Best available technology and benchmark base-line setting under the Article 6.4 mechanism

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Abbreviations

AILAC	Independent Alliance of Latin America and the Caribbean
AFOLU	Agriculture, Forestry and Other Land Use
APP	Asia-Pacific Partnership on Clean Development and Climate
A6.4ER	Article 6.4 emission reduction
A6.4M	Article 6.4 mechanism
A6.4SB	Article 6.4 Supervisory Body
BAT	Best Available Technology
BAT(EA)	Best Available Technology (Economically Achievable)
BAT-AEL	Best Available Technology Associated Emission Levels
BATNEEC	Best Available Technology Not Entailing Excessive Costs
BATq	Best Available Technique
BAU	Business As Usual
BECCS	Bioenergy with Carbon Capture and Storage
BEE	Bureau of Energy Efficiency
BEMO	Best Environmental Management Options
BEP	Best Environmental Practices
BREF	Best Available Techniques Reference Documents
BTR	Biennial Transparency Report
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CIACA	Collaborative Instruments for Ambitious Climate Action
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
CO_2	Carbon Dioxide
COP	Coefficient of Performance/Conference of the Parties
CSI	Cement Sustainability Initiative
CTCN	Climate Technology Centre and Network
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EEA	European Economic Area
EFTA	European Free Trade Association
EIPPCB	European Integrated Pollution Prevention and Control Bureau
ELV	Emission Limit Value
ETS	Emission Trading System
EU	European Union
GEF	Grid Emission Factor
GHG	Greenhouse Gas
GJ	Gigajoule
GNR	Getting the Numbers Right

HCFC-22	Chlorodifluoromethane
HFC-23	Trifluoromethane
HNO_3	Nitric acid
IAI	International Aluminium Institute
IED	Industrial Emissions Directive
IFM	Integrated Forest Management
IISI	International Iron and Steel Institute
IPCC	Intergovernmental Panel on Climate Change
IPPC	Integrated Pollution and Prevention Control
ITMO	Internationally Transferred Mitigation Outcome
JCM	Joint Crediting Mechanism
JI	Joint Implementation
JISC	Joint Implementation Supervisory Committee
JRC	Joint Research Centre
kg	Kilogram
KliK	Foundation for Climate Protection and Carbon Offset (Stiftung Klimaschutz und CO_2-Kompensation)
LULUCF	Land Use, Land Use Change and Forestry
LT-LEDS	Long-term Low Emission Development Strategy
MO	Mitigation Outcome
MRV	Monitoring, Reporting and Verification
MW	Megawatt
NDC	Nationally Determined Contribution
NGO	Non-Governmental Organisation
NIR	National Inventory Report
NO_x	Nitrogen Oxides
N_2O	Nitrous Oxide
OECD	Organisation for Economic Co-operation and Development
OMGE	Overall Mitigation of Global Emissions
PA	Paris Agreement
PAT	Perform, Achieve and Trade
PS-AFOLU	Panda Standard Sectoral Specification for AFOLU
PV	Photovoltaic
RMP	Rules, Modalities and Procedures
RCC	Regional Collaboration Centre
SB	Subsidiary Body
SBSTA	Subsidiary Body for Scientific and Technological Advice
SEC	Specific Energy Consumption
SOP	Share of Proceeds
SO_2	Sulphur Dioxide
TIER	Technology Innovation and Emissions Reduction
t	Metric Tonne

UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States Dollars
VCM	Voluntary Carbon Market
VCS	Verified Carbon Standard

Executive Summary

Benchmarking approaches to baseline setting under international carbon market mechanisms have been discussed over the last 20 years in the context of the Clean Development Mechanism (CDM), Joint Implementation (JI) under the Kyoto Protocol and the voluntary carbon market (VCM). They have been applied in a subset of methodologies approved under these markets. We assess the appropriateness of benchmarking for the Article 6.4 mechanism (A6.4M), the baseline and credit mechanism established under the Paris Agreement (PA). We particularly look at the ‘best available technology’ (BAT) approach to baseline-setting, which is a sub-category of benchmarking approaches comparable to performance-based benchmarking. So far, there is limited experience with BAT-derived benchmarks in international carbon markets. Principally, such benchmarks can support the host country in its NDC implementation, as a more stringent baseline increases the share of mitigation outcomes accruing to the host country.

A key aspect that needs to be carefully considered in BAT approaches is the differentiation between ‘technology’ and ‘technique’, with the latter including operational practices. If one wants to include forestry and agriculture sectors, a ‘Best Available Technique’ (BATq) approach is necessary but in other sectors restricting the definition to technologies is more stringent

The process of defining BAT/BATq can help the host country to better understand technological developments at the national level, including their mitigation costs when conducting BAT assessments, thus enhancing national capacities in climate policy. Through strengthening data gathering processes, the host country can also enhance its MRV system of mitigation actions, leading to improved transparency. Most importantly, BAT/BATq-derived benchmarks can be aligned with long-term low emission development strategies (LT-LEDS) and their decarbonisation pathways and help to increase national mitigation ambition levels. BAT/BATq-derived benchmarks thereby offer opportunities to better align baseline setting in crediting mechanisms with implementation of host countries’ NDCs, as a larger share of mitigation remains in the host country. BAT/BATq-based baselines can lead to a shift of host country emission credit generation strategies from promoting low cost towards middle- and high abatement cost measures harnessed through international carbon pricing instruments. This could effectively avoid overselling of mitigation outcomes by the host country and contribute to closing the ‘ambition gap’ that characterises current NDCs.

Ongoing negotiations on the draft rules, modalities, and procedures (RMP) of the A6.4M suggest that baselines in this mechanism will be set below business as usual (BAU) to ensure that activities contribute to NDC implementation of the host country and facilitate higher ambition in the future. If this approach is retained, BAT may become a relevant approach for the A6.4M, whereas existing baseline setting approaches under the CDM based on the BAU principle will need revisions to be made ‘fit for Paris’.

In this study, we define a benchmark as a reference against which an output is compared. Key aspects for the determination of a benchmark include the level of aggregation for which the benchmark is calculated and whether the comparison group is determined based on institutions, activity types or technology types. In the case of a performance-based benchmark, a specific percentile of the comparison

group's best performers is chosen, while a BAT-derived benchmark is determined by a technology deemed best (or at least better than average) in a specific sector or sub-sector. The stringency of a benchmark is thus always based on a policy decision. Greenhouse gas emission trading schemes have used performance benchmarks widely for free allocation to trade-exposed industries, while they have only been used for certain sub-sectors in baseline and credit schemes. A BAT-derived benchmark is not necessarily more stringent than a performance-based benchmark. A performance benchmark set at the 30th percentile is likely to be less stringent than a BAT, if the latter is defined to be a recently matured best class of technologies in a sector, whereas a 10th percentile benchmark is probably more stringent than a BAT defined as the best available technology not entailing excessive costs (BAT-NEEC). However, the BAT approach is more linked to actual performance of a technology than the choice of a percentile of technology performance.

Zooming into the definition of BAT/BATq, 'best' usually refers to the top-performing technologies or techniques and 'available' defines the level of aggregation or geographical scope. The latter term in particular plays an important role in the potential acceptance of a BAT-derived approach by Parties with a lower level of development and the impact of domestic industries. To date, BATq as a benchmarking approach has found application in selected multilateral environmental agreements, including the Stockholm Convention on Persistent Organic Pollutants and the Minamata Convention on Mercury. A mix of BAT and BATq has been used in (supra)national environmental policy in the EU and in large economies like China, New Zealand, Russia, South Korea, and the US. In these contexts, 'best' has been defined as achieving a high general level of protection of the environment, going beyond GHG emissions. The definitions of 'available' range from accessibility of the technology/technique to a specific operator, the technology being produced within the jurisdiction to the technology being generally economically and technically viable in the jurisdiction. The narrower the definition of what is available, the less stringent the benchmark will be. Discussions about such definitions are highly politicised and will be pivotal for the acceptance of the BAT/BATq approach in the context of the ongoing Article 6.4 negotiations. The definitions then applied by the A6.4M Supervisory Body will also be key in determining the stringency of the approach and the robustness and integrity of the emissions credits issued by the mechanism (called Article 6.4 emission reductions, A6.4ERs).

Experiences from BAT/BATq applications in the contexts of international conventions, national regulations and ETSs show that the identification process of what constitutes BAT/BATq in a sector and region can be a lengthy exercise taking between 1-6 years, depending on the sector and the scope of the exercise. Therefore, the establishment of an efficient governance process for determining BAT/BATq is required. A key challenge to the process is the availability of disaggregated data on applied technologies in some (sub-)sectors, especially in industry contexts with a high degree of competition. The success of some industry-led initiatives in cement, steel, and aluminium in calculating and publishing performance levels shows that it is possible to overcome this challenge as long as anonymity of specific entities is protected. It must be noted that the process of determining BAT/BATq for carbon market engagement offers high synergies with collecting data and information required by governments when developing climate policy instruments and preparing, updating, and tracking implementation of their NDCs.

Under JI, BAT-derived benchmarks were applied for some projects focusing on the reduction of nitrous oxide (N_2O) from nitric acid production. The proposed revised JI guidelines (which were not approved in the end) aimed at striking a balance between host country ownership and international oversight in developing standardised baselines, including benchmarks. Under the Joint Crediting Mechanism (JCM), operated by the Japanese government, BAT-derived benchmarks have been applied extensively. Our analysis of benchmarking in baseline and credit schemes shows that some schemes introduce high-performance benchmarks which are similar or even equal to a BAT/BATq approach in terms of their stringency. Under JI, host countries were pushing for more stringent baselines, while in some CDM projects, it was an industry stakeholder striving for a more stringent BAT to preserve competitive advantage.

In the ongoing Article 6.4 negotiations, some Parties are supporting a broad-based application of BAT-derived benchmarks under the A6.4M. However, other Parties, especially developing countries, fear that identifying foreign technologies as BAT may lead to an imposition of specific technologies and a reduced scope to generate mitigation outcomes with domestically available technologies. A broader BATq approach may alleviate these fears, but also generate the risk that the approach becomes less stringent as inefficient operational and managerial practices are declared to be the best available in a specific context. For an agreement to be reached, Parties to the Paris Agreement need to develop a common understanding of the concept's applicability and underpinning definitions. It is important to recognise that a BATq-derived benchmark or performance benchmarking in general may not be the most appropriate option for all sectors. There is thus a need for carrying out an assessment under the work programme to clearly determine which sectors and sub-sectors should apply performance benchmarks or whether approaches based on projections of emission pathways would be more appropriate to ensure environmental integrity.

Our study explores different options how to include BATq in the Article 6.4 RMPs, including having it as a choice, determining BATq as a default approach or considering BATq as a sub-type of performance benchmarking. While we recognise that the RMPs must allow for the implementation of a broad range of activities, we caution against granting stakeholders too broad flexibilities in selecting the most convenient baseline-setting approach, as this will result in a lack of harmonisation, even among the same type of activities being implemented in the same country or region and jeopardize environmental integrity.

In the approval of baseline approaches, the Supervisory Body (SB) of the A6.4M should act as a facilitator and guardian of host countries' interests in terms of achieving their NDC and LT-LEDS and support them in setting BATq-derived benchmarks to meet the outlined rationales.

To promote a wide-spread adoption of BAT/BATq-derived benchmarks in A6.4M activities in sectors where they are the most appropriate and stringent option, some key challenges must be overcome. This relates most importantly to reducing the upfront costs of the BAT/BATq determination process, building host country capacities regarding choosing benchmarks and collecting the necessary data and finding solutions to appropriately deal with confidentiality of private sector data. We make the following recommendations to address these challenges:

- In the A6.4M RMPs, the term 'available' should be defined as representing the 'most effective and advanced technologies or techniques, as appropriate, used under economically and technically viable conditions in a given country or regional context, that are reasonably accessible to the economic actors in that context'. This definition of 'availability' must accommodate concerns of developing countries that BAT/BATq is not determined within a specific context but imposed at a global level.
- The costs of BAT/BATq determination processes should be reduced through the promotion of standardisation and the allocation of a part of the administrative share of proceeds (SOPs) by the A6.4SB to finance costs incurred in host countries. Therefore, further technical work should be mandated by Parties to the UNFCCC Secretariat to develop a standard process for BAT determination. Besides, the UNFCCC Secretariat should be mandated to take on preliminary cost estimations and identify options to fund the process through SOPs.
- Capacity building programmes for host countries in the context of the A6.4M should be promoted, including concrete guidance and tools, and should go beyond ad-hoc workshops for a limited number of staff. Capacity-building activities should increase the host countries' capacities in a broader sense and strengthen awareness of the synergies of a BAT/BATq identification process for carbon market activities with overall NDC planning and implementation.
- Technical experts should be trained through the UNFCCC Regional Collaboration Centres to undertake data collection for BAT/BATq assessments across sectors at the regional level to ensure enhanced transparency. Designated Operational Entities (DOEs) should be trained and certified to verify the data. Specific protocols to deal with confidentiality of sensitive data must be developed.

Further recommendations regarding the potential governance of BAT/BATq-derived benchmarks under the A6.4M include:

- The UNFCCC Secretariat should develop a standard process for BAT/BATq determination involving the host country government, activity participants, technical experts and DOEs, as well as the A6.4SB and its support structure.
- The A6.4SB should be mandated to:
  - develop guidance and procedures for BAT/BATq assessments and updates in different sectors.
  - identify and collaborate with relevant international organisations and entities (as relevant) and include BAT/BATq-related requirements and tasks in the accreditation processes of DOEs.
  - either assess BAT/BATq-derived benchmarks submitted by individual or groups of host Parties or develop such benchmarks upon request by the host country.
  - identify and promote synergies of BAT/BATq determination processes with NDC planning and update processes; and
  - check for consistency of reported information on performance data or national inventory data in biennial transparency reports (BTRs) and information reported in methodologies and assumptions in submitted Article 6.4 activity registration requests.

1. Introduction: Context and objective of the study

Article 6 of the Paris Agreement (PA) comprises two modes of market-based voluntary cooperation to implement and raise Parties' ambition in their nationally determined contributions (NDCs): Article 6.2 cooperative approaches and the Article 6.4 mechanism (A6.4M). The A6.4M has the objective of delivering emission reductions and removals and promoting sustainable development within the Party hosting the activity. The mechanism, which is subject to international oversight by the Article 6.4 Supervisory Body (A6.4SB), builds on the lessons learned with the baseline and credit mechanisms under the Kyoto Protocol: The Clean Development Mechanism (CDM) and Joint Implementation (JI). Rules, modalities, and procedures (RMPs) for the A6.4M are currently being negotiated, with a decision expected for the 26th Conference of the Parties (COP26) in Glasgow.

