the Parties at its fifteenth session on the basis of the report of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*, Advance Version, FCCC/CP/2010/2, UNFCCC, Bonn, 11 February.

Öko Institut and Ecofys (2008), *Pilot on benchmarking in the EU ETS*, Report prepared for the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Dutch Ministry of Economic Affairs, Öko Institut/Ecofys, Berlin and Utrecht, November.

APPENDIX 1. INITIATIVES WITH BENCHMARKING ELEMENTS

Table A.1 Existing programmes and research on benchmarking and best practice assessment: Progress in developing measurement protocols, performance indicators and technology guides

	General			Cement			Iron & Steel			Aluminium		
	MP	**PI**	**TG**	**MP**	**PI**	**TG**	**MP**	**PI**	**TG**	**MP**	**PI**	**TG**
Greenhouse Gas Protocol Initiative	X			X			X			X		
EU Emissions Trading Scheme (ETS) Monitoring and Reporting Guidelines	X			X			X			X		
Cement Sustainability Initiative (CSI)				(1)	(ra)							
World Steel Association (WSA)							X	(r)◊**				
International Aluminium Institute (IAI)										X	(ra)	
Benchmark-based EU ETS allowance allocations*		X			X			X			X	
Clean Development Mechanism (CDM) methodologies				?			?			?		
European Integrated Pollution and Control Bureau (EIPPCB)					(s)	X		(s)	X		(s)	X
International Energy Agency (IEA) Greenhouse Gas R&D Programme					(b)	X		(b)	X		(b)	X
Asia-Pacific Partnership				◊	◊?	?	◊	◊?	X		?	?
Canada: Industry Program for Energy Conservation (CIPEC)								(rp)			(rp)	
Flanders: Benchmarking Covenants							?	(rw)				

Table A.1 cont'd

Japan: Federation of Economic Organisations (Keidanren) Agreements			(rg)	(rg)
Mexico: GHG Program		(1) (r)		
Netherlands: Benchmarking Covenant		? (rw)	? (rw)	
UK: Climate Change Agreements		(rg)	(rg)	
US: EPA Energy Star for Industry; Energy Performance Indicator (EPI)		(rp) X		
US: EPA Climate Leaders Program	(rg)			
US: 1605b reporting	(r)	(r)	(r)	(r)
US: Climate VISION				
Benchmark-based EU ETS allowance allocations - Phases II & III	(ps)	(ps)	(ps)	(ps)

* Various countries (Belgium (in both Flanders and Wallonia), Italy, the Netherlands and Sweden) have used benchmarking as an explicit factor in distributing EU ETS allowances. These countries and regions, plus Denmark, Finland, Germany, Greece, Latvia, Lithuania and the UK, have also used benchmarking to allocate allowances to new market entrants.

** Although individual plant data is aimed at, to date the majority of plants are not yet covered, including those in China.

MP = Measurement protocol

PI = Performance indicator

TG = Technology guides (best practice)

(1) = Based on the Greenhouse Gas Protocol Initiative

(◊) = Under development

(b) = Performance of hypothetical best-practice plant

(s) = Performance of a small sample of plants

(r) = Performance of individual plants/corporations reported to registry

(rg) = Publicised corporate/sectoral goals

(rp) = Anonymous peer comparison

(ra) = Global/regional averages published

(rw) = Compared with world-class plant

(ps) = Research into performance standards

Source: Adapted from Newman (2009, p. 6).

APPENDIX 2. LIST OF TASK FORCE MEMBERS AND INVITED GUESTS AND SPEAKERS

Chair: Anna Törner,
Head of Section, Ministry of Enterprise, Energy and Communications, Sweden

Rapporteurs: Christian Egenhofer, Senior Research Fellow, CEPS
Anton Georgiev, Research Fellow, CEPS

Advisory Contributor: Hubert van den Bergh, Former Head of the Flemish Verification Office

MEMBERS OF THE TASK FORCE

Chris Beddoes
Deputy Secretary-General
European Petroleum Industry Association (EUROPIA)