Having well-functioning baseline and credit mechanisms crucially depends on having sufficiently robust rules and principles for baseline and monitoring methodologies in place. This is because emissions baselines from which the emission reduction achieved by an activity are calculated are 'counterfactuals', meaning that not one single, right approach to setting a baseline exists (Michaelowa 1998; Lo Re et al. 2019). Baseline methodologies provide guidance on operationalising core carbon market principles and include rules and procedures for additionality determination, baseline setting and monitoring of emission reductions/removals and support activity participants in operationalising them. Principles that were applied under the CDM for baselines included conservativeness, internal consistency, limited uncertainty, and accuracy. However, under the CDM, the generic approach has always been that a baseline should represent the 'business as usual' (BAU) course of action, given that CDM host countries did not have any emission targets and most methodologies were developed in a bottom-up process, where developers had no interest in developing benchmarks of broader applicability. In the context of the ongoing negotiations about the RMPs of the A6.4M, new principles for setting baselines below BAU are discussed in climate negotiations and a list of possible approaches is currently on the table (UNFCCC 2019a; UNFCCC 2019b).

This study discusses below-BAU performance benchmark approaches to baseline setting and focuses on the so-called 'best available technology' (BAT) approach as one specific form of performance benchmarking. The approach merits an in-depth analysis as it could facilitate alignment of baseline-setting with host country NDC implementation in the PA era.

There are other concepts related to BAT, such as 'best environmental (management) practices' (BEP) or 'best environmental management options' (BEMO), which are considered broader approaches. The EU regulation on eco-management and audit scheme (European Parliament and Council 2009) makes use of the former, which is defined as "the most effective way to implement the environmental management system by organisations in a relevant sector and that can result in best environmental performance under given economic and technical conditions" (European Parliament and Council 2009, para. 14). A key difference between BEP/BEMO (including other related concepts) and BAT is that the latter is more technology-centric and focused on technological advances and changes, as well as on the reduction of different emissions. BEP and BEMO are more environment-centric, considering, for example, the education of the public about environmental consequences of choices, the use of labels, the saving of resources (including energy), as well as recycling, recovery, and re-use (OSPAR Convention 1992).

Benchmarking is generally considered a relevant approach for baseline-setting. Benefits and challenges of performance benchmarks have been assessed, building on experiences in the CDM and JI. In the CDM, there was an arbitrary decision to set the performance benchmark at a specific percentile. Approaches which were initially formulated in a broad manner were interpreted in specific ways once operationalised. We assess whether the BAT concept can be a more objective and thus better approach for determining *where* the performance benchmark is to be set. We hope to provide clarity and contribute to a common understanding of approaches as this is a precondition for ensuring that baseline setting approaches are operationalised in accordance with the spirit of the agreement in the RMPs of the A6.4M.

This study builds on an earlier brief background paper which has been discussed with selected negotiators and technical experts during the spring of 2021. Chapter 2 discusses the definitions and terminology of benchmarking in general before providing details on performance-based and BAT-derived benchmarks. Chapter 3 provides an overview of the application of BAT in different environmental regulations beyond greenhouse gas (GHG) reduction. Chapter 4 dives deeper into the use of performance-based and BAT-derived benchmarks in different baseline-and-crediting schemes. Finally, chapter 5 focuses on the discussion of governance-related issues including the rationale for applying a BAT approach, challenges, and design options for the A6.4M.

2. Defining benchmarking and BAT-derived benchmarking

This chapter discusses the definitions of performance-based benchmarks and how BAT relates to these.

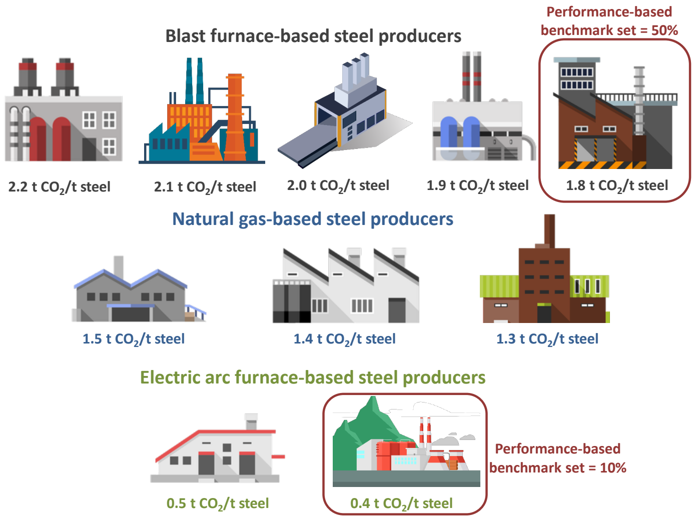
2.1. Defining benchmarks

A benchmark can be defined as a reference or threshold value against which an output is measured. It is used to show how an entity/activity/technology generating the output performs against the reference. Key for the development of a benchmark is the level of aggregation and the choice of the comparison group. The comparison group can include institutions, activities/projects, or the application of a specific technology. Parameters to define the comparison group can comprise a geographical area, jurisdiction, specific features of a technology, vintage of a technology and/or the size of an activity.

Benchmarks can be used to regulate technologies/entities, meaning that only technologies/entities performing better than the benchmark are allowed operate. In general, a benchmark serves as a 'yardstick' for comparison and is therefore often used in environmental policy setting. In the environmental context, a benchmark is understood as a rate of a pollutant. In climate policy, it is defined in terms of GHG, e.g., metric tonnes carbon dioxide equivalent (tCO_2e) per unit of output, also called "emissions intensity" (Fischer 2019). Regarding conservativeness of baselines, the stringency of a benchmark is decisive. It may differ within and between types of benchmarks (e.g., performance benchmark or BAT benchmark).

To illustrate the generic benchmarking approach, we use a numerical example: We want to calculate a GHG benchmark for steel production in the fictitious state of Ferroland. There are ten steel producers in Ferroland with each having a capacity of 1 million tonnes of steel per year. We now order the producers according to their GHG emissions intensity. There are five producers using the blast furnace route, three producers using the natural gas direct reduction route and two producers using the electric arc furnace route. The emissions intensity of the first five reaches 2.2, 2.1, 2.0, 1.9 and 1.8 tCO_2/t steel, followed by the three natural gas-based producers at 1.5, 1.4 and 1.3 tCO_2/t steel. The best two producers (electric arc furnace) stand at 0.5 and 0.4 tCO_2/t steel. A benchmark set at the average = 50% level would reach 1.8 tCO_2/t steel. If it is set at the best 10% it would be set at 0.4 tCO_2/t steel (see Figure 1).

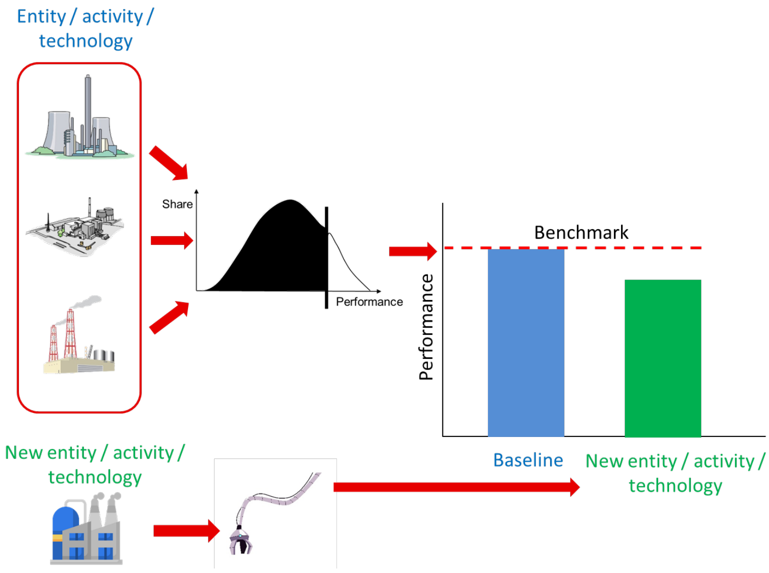
Figure 1: Performance-based benchmarks in Ferroland's steel industry



Source: Authors

Figure 2 shows how a performance-based benchmark is, in general, derived and applied in a sector context.

Figure 2: Deriving a performance-based benchmark



Source: Authors

Performance benchmarks are widely used in GHG emission trading schemes (ETSs) for free allocation to industrial entities exposed to international competition (see discussion in section 3.3 below). Entities with lower emission intensities than the benchmark can sell allowances, whereas entities with higher emissions intensity need to buy allowances. There is also a significant amount of expertise with using performance benchmarks as baselines in the context of baseline and credit mechanisms on various levels (see section 4 below).

The activities from which a benchmark is derived should be similar to the proposed one at an appropriate scale of aggregation. Consequently, the key conundrum of benchmarks is to choose the right level of aggregation. Looking at our Ferroland example, one may argue that there should not be one benchmark for the steel sector, but three benchmarks: one each for blast furnaces, natural gas direct reduction and electric arc furnaces. The argumentation would be that even the best blast furnace would never be able to reach the emissions intensity of even the worst electric arc furnace. A consequence of developing different benchmarks for sub-categories of technologies with different intensities is that the benchmark will always favour the ones with the lowest intensity regardless of other considerations such as additionality and commercial attractiveness. This may result in strong market distortions and implies the risk of politicisation of baseline setting.

2.2. Why standardised baselines are not benchmarks

Benchmarks should not be equated with standardised baselines, the latter being a much broader approach. Generally, any parameter being applied for a baseline can be standardised, but this does not mean that it automatically becomes a benchmark. Baselines can be standardised by the top-down definition of parameters that can include conservative defaults, emission-rate thresholds, or performance benchmarks (Schneider et al. 2012). An example of a standardised baseline in practice is the emission factor of 0.7 tCO_2/MWh for off-grid renewable electricity production, derived from a diesel generator deemed to be efficient as the standard reference for off-grid electricity generation. Further examples are the calculation of a country-specific grid emission factor for electricity-related projects according to CDM tool 07 (which can then be used by all other projects of that type in that country for a certain period), or the CDM standardised baseline methodology for methane emissions from rice cultivation in the Republic of the Philippines (ASB0008) (which specifies baseline emission factors for regions with different cropping practices) (CDM 2015). Such standardised baselines were increasingly promoted by the CDM's governing body, the CDM Executive Board (EB), from 2011 onwards to save time for activity developers and reduce their transaction costs. The development of standardised baselines was either done 'top down', through the staff of the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat for global applicability, or 'bottom up', through host countries and their consultants, often Regional Collaboration Centres (RCCs) (CDM Methodologies Panel 2012).

2.3. Performance and BAT benchmarks

Performance and BAT benchmarks differ in the way they set threshold values. A performance approach first establishes an actual (current/historical) performance distribution curve of a technology providing the same goods or services as the proposed activity under the market mechanism (see the black curve in Figure 2). The benchmark is then set at a certain percentile of (best) performance or expressed as a deviation from the average performance. In the context of the CDM, benchmarks were usually set at the 10th or 20th percentiles of best performers (see section 4.1). Box 1 describes the use of a performance-based benchmark in the Canadian province of Alberta.

Box 1: Performance benchmarks under the TIER system of Alberta

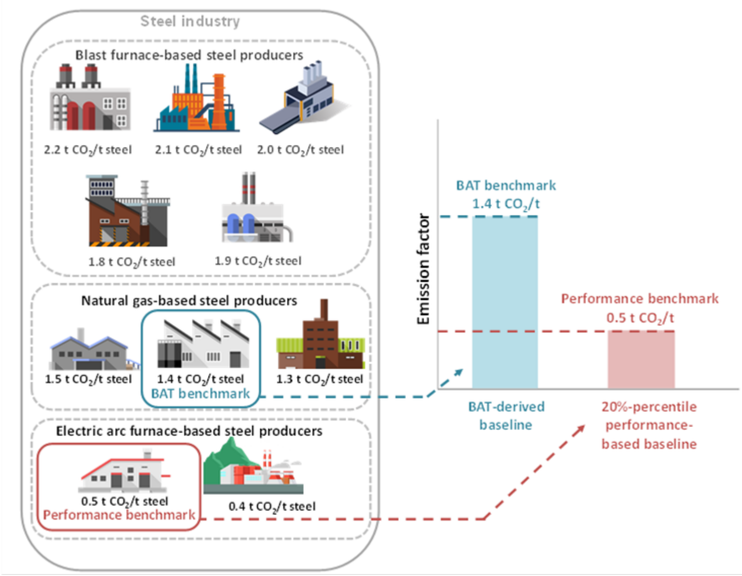
The TIER regulation in Alberta (Government of Alberta 2020) obliges facilities that emit more than 100,000 tCO_2 per year to reduce their GHG emissions. The regulation uses two types of benchmark approaches: (1) a high-performance benchmark that rewards the most efficient facilities in an industry, or (2) a facility-specific product benchmark, where the benchmark is set in accordance with the facility's historic performance (IEA 2020). High performance benchmarks are used when more than one facility regulated under TIER produces a given product in the province. The benchmark is set at the average emissions intensity of the top 10% of facilities in the sector. When there are less than or equal to 10 facilities, it is set to the emissions intensity of the best performing facility in the period of the benchmark reference years.

Performance benchmarks have been criticised for focusing too much on existing technologies instead of the mitigation potential of future technologies (Egenhofer and Fujiwara 2008).

A BAT benchmark refers to the best available option or alternative as the reference, which is not necessarily expressed by a percentile in the distribution curve. If the specification of BAT is done according to a normative reasoning, BAT-assessments change the way a benchmark is determined from a deterministic historical perspective (choosing a predetermined percentile from a historical intensity distribution curve) to a more forward-looking approach (the intensity of a technology normatively deemed as the best available option).

Below, we come back to the Ferroland example to show the difference between a performance and a BAT benchmark. Here, the BAT benchmark could be defined by the average emissions intensity of natural gas direct reduction, which is the most modern technology. So, the BAT benchmark would be 1.4 tCO_2/t steel. A performance benchmark defined at the best 20% level would reach 0.5 tCO_2/t steel as it moves into the electric arc furnace producer group. This illustrates that depending on the percentile chosen, the performance benchmark can be more or less stringent than a BAT benchmark (see Figure 3).

Figure 3: BAT-derived vs performance-based benchmarks



Source: Authors

For a BAT-derived approach, the definition of technologies or techniques[1] seeks a balance between 'best' and 'available'. 'Best' is often referring to the top-performing technologies or techniques but also provides room for broader environmental consideration, as discussed in the next sub-section. The term 'available' adds the consideration of the level of aggregation or geographical scope to the concept. Here, the concept has evolved over time to include also economic considerations, as will be discussed in the subsequent section (OECD 2017; OECD 2020). BAT will change over time due to technological advances, as well as changes in scientific knowledge and understanding (OSPAR Convention 1992). A technology that historically was BAT can lose this status due to the emergence of better technologies.

Box 2 below describes a set of power plant benchmarks for the Chinese ETS that has been derived with some BAT-like considerations. Please note the high degree of disaggregation by technology.

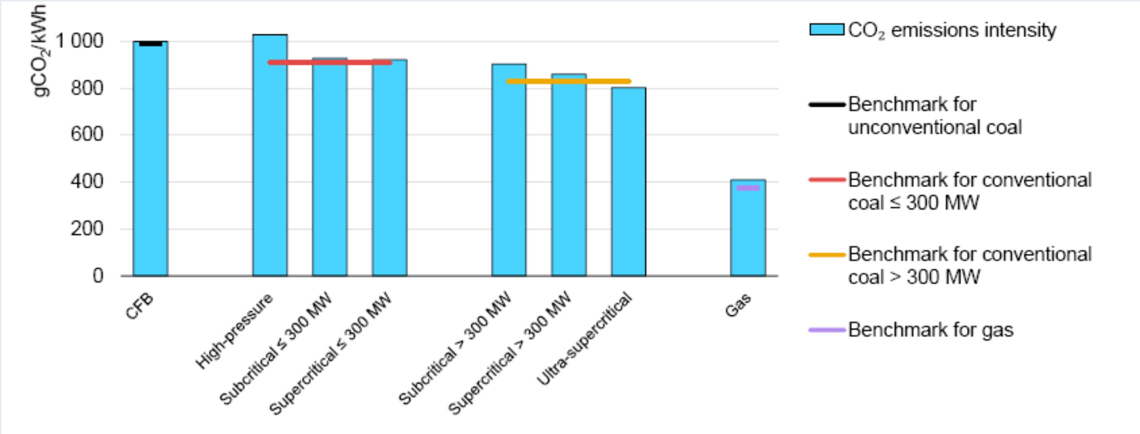
Box 2: Power plant benchmarks for allowance allocation in China's ETS

China's ETS, whose first compliance period in the power sector started in January 2021, allocates allowances free of charge according to historical electricity generation and technology-specific benchmarks for four categories of coal- and gas-fired power plants (IEA and Tsinghua University 2021). The following four benchmarks are established: conventional, i.e., sub-, and supercritical, coal plants below 300 MW, conventional coal plants

[1] A technique is a way of doing a thing or activity, compared to the technology being the physical equipment producing a good/service. The former definition is broader than the latter and comprises management practices (how the installation is designed, built, maintained, operated and decommissioned) (UNEP 2001; UNEP 2019). There are thus more options for economic actors to argue that under a 'technique', performance will be lower than under a 'technology'. We will apply the acronym BATq in the remainder of the study when explicitly referring to techniques to ensure conceptual clarity.

above 300 MW and unconventional coal and natural gas (ICAP 2021). A benchmark emissions intensity factor is set for each group and will be multiplied with 70% of their 2018 output to determine the number of allowances an entity receives (ICAP 2021). The resulting benchmarks are shown in Figure 4.

Figure 4: Benchmarks for the Chinese power sector



Source: IEA and Tsinghua University (2021)

Ex-post adjustments will be undertaken to reflect the actual output in 2019 and 2020 (ICAP 2021).

In general, both benchmarking approaches, the 'pure' performance-based benchmark, and the BAT-derived benchmark, ultimately require a normative decision as to where to set the reference value compared to the comparison group. Benchmarking in climate policy is ultimately a policy decision that must find a balance of stringency and preserving incentives for action. The next chapter will now discuss how BAT has been applied in various contexts both internationally and nationally and derive lessons for its potential application for baseline setting under Article 6.

3. Evolution and application of BAT/BATq in environmental regulation

This chapter looks at the application of BAT and related concepts in multilateral environmental agreements, (supra)national environmental policy and emission trading schemes.

3.1. BAT/BATq in multilateral environmental agreements

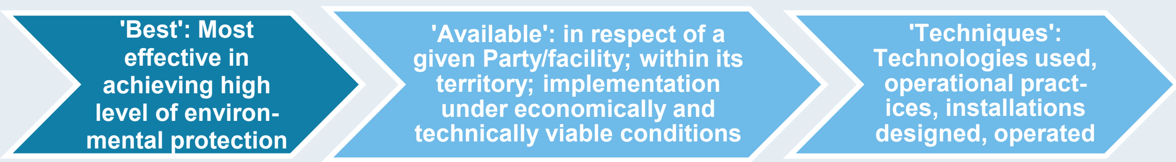
Different multilateral environmental agreements make use of the BATq concept, including the Minamata Convention on Mercury (see Box 3), the Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention hereafter) and the Ospar Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention hereafter). It should be noted that they all apply the broader definition of 'techniques' instead of 'technologies', so we will use the acronym BATq.

OSPAR was the first multilateral environmental agreement to introduce the concept of BATq and BEP in its efforts to prevent and eliminate marine pollution. BATq is defined as "the latest stage of development (state of the art) processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste" while BEP refers to the most appropriate combination of environmental control measures and strategies (OSPAR Convention 1992, Appendix I).

Article 5 of the Stockholm Convention stipulates that each Party shall promote and use BATq and BEP for existing and new sources of persistent organic pollutants (UNEP 2001). The Stockholm Convention uses the same definition for BEP as the OSPAR Convention and goes beyond it, as it specifies a combined used of BATq and BEP, with BATq being applied to new sources and BEP to be applied as soon as practicable within the first 5 years of entry into force (Tikhonova et al. 2021). The Stockholm Convention further notes that specific considerations should be made when it comes to the determination of BATq regarding the likely costs and benefits of a measure, as well as consideration of precaution and prevention (UNEP 2001).

Box 3: The Minamata Convention on Mercury and its BATq application

The Minamata Convention on Mercury, which was adopted in 2013 and entered into force in August 2017, stipulates that "each Party shall require the use of best available techniques and best environmental practices to control and, where feasible, reduce emissions" (UNEP 2019, Article 8, para. 4). It is further stated that a Party may use emission limit values that are consistent with the application of BATq. According to Article 2 of the Convention (UNEP 2019, Article 2) BATq is defined as those techniques that are "most effective to prevent and, where that is not practicable, to reduce emissions and release of mercury […], **taking into account economic and technical considerations for a given Party or a given facility within the territory of that Party**". Essentially, the approach is thus applying the BATNEEC interpretation first developed in the EU (see below).



The Convention also stipulates that, at its first meeting, the Conference of the Parties should adopt guidance on BATq and on BEP, which was eventually done in 2017 (see Secretariat of the Minamata Convention on Mercury 2017). It also applies the staggered introduction of BATq and BEP. The application of BATq is required for new point sources of emissions of mercury and mercury compounds to the atmosphere[2], while the application to existing sources remains voluntary (UNEP 2019, Article 8). The guidance document proposes the following approach for the implementation of BATq (Secretariat of the Minamata Convention on Mercury 2017):

- Step 1: Establishment of information about the source or source category.
- Step 2: Identification of the full range of options of emission control techniques and consideration of their combination.
- Step 3: Identification of technically viable control options.
- Step 4: From these options, selection of control technique options which are most effective for the control and, where feasible, for the reduction of emissions of mercury.
- Step 5: Determination of the options that can be implemented under economically and technically viable conditions, taking into consideration costs and benefits and their accessibility to the operator of the facility.

The document also provides some guidance to operationalise point source specific BATq specification. We would like to stress that this guidance is not mandatory. The determination of BATq is dependent on the respective national circumstances. The guidance notes that the described control measures may not be available to all Parties for economic or technical reasons (Secretariat of the Minamata Convention on Mercury 2017). In the case of coal-fired power plants and coal-fired industrial boilers, the guidance differentiates between four main types of control measures and discusses under which circumstances they could be deemed BATq; first,

[2] The different point source categories are coal-fired power plants, coal-fired industrial boilers, smelting, and roasting processes used in the production of non-ferrous metals, waste incineration facilities and cement clinker production facilities.

regarding the removal of mercury prior to combustion, it is established that coal washing alone does not represent BATq, but in combination with other control measures it provides effective reductions. Second, regarding the reduction of mercury emissions during combustion, the use of a fluidised bed boiler is considered effective, but not BATq. The third type of measures, the use of air pollution control systems for the removal of particulate matter, sulphur dioxide and nitrogen oxides can result in mercury removal efficiencies of up to 95%-99%, thus constituting BATq in developed countries such as EU member states, the United States (US), and Japan and emerging economies like China. The fourth measure considered BATq in selected developed economies, like the US, is the use of dedicated technologies for the reduction of atmospheric mercury emissions (e.g., through activated carbon injection technology or additives). **The Minamata Convention thus establishes a tiered approach to define BATq based on country circumstances which can be an important precedent for applying BATq in the context of Article 6.**

3.2. BAT/BATq in (supra)national environmental policy

BAT and BATq approaches are applied in national environmental policies in key countries including China, the EU, New Zealand, Russia, South Korea, and the US. The differentiation of BAT and BATq originated in the EU, where the concept of Best Available Technology Not Entailing Excessive Costs (BATNEEC) emerged in 1984 and was replaced by BATq in the Integrated Pollution Prevention and Control (IPPC) directive of 1996. The Organisation for Economic Co-operation and Development's (OECD) comparison of the different national BAT and BATq approaches reveals that these are not always clearly defined and that it is partially unclear to which extent the underlying criteria have been considered when selecting a technology/technique as the best one and when establishing associated emission values (OECD 2017). The comparison across BAT/BATq applications also revealed that most of the countries apply 'vertical' BAT/BATq documents, meaning BAT/BATq reference documents are developed for individual industrial sub-sectors instead of horizontal ones (documents applied to the entire industry sector) (OECD 2018).

In the case of the EU, Russia and South Korea, the derivation of mandatory emission limit values (ELVs) is based on BATq and the determination of BATq follows a standardised methodology. However, compared to the ELVs, the use of BATq does not constitute a mandatory regulation in any jurisdiction. Consequently, BAT concepts support operators to comply with the ELVs in their installation's design, operations, maintenance, and decommissioning. A disadvantage of BATq not being legally binding (only ELVs) is the potential tendency to apply end-of-pipe solutions instead of preventive measures. This is also why some countries have introduced procedures for the prioritisation of preventive measures in the BAT/BATq determination process. While ELVs are developed based on existing BAT/BATq in the EU, Russia and South Korea, an integrated approach for ELVs and BAT/BATq determination is pursued in China, and in some Indian cases BAT documents are developed after the introduction of ELVs (OECD 2017; OECD 2018).

The determination of BAT/BATq in China, the EU, Russia, and Korea follows standardised methodologies (OECD 2018). Across all countries, BAT/BATq determination starts with the collection of information on techniques and technologies through questionnaires and stakeholder meetings, and in some cases, data is also gathered though interviews and literature research. The data gathering process is typically carried out by governmental environmental authorities or also other ministries depending on the country and by industry associations (OECD 2018). In the subsequent evaluation process, both technical and environmental factors play an important role and economic aspects are often also brought in. The actual BAT/BATq determination process then includes multiple stakeholders such as government representatives, single industries, industry associations, NGOs, and research institutes. This renders the process resource intensive. OECD (2018) notes that some stakeholders are not willing to provide data on economic aspects of techniques/technologies. Countries without advanced monitoring systems are challenged to implement such a process. Overall, it takes 1-6 years to identify BAT/BATq and finalise related documents, which reveals an inherent contradiction with fast technological developments in some sectors.

Box 4: The application of BATq in the context of the EU's IED

In the context of the EU's Industrial Emissions Directive (IED) (European Parliament and Council 2010), industrial pollutant emissions in the EU to air, water and soil shall be prevented and controlled through the application of BATq, efficient energy use, waste prevention and management, as well as measures to avoid accidents. The prevention and control of industrial emissions is based on permits that must consider a plant's overall environmental performance (European Parliament and Council 2010). The permits therefore comprise ELVs for different pollutants (see Annex I) which need to be met by the plants. It is important to mention that permits of installations which are covered by the EU ETS Directive should not include an ELV for direct emissions of GHGs to avoid duplication (European Parliament and Council 2010, para. 9). This has been met with criticism as it is argued that both directives are not mutually exclusive and the revised IED expected to be adopted at the end of 2021 should therefore correct this (Ruggiero 2020).

The European Integrated Pollution Prevention and Control Bureau (EIPPCB) and the EU Joint Research Centre (JRC) in Seville steer the development of Best Available Techniques Reference Documents (BREFs) and 'BAT conclusions', providing EU member states with guidance to comply with the BATq approach. The EIPPCB and the JRC coordinate a technical work group for the exchange of technical information between different stakeholders, including companies and industrial associations, EU member state governments, research institutes, environmental NGOs, and the European Commission.

According to the BREF Guidance Document (European Commission 2012), the BREF development process should take between 31 to 39 months and the formal adoption process can take up to 12 additional months. In total, the development of a BREF and BAT conclusion takes over 4 years if it runs smoothly (European Commission 2012). Up to 100 experts can be involved in the process, forming part of the technical working group (EU Science Hub n.d.). As of 2021, 34 BREFs have been developed and published on the EIPCCCB's website, comprising many different industries[3]; 11 BREFs have been formally adopted (EIPCCB 2021). The listing of BREFs reveals that BAT is more often identified for air and water than for soil emissions, but also addresses resource uses.