Daniele Agostini
Environmental Affairs
ENEL

Richard Armand
Climate Change Adviser
Entreprises pour l'Environnement

David Bornstain
Adviser
Electricité de France (EDF)

Stephen Boucher
Programme Director for EU Climate Policies
European Climate Foundation

Graham Boyd
Deputy Director
Department for Business, Innovation & Skills
Business Economics

Karl Buttiens
General Manager
Environment Directorate
ArcelorMittal

Nick Campbell
Environment Manager
Fluorinated Products
ARKEMA SA;
Chairman
Climate Change Working Group
Business Europe & ICC

Jean-Yves Caneill
Project Manager
Environmental Affairs
Electricité de France (EDF)

Koen Coppenholle
Head of European Affairs
ArcelorMittal

Mike Coyle
Consultant

Erik Filipsson
Climate & Energy Policy Analyst
Research & Development
Vattenfall AB

Henrik Forsgren
Director Public Affairs
Göteborg Energi AB

Noriko Fujiwara
Head of Climate Change &
Research Fellow
CEPS

Sophie Galharret
Project Manager
Climate
IDDRI

Caterina Geremei
Senior Account Manager
Fleishman-Hillard Company

Francesco Giorgianni
Director for Public Affairs
ENEL SpA

Matthias Grandel
Energiewirtschaftliche
Grundsatzfragen und Prozesse
Energy Economics and Process
Design
E.ON Energie AG

Lars Holmquist
Director Public Affairs
Business Development
Göteborg Energi AB

Jan Janssen
Senter Novem

Staffan Jerneck
Director & Director of Corporate
Relations
CEPS

Marie Jernsund
Energy System Analyst
Goteborg Energie

Robert Klingens
Business Development - Key
Account Manager
Climate Change Services
DNV

Timm Kraegenow
Director
Brussels Office
Center for Clean Air Policy Europe

Tobias Krug
Department of Climate &
Sustainable Development
Federation of German Industries

Sanjeev Kumar
Senior Adviser
E3G – Third Generation
Environmentalism

Luc Larmuseau
Global Director
Climate Change Services Benelux
Det Norske Veritas AS (DNV)

Frederike Lehmann
CO_2 EU Emissions Trading Scheme
Adviser
Shell Deutschland Oil GmbH

Roxana Lesovici
Head of EU Affairs
Hydro

Giuseppe Lorubio
Stagiaire
ENEL SpA

Claude Lorea
Technical Director
CEMBUREAU

Vagner Maringolo
Issues Manager
CEMBUREAU

Roland-Jan Meijer
Vice President
Environmental Affairs
Holcim Group
Support (Brussels) SA

Marco Mensink
Environment & Energy Director
CEPI

Isabelle Müller
Secretary-General
European Petroleum Industry
Association (EUROPIA)

Simonetta Naletto
Senior Manager, EU Affairs
ENEL SpA

Aurelie Pattyn
EU Affairs Policy Officer
Hydro

Jean-Paul Peers
Vice President – Energy Policy
Siemens AG

Alessandro Profili
Director, European Affairs
Brussels Office
Alcoa Europe

Pétur Reimarsson
Director of Policymaking &
Communications
Confederation of Icelandic
Employers

Kazuhito Sakurai
Visiting Fellow
Royal Institute of International Affairs (Chatham House)

Elena Scaroni
Policy Adviser
External Relations
ENEL SpA

Sarah Schwarz
Vattenfall Europe

Vianney Schyns
Energy Coordinator
Utility Support Group B.V.