Standalone BATq conclusions comprise the parts of the respective BREFs which lay out the conclusions on BATq and represent the reference for setting permit conditions to all the installations covered by the Directive (EIPCCB 2021). The procedure of the selection and evaluation of techniques is referred to as the Seville Process and is based on a standardised methodology (OECD 2018). BREFs are periodically revised to account for developments in manufacturing techniques and pollution control. The IED stipulates that the Commission should aim for an update of the BREFs at least 8 years after the publication of the previous version (European

[3] The published BREFs comprise the following industries (EIPCCB 2021): ceramic manufacturing industry; common waste gas treatment in the chemical sector; common waste water and waste gas treatment/management systems in the chemical sector; economics and cross-media effects; emissions from storage; energy efficiency; ferrous metals processing industry; food, drink and milk industries; industrial cooling systems; intensive rearing of poultry and pigs; iron and steel production; large combustion plants; large volume inorganic chemicals – ammonia, acids and fertilizers; large volume inorganic chemicals – solids and others industry; manufacture of glass; manufacture of organic fine chemicals; monitoring of emissions to air and water from IED installations; non-ferrous metals industries; production of cement, lime and magnesium oxide; production of chloralkaline; production of polymers; production of pulp, paper and board; production of specialty inorganic chemicals; refining of mineral oil and gas; slaughterhouses and animals by-products industries; smitheries and foundries industry; surface treatment of metals and plastics; tanning of hides and skins; textiles industry; waste incineration; waste treatment and wood-based panels production.

Parliament and Council 2010, para. 13). Currently, five BREFs are under review (EIPCCB 2021). BREF reviews will take between 24-29 months according to the Guidance (European Commission 2012).

For the BATq determination process itself, the following criteria shall be considered (European Parliament and Council 2010):

- Use of low waste technology;
- Use of less hazardous substances.
- Furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate.
- Comparable processes, facilities or methods of operation which have been tried with success on an industrial scale.
- Technological advances and changes in scientific knowledge and understanding.
- Nature, effects and volume of the emissions concerned.
- Commissioning dates for new or existing installations.
- Length of time needed to introduce the best available technique.
- Consumption and nature of raw materials (including water) used in the process and energy efficiency.
- Need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it.
- Need to prevent accidents and to minimise the consequences for the environment.
- Information published by public international organisations.

The determined BATq then serves as basis for the development of 'BAT-associated emission levels' (BAT-AELs). BAT-AELs are defined as "the range of emission levels obtained under normal operating conditions using a best available technique or a combination of best available techniques" and form the basis for ELVs in permits. BAT-AELs are legally binding, but not BATq itself (OECD 2018).

In general, the IED's contribution to decarbonisation has been assessed to be limited because it did not focus on major GHGs such as CO_2 and N_2O (European Commission 2021a). Therefore, industrial associations have strongly opposed attempts to bring GHG-related aspects into the IED both in early 2020 (Fuels Europe et al. 2020) and early 2021 (Fuels Europe et al. 2021), apparently fearing stronger impacts than under the EU ETS.

3.3. BAT and benchmarking in emission trading schemes

In general, most ETSs that cover the industrial sectors and do free allocation use some type of production-based benchmarks, including California, China (see Box 2 above), the EU, New Zealand, Quebec, and South Korea (Fischer 2019).

Since the beginning of the third trading phase (2013-2020), the EU ETS makes use of 52 product-specific output-based benchmarks for the allocation of allowances to manufacturing sectors (European Commission 2021b). The chemical sector has 15 separate benchmarks, followed by 11 for pulp and paper, seven for cement and lime, six for ceramics, five for iron and steel, four for glass, two for aluminium and one for coke. According to Matthes (2015), product-specific benchmarks were chosen as they create the least distortion of allowance prices, while fuel- and/or process-specific benchmarks would create such distortions, especially on the power market. However, the approach taken by the EU is not implementing this principle fully, given that debatable distinctions of products according to production processes are made, such as separating steel from blast furnaces and steel from electric arc furnaces (Ecofys et al. 2009, p. 10).

The benchmark is set at the average GHG emissions of the best performing 10% of the installations producing that product in the EU and European Economic Area-European Free Trade Association

(EEA-EFTA) states. Benchmarks were set based on extensive technical work and stakeholder consultations (European Commission 2011). The benchmarks are based on the principle of 'one product = one benchmark'. This means that the methodology does not vary according to the technology or fuel used, the size of an installation or its geographical location. The benchmarks in phase 3 were derived from a 'benchmarking curve' which represents the sector's GHG emissions efficiency over the period 2007 and 2008, ordered from lowest to highest emitter. From this curve, the average efficiency of the best 10% of installations was determined (European Commission 2015). The default approach to setting the benchmark in the EU ETS is thus a performance-based benchmark. However, in case the underlying data to develop the so-called 'benchmarking curve' was insufficient, the BATq (as defined in the BREFs under the IED) were used as a starting point to develop the benchmarks (European Commission 2015). This was done for coke and hot metal and sintered ore (European Commission 2011). Thus, a BATq approach (as starting point) is only considered in the EU ETS if a performance-based benchmark cannot be calculated. Also, the BREFs are taken as a starting point to derive a benchmark and not BATq itself. In fact, BREFs which also include some information on energy consumption and GHG emissions were considered not suitable for the development of benchmarks for the EU ETS, as documents from the first Seville Process until 2010 are very heterogeneous regarding content and the data used have not always been clear (Füssler et al. 2019). In the fourth trading phase (2021-2030), the allocation rules have been revised and the benchmark values are to be updated twice throughout the period, based on an annual reduction rate for each benchmark that varies between 0.2-1.6% depending on the respective sector's innovation uptake. In March 2021, the European Commission published the Implementing Regulation of the fourth phase, which introduces updated benchmark values (see European Commission 2021c).

Also, none of the benchmarks used in the Californian/Quebec or Korean ETS has any BAT/BATq component (OECD 2017). In summary, ETSs thus use performance-based benchmarks and not BAT/BATq approaches for allowance allocation purposes.

3.4. Overview of definitions of key terms related to BAT/BATq

A generic problem with a normative approach like BAT and related terminology that shall be applicable on a global level is that different interpretations of terms exist in national legislation, making it difficult to reach an agreement at the international level.

Regarding the key components of BAT/BATq, the definition of 'best' in the different interpretations shows some convergence on the meaning of 'high level of environmental protection'. This might also include the reduction of different emissions from all kinds of pollutants. In the case of the IED, GHG emissions are not directly regulated, as these are covered by the EU ETS, apart from some indirect regulation effects. While 'environmentally sound' forms part of the proposed BAT definition under the A6.4M, the term is not really used in multilateral environmental conventions or national jurisdictions in relation to BAT/BATq as outlined in the following. Also, there is no international agreement on what 'environmentally sound' means at the international level.

Table 1: Definitions of 'best'

Convention/jurisdiction	Definition of 'best'
Stockholm Convention on Persistent Organic Pollutants	'Best' means most effective in achieving a **high general level of protection of the environment** as a whole (UNEP 2001, Appendix I)
Minamata Convention on Mercury	'Best' means most effective in achieving a **high general level of protection of the environment** as a whole (UNEP 2019, Article 2)
EU Industrial Emissions Directive	'Best' means most effective in achieving a **high general level of protection of the environment** as a whole (European Parliament and Council 2010)

As mentioned above, the term 'available' brings another dimension to the concept. There is an important distinction to be made between 'best technology/technique' and 'best available technology/technique'. The following table summarises the different shades of interpretation:

Table 2: Definitions of 'available'

Convention/jurisdiction	Definition of 'available'
Stockholm Convention on Persistent Organic Pollutants	'Available' techniques refer to techniques that are **accessible to the operator** and that are developed on a scale that allows implementation **in the relevant industrial sector**, under **economically and technically viable conditions**, taking into consideration the costs and advantages (UNEP 2001).
Minamata Convention on Mercury	'Available' techniques means, in respect of a given Party and a given facility **within the territory of that Party**, those techniques developed on a scale that allows implementation in a relevant industrial sector **under economically and technically viable conditions**, **taking into consideration the costs and benefits**, **whether or not those techniques are used or developed within the territory of that Party**, provided that they are accessible to the operator of the facility as determined by that Party (UNEP 2019, Article 2).
EU Industrial Emissions Directive (IED)	'Available' techniques mean those developed on a scale which allows implementation in the relevant industrial sector, **under economically and technically viable conditions**, **taking into consideration the costs and advantages**, **whether or not the techniques are used or produced inside the Member State in question**, as long as they are reasonably accessible to the operator (European Parliament and Council 2010).

Compared to the definition of 'best', there are more diverse interpretations of what 'available' means, placing its definition at the centre stage of discussions on the level of aggregation. Whereas some definitions restrict the concept's application to a certain geographic area, other definitions put an emphasis on 'reasonable accessibility' for the operator in the country in question. This reveals that in some understandings of BAT/BATq, the geographical scope does not play a decisive role, whereas for other understandings, the identification of the 'best technology/technique' takes place within a specific geography (e.g., region, country). The definition introduced by the EU IED makes it clear, for example, that 'accessibility' could also imply that the country should consider techniques across the country's border, while this is not explicitly stated in the Stockholm Convention. The Minamata Convention also makes clear that the technique does not necessarily need to be used already within the territory of the Party but needs to be accessible to the respective operator.

As regulatory documents do not always clearly differentiate between the components, further definitions of BAT/BATq have been summarised in the following table.

Table 3: Further BAT/BATq definitions

Convention/jurisdiction	Definition of 'best available technology/technique'
US Clean Water Act (2018)	Best Available Technology (**Economically Achievable**) (BAT(EA)): Technology-based standards applied for priority as well as nonconventional pollutants. This level of control is generally described as the **best technology currently in use** and includes controls on toxic pollutants (OECD 2017).
Russian Federation: Amendment to the Federal Law on Environmental Protection (2014)	Best available technology: A technology of products (goods) production, services and works determined on the basis of modern scientific and technical achievements and on **the combination of environmental objectives under the condition of their technical applicability**. Criteria to determine best available techniques are: Minimum environmental exposure per unit time, or volume of production; economic efficiency; application of resource and energy saving methods; period of their installation; **utilization of technique in two or more installations** which provide negative environmental exposure (OECD 2017).
Korea's Act on the integrated control of pollutant-discharging facilities (2015)	Techniques comprising technically and economically applicable control techniques that can **most effectively reduce discharge of pollutants as environmental control techniques** for the designing, installation, operation and management of discharging facilities and prevention facilities considering the following matters: **Practicability in the relevant business establishment; the effect of reducing the volume of pollutants, etc. produced and discharged**; **expenses incurred in applying and managing environmental control techniques**; whether the techniques can promote the reduction of recycling of wastes; efficiency in the use of energy; whether it is possible to take preventive measures for the control of pollution by reducing pollutants, etc. from sources (Korea Legislation Research Institute 2015).
United Nations Economic Commissions for Europe (2019)	The concept of "best available techniques" refers to the **most effective and advanced practices and methods used under economically and technically viable conditions** in relevant industrial sectors to reduce emissions and the impact on the environment (UNECE 2019).

A commonality of most of all outlined 'available' and overarching definitions is the reference to economical and technical viability. Economic efficiency thus plays an important role in operationalising the BATq concept, and many definitions argue that costs and benefits/advantages need to be balanced. Next to the economic efficiency, technical applicability is also mentioned as another aspect that needs to be considered. It becomes clear that availability is thus not only referring to geographical availability, including the level of aggregation, but also adds a cost and technical dimension to it. In the context of carbon markets, the term 'economically feasible' is used both in the Marrakech Accords (which established important rules for the CDM and JI) but also in the draft Article 6.4 RMPs. In the early years of applying BAT concepts in the EU, the concept of BATNEEC was introduced to resolve opposition to

BAT in the EU context. Over time, the consideration of technology costs and economic efficiency was incorporated in the definition of what is to be considered *available* in the EU.

In general, an expansion of the BAT/BATq concept to include other dimensions, such as more economic ones, might result in a less stringent approach as other factors such as the technology's costs and management abilities in the context of techniques will also need to be considered. This will, however, depend on the policy context-specific interpretation of reasonable costs and generally acceptable management competence. This aspect, in turn, reveals that attention needs to be paid to the definition of the concept's components to judge the stringency of the approach. 'Economically and technically viable' is, for example, not further defined in the legislative documents, which leaves ample room for varying interpretations. Anyone who has been involved with investment tests for additionality testing under the CDM has seen widely different interpretations regarding threshold internal rates of return, assessment of activity risk and the definition of prohibitive non-monetary barriers to an activity.

Next to the quoted definitions of BATq from multilateral environmental agreements and BAT/BATq by the EU, Russia and South Korea, further similar concepts exist. The US, for example, applies the concept 'best available control technology', India makes use of the so-called 'techno-economically available techniques' and New Zealand policy makers refer to 'best practicable options' (OECD 2018). These concepts and their attributed meanings in a specific jurisdictional or conventional context shall not be further explored in this study.

3.5. General lessons learned with BAT-approaches

The preceding discussion has shown the differences in determining 'best', 'available', 'technology', 'technique' and further qualifiers which lead to significant variation in a BAT/BATq benchmark's stringency. The diverging BAT/BATq definitions also reveal that the question of the appropriate level of aggregation becomes a highly political one. While some definitions put an emphasis on a specific geography, others emphasise the best technology's accessibility, which involves economic analysis. The question of the appropriate level of aggregation will also depend on the specific sector or action in question. The debate on what is substitutable (depending on how substitutability is defined) could help to guide the determination of the appropriate level of aggregation. It needs to be considered though that even in globally fully integrated sectors, there may be very different technologies applied that lead to different outcomes. The Ferroland example from chapter 2 as well as the Chinese ETS benchmarks for the power sector illustrate this. Developing countries' concerns that a BAT-derived benchmark (and consequently the use of certain technologies) might be imposed upon them require specific attention in this regard. The appropriate level of aggregation could also need to be differentiated in a national context, as there is usually a divide between urban and rural accessibility of technologies.

Principally, a technology benchmark – regardless of whether it is performance-based or BAT/BATq-based – is only appropriate for technologies that are applied homogeneously without being influenced by their specific location. A homogenous production process means that the production does not include a diversity of processes with different carbon intensities, so that an introduced benchmark does not have widely diverse impacts on different producers (Grubb and Counsell 2010). Alternatively, a benchmark can be set on a product level, as is the case in many ETSs. It is important to distinguish products for which a technology-based benchmark can be applied (e.g., a BAT-derived approach) and products for which a performance-based benchmark (e.g., below average CO_2 intensity) is more appropriate for environmental regulation (see our steel example above and an elaborated version of the discussion on the steel sector in Ecofys et al. 2009, p. 10).

A relevant lesson learned from the BATq determination process in the IED context is that BATq documents resulting from a determination process need to be homogenous and concise, as they otherwise risk being discarded, as in the case of the EU ETS. In general, BREFs are lengthy, which hampers the identification of relevant information. A success criterion of the IED process is its governance model that builds on the co-creation of environmental standards with member states, industry stakeholders and NGOs (European Commission 2021a). While this allows stakeholder buy-in, it leads to a lengthy process to agree on a BATq and high transaction costs. These transaction costs will increase if the benchmarks are calculated in a disaggregated fashion. If BATq determination requires up to four to six years, it is much too lengthy to enable use of this approach under Article 6 before 2030. However, if the BAT/BATq determination process is kept short, the quality of the documents might suffer (OECD 2018). Therefore, it is pivotal to have a good governance process for the BAT/BATq determination in place, which ensures good quality throughout the process.

Data availability poses another key challenge for the development of BAT benchmarks. Especially in some industry sectors, it will be difficult to get the data as companies fear the disclosure might result in strategic disadvantages if competitors get hold of the data. There are some industry initiatives in place which themselves set mitigation targets or strive towards enhanced transparency of GHG emissions. Some of these initiatives have, for example, subcontracted a third entity for the data collection process to render it as anonymous as possible. In the following, these initiatives are introduced:

- In the aluminium sector, the major companies worldwide have formed the International Aluminium Institute (IAI). Over 60% of global bauxite, alumina and aluminium producers form part of the institute. Among its objectives is also the collection of statistical and other relevant information (IAI 2021a). Recently, the institute published a report on aluminium sector GHG pathways to 2050 (IAI 2021b). Only geographically aggregated data is reported by IAI's statistical system to prevent it being allocated to single producers. Already a decade ago, discussions on global sector crediting among the IAI participants have taken place (Egenhofer and Fujiwara 2008) that were not taken further post-COP15 in 2009 (Copenhagen).
- The Cement Sustainability Initiative (CSI), an industry initiative comprising major multinational cement producers, introduced the 'Getting the Numbers Right' (GNR) exercise, which aims at gathering relevant data on existing technologies and a creating a benchmarking system (Egenhofer and Fujiwara 2008; Cook and Ponssard 2011). Data on energy consumption and CO_2 emissions is reported according to CSI's *CO_2 and Energy Accounting and Reporting Standard for the Cement Industry* (CSI 2016). A decade ago, the initiative was also pursuing efforts to establish a crediting system based on national and regional baselines negotiated between governments (Egenhofer and Fujiwara 2008) that were not developed further post-COP15 (Copenhagen). The GNR database is managed under strict compliance with anti-trust requirements and represents the most comprehensive public database on CO_2 and energy consumption data of any industry (CSI 2016).

- The members of worldsteel (the World Steel Association) represent around 85% of global steel production (worldsteel 2021a). Under its Climate Action programme, the organisation collects industry-wide CO_2 data. Data shared by companies will only be known to the company itself, worldsteel and the administrator of the data management system (worldsteel 2021b). Besides, the organisation develops industry-wide performance statistics based on regular exchanges on best practices under strict antitrust guidelines and monitored by legal counsel (worldsteel 2021b). Access to this benchmarking system is only granted to a selected group of appointees by each worldsteel member organisation.
- In the run-up to COP15, the Asia-Pacific Partnership on Clean Development and Climate (APP) supported data gathering and benchmarking exercises in three energy supply sectors and five energy-intensive sectors including steel, aluminium, cement, coal mining as well as building and appliances (Egenhofer and Fujiwara 2008). However, this initiative was discontinued after Copenhagen.

The outlined initiatives and potential future ones can help to overcome data availability issues, thus providing governments with the required information on abatement potentials in a respective sector (Egenhofer and Fujiwara 2008) and serve as basis for performance benchmarking.

In the case of multilateral agreements, it is often left to the Parties to assess BATq for their own country-specific context. As outlined above, the Minamata Convention provides guidance but does not stipulate a certain technique for a specific region or country. In the end, the country determines BATq and reports on it in the full report, which is to be submitted every four years. The first full reports are due by the end of 2021.

It needs to be ensured that data is not distorted to achieve less stringent performance benchmarks. Given the well-established asymmetry of information between governments and industry actors and the fact that industry does not have a clear interest in fully disclosing its abatement potential and costs, this is a critical issue. Governments are also suspicious of information exchange between private competitors as this could potentially result in the distortion of competition. This speaks in favour of involving independent third parties to gather information and to protect the confidentiality of the shared information (Egenhofer and Fujiwara 2008).

4. Experience with performance benchmarking and BAT in crediting mechanisms

In the following, the experience with performance-based and BAT-derived benchmarks in setting baselines under different crediting schemes is summarised and assessed.

4.1. CDM

Among the three generic baseline methodology approaches adopted by the Marrakech Accords in 2001 was also a benchmark approach. The third approach specified that benchmarks should be set at the “average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, **and whose performance is among the top 20 percent of their category**” (UNFCCC 2002a). However, bottom-up development of baseline methodologies focused on the first two approaches and thus benchmarking was not operationalised under the CDM.

In the run-up to the Copenhagen conference, global sectoral approaches for mitigation were an important topic. The Bali Action Plan, which was adopted at COP13 in 2007, specifically referred to the need to consider sectoral approaches in a post-2012 agreement (Egenhofer and Fujiwara 2009).

Over the years, the calls from international experts on the use of performance benchmarks under the CDM for some project types became louder. The first case related to the emission of N_2O from adipic acid production, which related to very few, but very large projects. Schneider et al. (2010) discussed how the economic incentives from the CDM led to a shift from adipic acid production from non-CDM plants to CDM plants during the financial crisis in 2008-2009 and argued that baseline abatement performance was considerable higher than the reference values derived from literature on BAT for adipic acid plants. Therefore, Schneider et al. (2010) proposed a performance benchmark of 30 kg N_2O per tonne of adipic acid (equivalent to 90% of N_2O reduction from an unabated plant), 20 kg lower than the benchmark proposed by the CDM Methodology Panel for new adipic acid plants.

Subsequently, benchmarks were discussed and finally introduced for N_2O emissions from nitric acid production, influenced by the discussions on JI (see Box 5). The CDM Methodologies Panel (2011) discussed in detail how to set the benchmark, also referring to a BAT document in the EU but discarding that document with the argument that it assumed that secondary or tertiary N_2O abatement measures were already installed. The Panel recommended a benchmark declining over time, starting with the average emissions factor for the top 20% CDM plants in the year 2005, reaching the value of 2.5 kg/t nitric acid (HNO_3) (proposed by industry representatives in the BAT discussions in the EU in 2020) and remaining there[4]. The Panel explicitly justified its proposal by the wording “this value represents the currently best available technology” (CDM Methodologies Panel 2011, p. 5). The CDM EB did not accept this benchmark proposal, but in 2013 adopted a similar but less stringent declining benchmark for one class of technologies, reaching the value originally proposed by the Panel in the year 2028 (CDM 2013a). For two other classes of technologies, the benchmarks were substantially less stringent.

In 2011 and 2012, the UNFCCC Secretariat promoted a broad-based approach to introduce widespread benchmarking in the CDM and JI. The “Guidelines for the establishment of sector specific standardized baselines” (CDM 2012) essentially provided a framework for establishment of performance benchmarks, without, however, giving guidance regarding the level of disaggregation to be applied, followed by further guidelines and procedures in 2013 (CDM 2013b). Regarding the 2012 guidelines, criticism was raised by experts (Schneider et al. 2012) that these are only based on one single methodological approach (performance benchmarks) for different types, sectors, and locations. It was, for example, noted that for fuel switching in an existing plant, the performance benchmark is not suitable. Another issue which was raised was that sector-specific circumstances, technologies and trends were not really considered in the guidelines. Besides, the guidelines did not consider the distinction of facilities’ specific properties (e.g., size, age) for establishing performance benchmarks. Another concern which was raised by the international experts was the issue of data availability, as it became clear that the 2012 guidelines would require a large amount of activity data and information on technologies used

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[4] Interestingly, the Panel did not refer to that value being the BAT AEL of the EU (see Box 5).

in each plant. However, such data might not be available in many countries and sectors, specifically if the data is commercially sensitive. It was further criticised that the proposed partial use of hypothetical design efficiencies may not reflect the actual efficiency of technologies and that the use of actual performance data – if available – might be more appropriate (Schneider et al. 2012).

In 2018 (CDM 2018), rules for sector-specific benchmarking were introduced, which were often incorrectly referred to as standardised baselines. As outlined in chapter 2, standardised baselines are a broader approach that can make use of performance benchmarks but also other parameters. A standardised baseline can relate to many things: an emission factor for landfills, a grid emission factor for a national grid, the share of non-renewable biomass to be applied for a clean cookstove project. As such baselines reduce transaction costs, they are supported by many Parties with lower levels of capacity or low expected number of activities under Article 6.

According to CDM (2018), the sector-specific benchmarks may be based on the GHG emissions performance of the fuel (e.g., tCO_2/GJ), feedstock (e.g., tCO_2/t) or output (tCO_2/t), or the energy efficiency of the technology (e.g., GJ/t output). The level of aggregation shall be determined and proposed by the Designated National Authority (DNA). Baseline emission factors are based on an assessment of the lowest emission factors identified for a 10-20% percentage of the cumulative output of a sector[5] (CDM 2018).

Only few CDM methodologies included BAT-derived elements. One example is the submission to the CDM EB from DuPont, a large chemical company. DuPont made a non-public submission to the CDM EB in the early 2000s calling for a more stringent baseline for hydrofluorocarbon-12 (HFC-23) destruction from hydrochlorofluorocarbon-22 (HCFC-22) production, based on DuPont's own (more efficient) technology than the technology of competitors, basically calling for a BAT approach (Michaelowa et al. 2007). DuPont feared that its competitors could receive large volumes of revenues from CERs and therefore proposed a more stringent benchmark of 1.37% reached at their Louisville Works plant in the US instead of the IPCC's default level of 4% (Lindley 2004). The lobbying was successful as the CDM EB decided to revise the methodology. The methodology was also revised to exclude companies that had operated less than three years before the end of 2004, as experts argued that the CDM would have introduced perverse incentives to increase HCFC-22 production (Michaelowa et al. 2007, later taken up by Schneider 2011; Schneider and Cames 2014).

4.2. Joint Implementation

The original JI rules on baseline setting as part of the Marrakech Accords did not include the use of benchmarks but stipulated that baselines shall be established "on a project-specific basis and/or using a multi-project emission factor" (UNFCCC 2002b). In 2006, the JI Supervisory Committee (JISC)

[5] This standard CDM-EB101-A05-STAN does allow for disaggregation below the sectoral level when 'significant dissimilarities' exist in the performance of facilities or groups of facilities. The application of this may result in opportunities for gaming of parameters. In addition, the standardised baseline may result in a positive list. The positive list includes activities that are deemed to objectively demonstrate the existence of barriers and that can show themselves to be 'less commercially attractive' than the fuels/feedstock used to produce aggregately more than a sector-specific percentage of an output.

adopted the 'Guidance on criteria for baseline setting and monitoring' which outlines three options for baseline setting: A JI-specific approach based on provisions of the Marrakech Accords, a CDM EB-approved methodology or an approach that has already been applied for comparable JI projects (UNFCCC 2006). Besides, a baseline shall be established by "taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans and the economic situation in the project sector" (UNFCCC 2006, Appendix B).

As mentioned above, N_2O abatement was a very attractive project type under the CDM, and the baseline determination was based on historical data. In the JI context, there have also been many projects focusing on the reduction of N_2O from nitric acid production (Shishlov et al. 2012; Kollmuss et al. 2015). Compared to the CDM, the baselines were set by considering both benchmarks and technical characteristics −in some cases even BAT-derived benchmarks. In the context of the EU's IPPC Directive, which was replaced by the IED in 2010, member states decided in 2007 upon the use of a BAT AEL of 2.5 kg/t HNO_3 (Karschunke 2021).

Box 5: Application of BAT under JI

In the JI context, various host Parties opted for stringent benchmarking. Germany decided to set baselines on a plant-specific basis, considering benchmarks and technical characteristics. When setting the baseline, the planned policies ('sectoral reform initiatives') were considered in accordance with the JI guidelines. Applicant plants proposed full crediting against unabated levels (8.1-4.5 kgN_2O/tHNO_3), falling to the EU BAT-AEL benchmark of 2.5 kg/t in 2010. In this context, Spain decided, for example, to not apply the benchmark resulting from the national regulations of IPCC, but the more ambitious benchmark of 2.5 kg/t, in line with BAT provisions (Ministerio de Medio Ambiente, y Medio Rural y Marino 2010). In 2002, Germany had already set an emission limit value of 1.85 kg/t for 2010, though, and the more stringent benchmark was applied in Germany. Finland and France also tightened the applied benchmark emission factor to 1.85 kg/t in 2011 and Belgium followed in 2012 (Latvian Presidency of the Council of the European Union 2015).

With the start of the third trading phase of the EU ETS, its scope was expanded to also include N_2O emissions from the production of nitric, adipic and glyoxylic acids and PFC emissions from aluminium production (European Commission 2015). Therefore, the crediting period for JI N_2O abatement projects was limited until the end of 2012 (Latvian Presidency of the Council of the European Union 2015). The benchmark which was adopted for the EU ETS in 2011 was more stringent with 1.0 kg/t (Karschunke 2021).

In 2011, the rules for baseline setting were further specified by the JI Supervisory Committee (JISC), stipulating the consideration of "local availability of technologies/techniques, skills, and know-how and availability of best available technologies/techniques in the future" (JISC 2011, para. 25). In 2016, a revision of the JI guidelines foresaw a single-track JI that aimed to strike a balance between the host country's role and international oversight. It was, for example, proposed that the host Party develop standardised baselines, but that the criteria upon which it is based are set and periodically updated by the JISC (JISC 2016, Annex I). Once the developed national or sectoral standardised baselines are approved, their use would be compulsory unless applied project-specific baselines are more ambitious (UNFCCC 2016, Annex I). The use of benchmarks was a central element of the revised rules, including performance benchmarks and financial return benchmarks (UNFCCC 2016, Annex I). In addition, the host Party could decide to transact a lower volume of JI credits to account them towards its own climate targets (UNFCCC 2016, Annex I). The proposed revision did not get adopted, but the developed rules are particularly relevant in the context of the A6.4M.