Frederik Seeger
Account Executive
Fleishman-Hillard Company

Vanessa Tedeschi
ENEL SpA

Nadine Toscani
Government Affairs Manager
Alcoa Europe

Bruno Vanderborght
Senior Vice President
Climate Change
Holcim Group Support (Zurich) Ltd

Rob van der Meer
Director, EU Public Affairs
Global Environment Sustainability
HeidelbergCement

Hajime Wakuda
Deputy Executive Director
Japan Machinery Center

Hans-Jörn Weddige
Head of Corporate Climate Policies
ThyssenKrupp Steel AG

Mike Wriglesworth
Senior Adviser
CEPS

Tomas Wyns
EU ETS Policy Officer
Climate Action Network Europe

Roberto Zangrandi
Director
ENEL SpA

Lars Zetterberg
Director
IVL Swedish Environmental Research Institute

INVITED SPEAKERS AND GUESTS

Hans Bergman
Policy Coordinator
DG Environment
European Commission

Andrea Biagiotti
Ministry for the Environment Land and Sea, Italy

Ondrej Bores
Governmental Expert
Ministry of Environment
Czech Republic

Simon Crode
Policy Adviser
Department of Business Innovation & Skills, UK

Chiara Di Mambro
Ministry for the Environment Land and Sea, Italy

Joachim Ehrenberg
Policy Officer – Climate Change
DG Enterprise
European Commission

Kirsten Lundt Erichsen
Danish Energy Authority

Glory Francke
Acting European Policy Director
International Emissions Trading Association (IETA)

Mariano Garces
Environmental Technician
Spanish Environmental Ministry

Agime Gerbeti
Gestore dei Servizi Energetici – GSE S.p.a
Expert on EU Emissions Trading Scheme, on behalf of the Italian Ministry of Economic Development

Frédéric Lehmann
Ministère des Finances, France

Mark Hayden
Economist
DG ECFIN
European Commission

Didier Herbert
Head of Unit
DG Enterprise
European Commission

Päivi Janka
Head of Emissions Trading Unit
Ministry of Employment and the Economy, Finland

Robert Jeszke
Head of Strategy & Analysis Unit
KASHUE, Poland

Asa Johannesson Linden
Administrator
DG ECFIN
European Commission

Yvan Keckeis
Senior Policy Officer
Federal Office for the Environment
Mission of Switzerland to the EU

Joanna Krzes-Dobieszewska
Chief Expert
Ministry of Economy, Poland

Linda Leja
Head of Climate Policy Division
Climate & Renewable Energy
Ministry of Environment
Republic of Latvia

Akihiro Matsuta
Deputy Director
Agency for Natural Resources and Energy
Ministry of Economy, Trade and Industry, Japan

Maarten Neelis
Senior Consultant
Ecofys Netherlands BV

C.S. Nemes
Climate Change & Energy Unit
Ministry of Environment & Water
Hungary

Daniel Newport
Economic Assistant
DECC-Department of Energy & Climate Change, UK

Annie Norgrove
Head of Policy – EU ETS
Department of Business Innovation & Skills, UK

Julien Pestiaux
Engagement Manager
McKinsey & Co Belgium

Pavel Prokes
Administrator
DG Enterprise
European Commission

Julia Reinaud
European Climate Foundation

Sarah Resouly
Policy Adviser
EU Emissions Trading System
Department of Energy & Climate Change (DECC), UK

Cristina Riestra Lopez
Ministry of Industry, Tourism & Trade, Spain

Marcos Savini
Diplomat
Mission of Brazil to the EU

Przemyslaw Sikora
Expert
KASHUE, Poland

Yvon Slingenberg
Head of Unit
DG ENV
European Commission

Lukasz Sosnowski
Referendary
Ministry of Economy, Poland

Sandra Stevens
Policy Coordinator
DG Energy & Transport
European Commission

Stefano Vescovi
Counsellor
Mission of Switzerland to the EU

Yoshinori Tanaka
First Secretary (Environment)
Mission of Japan to the EU

Philipp Troppmann
Policy Officer
DG ENTR B.1
European Commission

Elske Van Efferink
Senior Adviser
Ministry of Economic Affairs
The Netherlands

Kornél Varsanyi
Climate Change & Energy Unit
Ministry of Environment & Water,
Hungary

Alexander Vasa
DG Enterprise
European Commission

Tomas Velghe
Seconded National Expert
DG Environment
European Commission

Julia Williams-Jacobse
Senior Policy Coordinator
Ministry of Environment,
The Netherlands

Atushi Yushita
Counsellor
Economic and Financial Affairs
Mission of Japan to the EU