4.3. JCM

Under the Joint Crediting Mechanism (JCM), which has been operated by the Japanese government over the last decade and which shall also contribute towards Japan's 2030 NDC target, performance benchmarks, but also specifically BAT-derived benchmarks have been applied extensively. The JCM differentiates between three "below BAU" baseline setting approaches (Koakutsu 2021):

- Based on economically feasible and environmentally friendly technology (best available technology).
- Based on data with good carbon efficiency from the latest past data of existing or similar equipment (performance).
- Based on the target standard and the efficiency set to exceed the currently feasible efficiency (benchmark).

The second and third approaches are variations of what we call performance benchmarks.

In general, methodologies are developed at the host country level and approved by the Joint Committee, which comprises Japanese representatives, as well as representatives from the partner country (ADB 2016).

As methodologies are country-specific, an already existing JCM methodology would always need to be adjusted to reflect the specific host country circumstances (ADB 2016). For BAT/BATq-derived benchmarks, this means that BAT/BATq at the host country level needs first to be identified. As of now, 30.4% of all JCM methodologies are based on a performance approach, while 27.5% follow a benchmark approach. 32.4% of the 102 examined methodologies apply a BAT approach (Koakutsu 2021). One methodology is further described in the following.

Box 6: Application of BAT under the JCM

Among the methodologies with a BAT approach is, for example, the methodology TH_AM003 for an energy saving project in Thailand through the introduction of high efficiency, inverter type centrifugal chillers (see JCM 2017). In this case, the coefficient of performance (COP) of the reference chiller is set conservatively at the most efficient COP value of inverter type centrifugal chillers available in the national market for the respective cooling capacity (JCM 2017). The maximum values of COP (BAT) in each cooling capacity range are defined as COP_{RE} and have been identified from surveys with manufacturers with a high market share (JCM 2017):

Cooling capacity per unit (USRt)	300≤x<450	450≤x<550	550≤x<825	825≤x≤1,500
COP_{RE}	5.59	5.69	5.85	6.06

Based on this BAT assessment to determine the performance co-efficient benchmark for crediting, the crediting baseline is developed.

It was noted by a JCM representative that in practice, a performance-based and BAT-derived approach might not deviate from each other (Koakutsu 2021). This also shows that if a high percentile of performers is chosen as comparison group, the resulting BAT benchmark might be similar or even the same.

4.4. VCM

Standardised approaches building on performance benchmarks have increasingly been promoted by independent carbon crediting standards in the voluntary carbon market (VCM), such as Verra, to simplify the entire crediting process and to reduce transaction costs. In 2010, the first methodology (VM0008) with a performance benchmark approach was developed under the Verified Carbon Standard (VCS), which covered reductions of GHGs achieved through home weatherisation (Verra 2010). Consequently, weatherised homes with a better energy efficiency than the established benchmark are eligible for carbon crediting (Verra 2010). For all energy retrofits, the performance benchmark is "a value above the average performance that represents a percent savings in energy consumption that dwellings are not likely to reach with 90% certainty in the absence of the project" (Verra 2012).

After 2011, Verra adopted guidance for standardised methods under the VCS covering two standardised methods, performance methods based on performance benchmarks and activity methods that use positive lists (see Verra 2013a). Performance benchmarks are used for both additionality testing and baseline setting, and the benchmarks can also serve as baseline for crediting emission reductions and removals (Verra 2013b). The guidance on standardised methods (2013a) specifies that third party assessment of the dataset is required, but also recognises that it might be necessary to protect the confidentiality of some data. Therefore, data can be maintained in a central repository, but the responsible actor needs to be able to ensure the data's integrity.

The Gold Standard, which has developed 25 proprietary methodologies for decentralised household energy activities, agriculture, forestry, and shipping has not applied any benchmarking approaches to date.

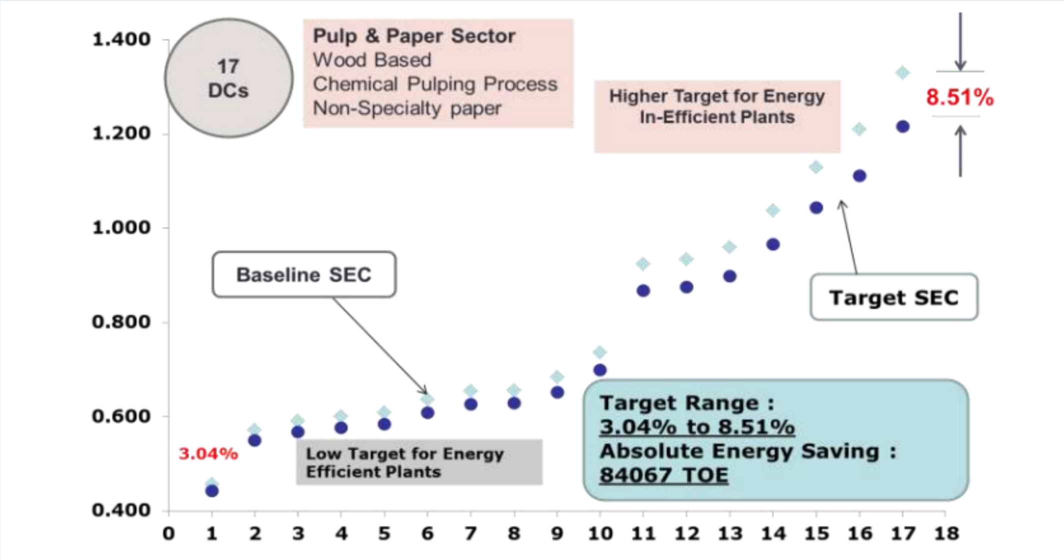
4.5. National and sub-national crediting mechanisms

There are also some national and sub-national crediting mechanisms in place which offset GHG emissions within the host country that apply performance-based benchmarks. The Indian "Perform, Achieve and Trade" (PAT) scheme as well as Alberta's Technology and Innovation and Emissions Reduction Regulation (TIER) described in Box 1 above are two such examples.

Box 7: Benchmarks in the PAT energy efficiency trading scheme in India

The **Indian PAT scheme** for energy efficiency, which was introduced in 2012, is an example of a national crediting mechanism that applies performance-based benchmarks. The scheme assigns each covered facility an energy consumption reduction target for a three-year cycle (GIZ n.d.). The scheme targets large industrial companies in the cement, fertiliser, iron & steel, paper & pulp sector, as well as railways and thermal power plants. It covered around 478 facilities in its first phase (2012-2015) (GIZ n.d.) and already covered over 1000 industries in its second phase (Deore 2017). During the second cycle (2016-2019), the coverage was extended to petroleum refineries and electricity distribution companies (BEE 2020). PAT is based on a benchmarking approach, which is managed by the Bureau of Energy Efficiency (BEE) under the Ministry of Power. Each facility has a specific energy consumption (SEC); this approach shows a lack of homogeneity across the sectors, which makes it impossible to establish a single benchmark SEC for the entire sector (Ranjan 2016). The plant-specific SEC benchmark considers the trend of energy consumption and the energy-saving potential of a plant. The national energy saving targets for a specific PAT cycle are broken down in sectoral reduction targets, which are subsequently further disaggregated among the designated consumers (Ranjan 2016). The lowest reduction target (X%) is thereby given to the best performing plant. The reduction target for other plants is then calculated according to the following equation: Plant SEC/best SEC*X% (Ranjan 2016). Figure 5 shows an example for plant-level target setting in the pulp and paper industry.

Figure 5: Plant-level target setting in the pulp and paper industry



Source: Deore (2017)

The required data for the benchmarking are gathered by the BEE together with State Designated Authorities, as well as energy auditors (GIZ n.d.). An emphasis was put on stakeholder consultations with designated consumers in the scheme's design phase, with over 100 workshops and meetings to ensure industry engagement. Industry associations in the form of the Confederation of Indian Industry were also involved in the process (GIZ n.d.). The data collection process from over 1000 industries, including third party verification of the baselines, takes around 6 months under the PAT scheme (Deore 2017). After the data gathering process, consultations are held with industries, associations, ministries, and research bodies, which take up to three months (Deore 2017).

Under the **Alberta Technology Innovation and Emissions Reduction (TIER) regulation,** which was introduced in 2020 (see Box 1 above), four new high-performance benchmarks for crude canola oil, ethyl alcohol, granular urea, and sub-bituminous coal producers were introduced in 2021 (Environment and Parks 2021):

Table 4: High-performance benchmarks

Product	High-performance benchmark (tCO_2e per benchmark unit)
Crude canola oil	0.1131
Ethyl alcohol	0.001402
Granular urea	0.2493
Sub-bituminous coal	0.01189

Considering the framing of these benchmarks, these can basically be considered BAT benchmarks in their respective sub-sectors. This shows again that sometimes there is a very fine line between performance-based and BAT-derived benchmarks.

4.6. Lessons on performance benchmarking vs BAT and other baseline setting approaches in crediting mechanisms

We conclude that BAT/BATq is only a rarely applied concept in crediting mechanisms, while performance benchmarking is applied more often, even though also to a limited extent. It is difficult to say whether a BAT-benchmarking approach is per se more stringent than a performance-based benchmark. As outlined in section 4.3, the application of BAT-derived benchmarks under the JCM was sometimes not different from a performance-based approach. Whether a performance-based approach will differ significantly from a BAT-derived benchmark depends on the market share[6] of the BAT and the stringency of the performance benchmark in terms of the percentile chosen for the threshold. If the former equals the latter, BAT and performance benchmark are fully aligned. Given that the latter is often set at 10% or 20%, a BAT market share of 10% or20% respectively would lead to such an alignment. Usually, a BAT-derived approach is more stringent than a BAU baseline. For the performance benchmark, one cannot make such a statement. Whether a high percentile benchmark beats BAU strongly depends on the vintages of the comparison group as well as the technology distribution within this group. A new BAU technology can pass a seemingly stringent benchmark if there has been significant autonomous technology improvement in a recent period, but not before. Moreover, a new BAU technology can pass if it belongs to a low-intensity technology category that is economically attractive while BAT of a high-intensity technology category is achieving a lower performance than the BAU technology. Looking at our Ferroland case, this would be the case for a new electric arc furnace, whereas the BAT blast furnaces would not achieve the performance of the BAU project. The case studies show that performance-based benchmarks can differ decisively in their stringency. Some schemes introduce high-performance benchmarks (e.g., Alberta TIER) which are very similar or equal to a BAT approach. Whereas individual industry stakeholders were pushing for more stringent performance-based benchmarks in the CDM context to attain a competitive advantage (DuPont case study), it was the host countries striving for more ambitious benchmarks in the JI context. JCM's years of experience with performance-based and BAT-derived benchmarks has revealed that the resulting baselines can be similar, if not even the same. The example of the Indian PAT scheme shows low level performance benchmarks not different from a BAU baseline.

The analysis further reveals that the data collection and update processes differ decisively between the schemes. In the case of the Indian PAT scheme, the data collection, including third party verification, took just 6 months, while the BREF development process takes 4 years. It is difficult to say whether the development of performance benchmarks is in general less time-intensive than the derivation of BAT. Time needed will also depend on the specific sector. For example, the cement sector in India is relatively heterogeneous, which required the classification of plants into different categories (e.g., wet plants, white plants etc.) (PMR 2017). The sector-wide target had to then be allocated to the subcategories, which made the process more difficult (PMR 2017). The cement sector in the EU is, however, homogenous, as over 90% of the cement production relies on dry process kilns (PMR 2017).

[6] The market share is defined as "the percentage of the market that the technology measures capture out of the total market size of all the technologies providing similar services/products in the same period" (CDM 2020).

Therefore, it was possible to apply a single product benchmark and no categorisation was required (PMR 2017).

In the following, some consideration regarding performance benchmarking and BAT in specific sectors are outlined.

Electricity sector

Considering the quickly increasing market shares of renewable energy in the electricity sector, also in many developing countries, a key question that emerges is what constitutes a 'best technology' in energy generation. This is made more difficult by the site-dependent resource availability. A PV plant in a world class site with 2500 hours of full insolation is completely different from a PV plant in a site with 1500 hours; the same applies for all other types of renewables dependent on site-specific characteristics. With regards to renewable electricity generation, BAT cannot refer to GHG intensity (which is zero) but only to technology characteristics (e.g., a 0.5 MW wind turbine was BAT in the 1990s, today a 5 MW turbine would be BAT). A far-reaching interpretation of BAT in the renewable electricity sector may require removal of GHG emissions (sequestration) at the same time. Bioenergy with carbon capture and storage (BECCS) could then for example be a BAT in energy generation. But then, no creditable emissions mitigation could be undertaken anymore by any renewable electricity project, because the BAT benchmark would be at a level of negative emissions that could not be surpassed.

Industry sector: Cement industry

Kiln systems are in general responsible for the main emissions of the cement industry (Valderrama et al. 2012). Earlier BAT assessments in the cement sector identified improvements in the kiln system as central for emissions reductions (Valderrama et al. 2012). The BREF document of the European Commission (2013) specifies BAT-AEL for pollutants such as dust, nitrogen oxides (NO_x), sulphur dioxide (SO_2), hydrogen chloride and ammonia. Regarding the reduction of nitrogen oxides, two technologies are identified (Cinti 2019). However, the reduction of GHG emissions, such as CO_2 emissions, are not addressed in detail by the BREF, as this would be covered by the EU ETS. The updated product-specific benchmark values under the fourth trading phase of the EU ETS include two benchmarks for the cement industry. The regulation specifies a benchmark value of 0.693 allowances/t for grey cement clinker and a benchmark value of 0.957 allowances/t for white cement clinker in the 2021-2025 period (European Commission 2021c). In the European context, the first large cement companies are starting to introduce hydrogen technology as part of their fuel mix (World Cement 2021). CEMEX made investments of around USD 40 million to use these technologies in its operations around the world (World Cement 2021). This shows that BAT in the cement sector could soon also become the use of hydrogen, especially once its use has been scaled up and costs have been reduced.

AFOLU sector

In the agriculture sector, Müller et al. (2014) assessed the potential of a benchmark-based methodology for the reduction of N_2O emissions from agriculture in Switzerland to generate domestic emissions credits for the KliK Foundation. The potential was estimated to be rather low, and it was therefore recommended to not further pursue it in the context of the KliK Foundation. The most important lesson learned from this exercise was the recognition that a benchmark-based approach is not effective for reducing N_2O emissions from soils, as the greatest mitigation potential lies with the farms with rather inefficient N_2O use, which would be below the benchmark. However, in the case of farms with efficient use of N_2O, which constitute the target group, emissions leakage due to yield losses will be a serious problem and lead to a significant reduction of emission credits. There were, however, no other technical issues, including during the data gathering process, that impeded the application of a benchmark-based approach. The proposed methodology would still make sense to be used for the calculation of the baseline and project emissions but using the benchmark approach would not allow to get a significant volume of credits (Müller et al. 2014).

Performance-based benchmarks are rarely used in the AFOLU sector, not at least because it is rather difficult to compare ecosystem-based project activities across areas and regions. For instance, the same forest management or agricultural practice is likely to have different implications in different areas due to different environmental and social conditions. Two standards that are considering performance standard baselines are Verra and China's Panda Standard. Verra has been working with the American Forest Foundation, the Nature Conservancy and TerraCarbon to develop a new integrated forest management (IFM) methodology, which is currently at the last stage of approval (Verra 2020). The new methodology is targeted at IFM practices that avoid emissions – from harvest or natural disturbance – or enhance sequestration. To determine the crediting baseline, a 'performance method' is used:

> "For all activities, stock change is directly monitored in paired permanent treatment (representing the project scenario) and control plots (representing the baseline scenario), permitting GHG emission reductions to be estimated independently for every sample unit (or pair) (….) Baseline quantification is focused on measured stock change in the composite controls, representing the absence of the project activity" (Verra 2020, p. 7-12).

The methodology implies that sample plots must be located outside of the project area but in the same ecoregion (Verra 2020). Hence, this is not a performance benchmark approach, but a 'control group' approach, as has been undertaken in many CDM methodologies to date.

The Panda Standard is China's domestic third-party standard for voluntary carbon reductions and initially focused on project activities in the Agriculture, Forestry and Other Land Use (AFOLU) sector (Peters-Stanley 2011). In line with the Panda Standard Sectoral Specification for AFOLU (PS-AFOLU), project proponents must demonstrate that the proposed project activity exceeds a performance threshold. That means, the project activity must achieve a level of performance that "is significantly better than average compared with similar recently undertaken practices or activities in a relevant geographic area" (Panda Standard Association 2011, p. 23). The performance threshold can be:

a. Practice-based (referring to particular practice within the industry, sector or sub-sector).
b. Technology-based (applicable if a particular technology is installed).
c. Emissions-based (project activity is credited if the corresponding net GHG emissions/removals associated exceeds the benchmark, i.e., the emission rate of the industry, sector, sub-sector, or typical land management regime) (Panda Standard Association 2011).

The latter example shows that a BATq approach may be applicable in the AFOLU sector, but it remains to be seen whether it is robust.

5. BAT-derived benchmarking under the A6.4M

After outlining how the BAT/BATq approach is taken up in different jurisdictions worldwide and applied in some baseline-and-credit systems, this chapter is of more forward-looking nature and discusses the role BAT/BATq-derived benchmarks could play in the context of the A6.4M. A key lesson from existing applications of the BAT/BATq concept is that it is highly context specific and interpretations of it – and subsequently operationalisation – varies widely. The application of BAT is therefore no panacea. Experiences with performance benchmarks that were first considered a generic solution for CDM baseline methodologies about a decade ago but were subsequently found to be applicable for limited circumstances only should not be forgotten. Enshrining the BAT/BATq concept in the A6.4M will require a careful and clear definition and common understanding of the concept's applicability. As shown by our Ferroland example, the level of aggregation as well as the definition of 'technique' are two key aspects that determine whether the approach leads to high environmental integrity or not. In this transition period of defining new and Article 6-aligned methodological approaches, no potential solution should be excluded from the start. As we describe challenges and opportunities of performance-based and BAT-derived benchmarks, other options may very well lead to highly stringent results while keeping transaction costs low. For a prompt start of the A6.4M, where activities will largely rely on existing methodologies, parameters derived from BAU scenarios could be used, to which an 'ambition coefficient' is applied that gets more stringent over time, in line with national emissions paths aligned with the long-term target of the PA (Michaelowa et al. 2021b). We think that such approaches are valid alternatives to the use of BAT-derived benchmarks to ensure baseline setting with high environmental integrity under the A6.4M.

As a starting point, the chapter addresses references to BAT in the draft negotiation text and ongoing negotiations, including an overview of the different design options. This is followed by explaining the rationale for using BAT/BATq approaches for Article 6 cooperation and summarising the key challenges, while identifying recommendations for negotiators on how to set rules that deliver on the objective of high environmental integrity and overcome these challenges. Subsequently, the chapter will dive into the question of governance considering previously made recommendations.

5.1. BAT-derived benchmarking in Article 6 negotiations

Baseline setting principles and approaches identified in recent Subsidiary Body for Scientific and Technological Advice (SBSTA) discussions are a key issue for negotiations at COP26, but an agreement is far from obvious. Parties have widely differing views[7] on the appropriateness of benchmarking and BAT under the A6.4M.

[7] As of May 2021, Parties shared the following positions: Benchmarking as baseline setting approach is supported by several Parties and groups of Parties, such as the Independent Alliance of Latin America and the Caribbean (AILAC) and Japan. BAT is specifically promoted in negotiations by the EU to ensure that baseline setting is done in a manner consistent with the need to advance transformation in all sectors, in the context of NDCs and long-term low emission development strategies (LT-LEDS). The idea is to include "forward looking elements", meaning the increased adoption of the BAT in a country. Japan supports BAT approaches as a sub-set of benchmarking approaches and argues in favour of discussing principles under the CMA and having details worked on by the SB.

As a logical consequence to the lack of agreement, the draft RMPs still comprise a broad range of baseline setting options. While the first iteration of the Article 6.4 RMPs still includes three options for baseline setting, the second iteration only includes two options. Among the outlined options in each iteration, one includes the BAT approach respectively (1st iteration: Option B; 2nd iteration: Option A). Besides, the first iteration states that regional and sub-regional best available technologies may be developed by the SB at the request of the host Party or may be developed by the host Party itself and approved by the SB. Such a concrete reference to the level of aggregation for deriving a BAT baseline is not included anymore in the second iteration. For the detailed overview on how the methodological aspects developed from the first to the second iteration, please see Annex B: Draft Article 6.4 RMPs development at COP25. In the third iteration, methodology-specific text was left out and a generic SBSTA mandate inserted to look at this in the work programme. This reveals that methodological issues are still highly contested in this negotiation item. We would like to note that the term 'techniques' has not yet been applied in the text, only the term 'technologies'.

More specifically, these are the broad options considered in negotiations that relate to the BAT-concept:

(1) **Granting actors flexibilities in baseline applications**: The most lenient option would be a high degree of flexibility for activity proponents and methodology developers in the choice of a baseline approach, ranging from performance-based approaches to projected emissions derived from BAU scenarios to historical emission levels. However, this report has highlighted that different understandings of the same approach can already result in very different outcomes. Therefore, we would caution against granting stakeholders broad flexibility in baseline applications, as a wide range of approaches and lack of harmonisation may be the result. In our opinion, clear rules enhance a common understanding, while several options may be retained to ensure the most applicable option is available for a specific activity. Overarching principles must hedge against the risk of gaming. We would see a clear need to assess which sectors and sub-sectors are appropriate for performance benchmarking, building on the discussion by Schneider et al. (2012) whose results remain valid until today as well as the refinements provided by Füssler et al. (2019). This discussion should become part of the work programme. A second step should be to derive – for those sectors and sub-sectors for which performance benchmarking is generally found applicable – appropriate percentile levels for the benchmark that are aligned with below BAU principle. Based on the assessment's outcome, the A6.4SB should decide for which sectors and sub-sectors performance benchmarking would be the appropriate baseline setting approach and provide guidance to methodology developers regarding the stringency of the benchmark.

(2) **Including BAT/benchmarking as a default approach**: The first and second iteration currently take the form of a menu-approach regarding baseline setting options. A variety of different

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Other Parties are sceptical regarding the BAT approach and what it would mean for countries that generally use technologies with lower performance. Some are also not in favour of adopting benchmarking as a general baseline setting approach and stress the need to also consider approaches based on projected emissions, based on BAU or historic emission levels as known from the CDM. Brazil, for example, has raised its opposition to BAT approaches in Article 6 negotiations at the 52nd Subsidiary Bodies session in May and June 2021.

options is given from which can be chosen. However, a certain hierarchy is also introduced, as historical and BAU baselines should only be considered if the other approaches are not considered (economically or technologically) feasible or appropriate and performance-based benchmarking or BAT-derived baselines would be the default approach. This would have to be derived from the result of the assessment of performance benchmarking appropriateness proposed above. Such a hierarchy provides clearer guidance to market participants and the A6.4SB and promotes a certain degree of harmonisation. However, qualifiers to deviate from default approaches must be carefully defined. Whether historical or BAU baselines are applicable alternatives to benchmarking in the context of the PA is questioned by many Parties. Instead of these two approaches, Parties could consider allowing baselines from projected emission levels that are below a credible BAU pathway, which may include baselines that are *based* on the consideration of historical emission trends (which may be conservative, e.g., for forestry activities in areas of rising deforestation).

(3) **BAT as a sub-type of performance benchmarking**: The current draft RMPs list performance-based and BAT benchmarks separately. To clarify the relationship, the final RMPs could introduce general principles for benchmarking and then include the option of a performance benchmark set at the highest 10^{th} or 20^{th} percentile of performance or a BAT-derived performance benchmark. As we show above, the results could very well be similar, with non-BAT performance benchmarking sometimes entailing lower transaction costs.

In case performance benchmarking is set as the preferred/default approach for sectors and sub-sectors considered appropriate, with BAT-derived performance benchmarks as an option, the following implications would need to be considered:

- Existing carbon market methodologies applied in these sectors will have to undergo fundamental revisions: Only 1% of the 216 approved CDM methodologies applied a performance-based approach (excluding combinations) (Koakutsu 2021). For CDM methodologies transitioned to the A6.4M (if a decision is taken to do so) a revision into a benchmark would certainly cost USD 100,000 or more if the full data collection work for defining the benchmark needs to be undertaken. If all data to calculate the benchmark is readily available, the cost would be limited to about USD 20,000 - 50,000.
- For sectors and sub-sectors for which performance benchmarks are considered inappropriate, the principle that projected emission baselines must be below a credible BAU pathway needs to be applied as a guardrail. Again, the ‘ambition coefficient’ approach by Michaelowa et al. (2021b) could be an effective option to achieve such an outcome.

In conclusion, it must be stressed that the BAT concept in the current negotiation text is neither well defined, nor linked to performance benchmarking approaches and subject to widely different interpretations and understandings. A common understanding leading to a clear definition of the concept is a prerequisite for ensuring that BAT assessments and applications of derived benchmarks deliver on the objectives of the A6.4M. In the following, we discuss further necessary steps regarding rule-setting and their operationalisation to promote BAT/BATq-derived benchmarking under the A6.4M in a meaningful way.

5.2. Rationale to include the BAT concept in Article 6

This section describes the rationale for including the BAT concept in Article 6 methodologies. Readers should note the caveats regarding applicability of performance benchmarks set out by Schneider et al. (2012) and Füssler et al. (2019). For each rationale outlined below, potential qualifiers in a COP26 decision as well additional guidance and related mandates for UNFCCC regulators are discussed.

5.2.1. Supporting host country NDC implementation

The application of BAT-derived approaches to baseline setting can contribute to host country NDC implementation. As NDCs are nationally determined, such a role would have to be promoted by the host country itself. If, however, a host country chooses to capitalise on synergies and use A6.4M BAT assessments for its NDC planning and implementation, the A6.4M should be mandated and able to deliver on this benefit. The SB should act as a facilitator and guardian of host countries' interests in terms of achieving their NDCs and LT-LEDS, thereby providing country-specific support on setting benchmarks if needed.

The more stringent benchmarks (performance benchmarks and BAT/BATq) are, the higher the share of mitigation accruing to the host country as the difference of emissions reductions between a stringent benchmark and a projected baseline emissions scenario (e.g., based on existing policies and measures or a commercially viable course of action) increases. This would facilitate achievement of the NDC and reduce the risk that the host country transfers too many ITMOs, which it needs to compensate through additional mitigation actions in the end (Spalding-Fecher et al. 2020). However, very stringent benchmarks may prevent Article 6 activities from materialising, especially if projected ITMO prices are low. Consequently, there will be a trade-off between benchmark stringency and the overall volume of ITMOs transacted at a given ITMO price level. Reaching the optimal level, which generates the maximum level of mitigation contribution to the NDC, will be difficult, if not impossible in practice. Unless benefits of establishing BAT benchmarks are evident and exceed associated transaction costs, host countries may prefer projected emission baselines that are based on existing methodologies, and then retain a part of the mitigation for achievement of the NDC.

The COP26 decision should thus state that for sectors and sub-sectors found to be appropriate for benchmarking, a BAT/BATq-derived benchmark should be set at a level that contributes to mitigation in the host country and mandate the SB to undertake studies to assess what level of stringency would be likely to do so, considering different circumstances of host countries. Host countries should be engaged in that process and be able to impose guardrails. Guidance on processes and outcomes of determining BAT in each country context should maximise synergies and ensure the outcome can inform and be used by the host country in the context of different climate policy instruments if the host country expresses a clear preference.

An important qualifier for BAT-derived benchmarks (and all other baseline setting approaches) would therefore be the principle of ensuring that process and outcome contribute to the host Parties' NDC implementation and planning processes and contribute to reducing emission levels in the host country.

The results of these studies should inform the SB's decisions about the minimum level of benchmark stringency and enable host countries to take informed decisions whether to set benchmarks in a more stringent manner than required by the SB. Generally, guidance provided by the SB could be helpful for host countries to ensure that they understand the process of deriving BAT benchmarks in those sectors generally seen as appropriate.

An important qualifier for BAT-derived benchmarks is that guidance on ensuring a level of stringency that delivers on real mitigation is adopted by the SB, with host Parties being able to determine a more stringent reference level at their discretion to maximise the share of mitigation to be retained in-country.

Another qualifier is the SB's role as a guardian of host countries' interests, ensuring that host countries achieve their NDC and LT-LEDS, also through the application of a stringent baseline. The SB thereby acts as a facilitator that supports the country in assessing the benchmark's appropriateness and level of stringency, if needed, and based on the criteria the host countries communicate to the SB.

5.2.2. Enhancing capacity and improving transparency

By defining BAT/BATq in a country context:

Stringent benchmarks will focus Article 6 interventions on 'middle- and high-hanging fruit' in host countries rather than on technologies with low abatement costs or widely available ones in the country context. In fact, through the identification of BAT/BATq in a certain sector, host country governments can better distinguish between mitigation options with lower and higher abatement costs. BAT/BATq-benchmarking as a process thus supports the host country in identifying the interventions and activities which are best to be implemented in Article 6 cooperation (or to be financed by climate finance), does not jeopardise NDC achievement and contributes to long-term transformation of sectors (Forth 2021). A reference to the mandate by UNFCCC to the Climate Technology Centre and Network (CTCN) to assist developing countries in identifying *environmentally sound technologies* should be made to enhance synergies with capacity building support for the BAT/BATq determination exercise, including for which sectors technologies should be specified, whereas techniques would be specified for other sectors, e.g., agriculture and forestry.

The definition of 'best' as 'general high level of environmental protection' by other conventions and regulations as outlined in chapter 2 could be taken up for the Article 6.4 RMPs. An alternative qualifier could be the reference to "environmentally sound" technologies or other qualifiers that hint at considering the environmental impacts next to the technologies' mitigation potential. It must be noted, though, that there is no common understanding of what "environmentally sound" means in the international space. A final decision including this qualifier should therefore also provide a definition of "environmentally sound", potentially adapting the United Nations Conference on Environment and Development's definition, which states that environmentally sound technologies "protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes" (UNCED 1992).

The Article 6.4 RMPs should highlight the benefits of conducting BAT/BATq assessments for an enhanced understanding of technologies' and techniques' abatement costs and the important role the CTCN and technology assessments could play therein.

In the Article 6.4 RMPs, a technology/ technique should be eligible to constitute BAT/BATq if it is offering a generally high level of environmental protection. If "environmentally sound" is used as a qualifier, a clear definition of this principle in line with its use by other international regimes must be included in the RMPs.

Through the process of identifying BAT in a country context:

Through Article 6 cooperation, the private sector could be incentivised to share data on their technologies with the government which, in turn, helps policy planning for NDC implementation, representing a win-win situation. To reduce the potential for gaming and risks for companies in competitive situations, independent third parties should be engaged in the process.

In an ideal scenario, the BAT/BATq identification process in a host country is aligned with the respective NDC planning and updates, which rely on extensive data gathering exercises. In addition, the national inventory compilation processes also offer synergies. Therefore, the BAT/BATq identification process should be embedded in an existing MRV system to benefit from efforts that have already been undertaken. This is further discussed in chapter 5.4. In conjunction with transparent documentation of sectoral and technological circumstances, a host country-driven and independently overseen BAT/BATq-benchmarking process can enhance objectivity in baseline setting and NDC alignment for sectors where benchmarking is generally appropriate.

In the A6.4M RMPs, Parties should give clear guidance in this regard to the A6.4SB and the UNFCCC Secretariat support structure for the mechanism.

5.2.3. Increasing mitigation ambition levels

BAT/BATq-derived benchmarks are usually more stringent than BAU baselines or performance-based benchmarks set at percentiles of high intensity (Lo Re et al. 2019). Whether a BAT approach is more stringent than a performance-based benchmark depends also on the market share of BAT and characteristics of the underlying sector/sub-sector, as discussed in section 4.6.

The example above shows that assumptions made in NDC development processes on specific market shares should also be aligned with the development of benchmarks. This could provide more synergies between both processes and contribute to enhanced ambition.

Besides, BAT-benchmarks can be aligned with LT-LEDS and their decarbonisation pathways, thus contributing to transformation, especially through benchmarks derived from BAT but aligned with emission levels of LT-LEDS. In this way, the ambition increase is inherently built into baseline setting approaches. Bottom-up benchmark values can be matched against existing science-based decarbonisation pathways for sectors. Costa Rica's decarbonisation plan specifies, for example, ten sectoral focus areas (decarbonisation axes) with policy packages up to 2050 (Government of Costa Rica 2019). Decarbonisation axis 6 strives for transformation of the industrial sector and thereby outlines specific activities which could be translated in BAT approaches.

A technology or technique should be deemed 'best' in an A6.4M context if its application is consistent with the long-term objectives of the PA and relevant LT-LEDS of the host Party, while resulting in a general high level of environmental protection (see above). A BAT/BATq-derived benchmark should *provide justification for its alignment with long-term goals, based on both the definition of 'best' as well as the definition of 'available'.*

5.3. Addressing the key challenges

The development of BAT benchmarks comes with many challenges that need to be addressed to ensure that such approaches are seriously considered by a broad range of Parties. This applies even beyond the key question of appropriateness of a sector/sub-sector for performance benchmarking.

5.3.1. Distributional questions and context-specificity

Sceptics of BAT-derived benchmarks under the A6.4M criticise the technology-specific aspects of this forward-looking approach for setting baselines. There is a fear that BAT assessments would lead to a situation where a host country is dependent on technology imports to be able to generate ITMOs and is specific technology options are imposed. Compared to performance-based benchmarks or projected/historic emission approaches, the technology-centric nature of BAT approaches raises fears of dependency. To address this issue, synergies with technology needs assessments and technology action plans carried in the context of the Technology Mechanism under the UNFCCC and the technology framework of the Paris Agreement could be explored, where technical and methodological support is provided to developing countries with results that are highly relevant to determine BAT/BATq. In addition, reporting on technology transfer supported by Article 6 cooperation as one means of implementation of the PA could be enhanced.

One approach which could help to overcome developing countries' reluctance to consider the approach is to focus on the term 'technique', especially regarding sectors where specific technologies are absent and operational practices are key. As has been outlined in chapter 3, BATq is a concept that has already been used in other international conventions and might therefore be more acceptable at the international level. Here, of course, it needs to be prevented that interest groups distort the definition of 'technique' in a way that leads to a hollowing of the approach.

In addition, the distributional question in terms of developing countries not having access to certain technology must be addressed. These fears can only be remedied through a realistic definition of 'availability' and a stringency level that still enables sufficient Article 6 activities to go ahead. In fact, it needs to be made clear in the negotiations that the determination of BAT/BATq is context-specific, due to the chosen level of aggregation on a geographic basis. The current draft RMPs refer to the regional and sub-regional level. It would need to be seen whether Parties consider such a level of aggregation as appropriate. In general, the determination of the level of aggregation is sector-specific and depends on the degree of economic integration of a sector. Therefore, sector-specific guidance will be needed and robust documentation of the chosen level of aggregation is required. Such a discussion of the level of aggregation for a BAT/BATq approach has so far been absent in international climate negotiations. In the end, the distributional question comes down to the definition of *available* in the negotiation text. Considering similarities across the definitions outlined in section 2.3., the following clarification could also be taken up by a CMA decision to make clear that accessibility is key: *"taking into consideration the costs and benefits, whether or not those techniques/technologies are used or developed within the* *territory of that Party, provided that they are accessible to a reasonably well managed operator of the facility/entity as determined by that Party".*

An additional qualifier next to the appropriate level of aggregation in the BAT definition is the consideration of costs. Developing countries specifically fear the costs that such an approach entails. Therefore, it should become clear from the final draft text that the determination of BAT is not only dependent on its availability, but also accessibility. Accessibility should, in turn, be defined as considering costs and benefits of the technologies.

In the A6.4M RMPs, a technique or technology shall be deemed available 'if it represents the most effective and advanced option used under economically and technically viable conditions in a given country or regional context, that is reasonably accessible to the economic actors in that context.'

A remedy to address distributional questions is the discussion of different technologies' competitiveness and the need to consider a broad range of issues under 'best' to avoid that a technology with lower GHG intensity but lower performance regarding sustainable development co-benefits is promoted. To increase the concept's acceptance, the definition of 'best', meaning a 'general high level of environmental protection' as promoted by other conventions and regulations (see chapter 2) could be taken up by the CMA decision. In this context, international guidance will be key and good and independent experts are required to avoid gaming with the BAT concepts' components.

5.3.2. Costs of BAT determination, ITMO price levels and incentives

As outlined in chapter 4, a BAT/BATq determination process is time- and resource-intensive, not least due to its nature as a moving target, since what is best, and what is available, changes over time, and not necessarily in a predictable or smooth manner.

In the case of a projected or historic emission approach, the baseline setting approach also requires data inputs, but only related to the project level. A performance-based benchmark, on the contrary, requires data on an entire comparison group, which entails high transaction costs if this data is not readily available. Availability of data is better, the larger the company and the more it is exposed to scrutiny of investors. As the Carbon Disclosure Project shows, most large companies now routinely publish GHG emissions data. However, getting such information disaggregated according to sectors and sub-sectors or even specific technologies is rare. Sectoral actors might in general be more willing to provide data on their overall performance than on specific technologies, as this is less sensitive in terms of undermining their competitive advantage. The costs of a BAT assessment depend on many different factors. In the following, the potential cost drivers are outlined:

- Activity type: Many technological options or techniques are not available for all activity types. If there are only few options available, it may be easier to assess BAT, but if there are many options, assessment and comparison may be more complex and costly. BAT can also be part of approaches for policy crediting if the policy instrument is meant to mobilise mitigation action beyond BAT. However, the same caveats apply as for project-based BAT.
- Sector: Some sector entities will be more reluctant to share data than others (e.g., highly globally competitive industry sector) which will then require more data gathering efforts and involvement of experts than for other sectors. Also, in some sectors data might simply not be collected

yet, which poses a challenge to the BAT determination process. The costs may also depend on the number of actors in a sector, as the more actors are involved (e.g., households compared to steel companies) the more complex and costly the data gathering process becomes. In addition, if a sector is dominated by informal actors, this also restricts data availability.

- Level of aggregation: Usually, the higher the level of aggregation, the more factors need to be considered and the more complex the BAT determination becomes. The lower the level of aggregation, the more likely it is that BAT is the only relevant technology, which would defeat the purpose of the approach.
- Emerging vs mature technology: The technology needs to be sufficiently tested to be able to achieve its theoretical technical lifetime under local circumstances. Experimental technologies should be excluded from the assessment. Applying a 'technique' approach would ensure that only activities that can reasonably be implemented in the host country context are considered.
- Pace of technological development: In general, the faster the change of technological development, the higher the need for regular revisions and subsequently higher costs. However, if information on new technologies is readily available, fast change does not automatically result in higher costs of assessment, just higher cost of revisions.
- Frequency of updates: The frequency of updates has an impact on costs as well. In the context of the EU IED, the update process is a bit shorter than the initial BREF development process and needs to take place at least every 8 years. Even though this is not necessarily frequent, BREFs' comprehensiveness implies that their development and updating process is costly. In the context of other frameworks, the costs for revisions might be less.
- Existence of data gathering entities: In some industry sectors such as cement, steel and aluminium, the industry associations' efforts to gather and publish data can facilitate the BAT determination process, thus contributing to reducing crediting activities' transaction costs.

One way to reduce transaction costs is through the promotion of standardisation. The increase in costs for the host country could also be lowered through allocation of a part of the administrative share of proceeds (SOPs) by the SB to finance costs incurred in the context of BAT determination in host countries.

In the RMPs, it should be specified that BAT/BATq assessments for sectors and sub-sectors where they are generally appropriate should be done at the highest possible level of aggregation that keeps the approach meaningful and appropriate, and regularly updated in line with NDC implementation periods.

Further technical work should be mandated by Parties to the UNFCCC Secretariat to develop a standard process for BAT/BATq-determination, involving the host country government, activity participants, designated operational entities (DOEs) and the A6.4SB and support structure. The UNFCCC Secretariat should be mandated to take on preliminary cost estimations and identify options to fund the process through SOPs.

Based on this technical work and in consideration of costs, the A6.4SB should be mandated to develop guidance and procedures for BAT/BATq assessments and updates in different sectors. The SB should be mandated to identify and collaborate with relevant international organisations and entities as relevant.

Another cost implication which needs to be considered is that stringent baseline setting will only mobilise additional mitigation action if the carbon price level is high enough. A logical consequence from stringent baseline setting is the reduced volume of ITMOs. Consequently, a higher ITMO price may be required, so that activity developers still have sufficient incentives to invest in mitigation activities. This assumes that costs do not fall as stringency increases and/or the host country does not provide incentives or regulation for the uncredited part.

Capacity building programmes that are developed and implemented in the context of A6.4M should include training of government stakeholders and guidance on considering prices for A6.4ERs in their authorisation conditions.

5.3.3. Lack of host country experience

Many developing countries have not gained much experience with benchmarking under the CDM. The current draft RMPs enable host countries to approve or develop their own benchmarking approaches, thus incentivising enhanced host country ownership. In fact, country ownership is favourable for the development of performance-based or BAT-derived benchmarks as a high degree of understanding of the national context is required.

To become an attractive baseline setting approach, more capacity building and practical examples of how BAT-derived benchmarking can contribute to and relate to national developing strategies, NDCs and LT-LEDS of host countries are required. BAT can, for example, be linked to host country interests that stem from other processes, i.e., are not imposed by Article 6 buyers, but rather respond to goals identified by national experts, such as policymakers that develop energy efficiency standards and require information on the best technologies available. Linking Article 6 to that would make genuine host country interest and demand visible.

An important precondition for enhanced host country ownership is its ability and/or interest to incentivise action to move from BAU towards wide application of BAT/BATq. The host country could, for example, link a BAT benchmarking approach to the achievement of its unconditional NDC (low-hanging fruit) by putting in place national standards for promotion of BAT. Emissions credits eligible under Article 6 are then issued to those exceeding BAT. This is closely linked to the consideration of ITMO prices in authorisation of transfers (see above).

A host country may approach benchmarking differently if it wants to use the A6.4M methodologies (or certified credits) nationally. In the national context, Parties could, for example, lower the BAT-derived benchmark and use it in domestic pricing systems, while keeping the higher benchmark for international carbon markets. Such a differentiation of baseline setting approaches and benchmarks specifically could also be built in the A6.4M and operationalised in methodologies. A key question in this regard would then be the differentiation between ITMOs and domestic A6.4ERs (and operationalise SOP and OMGE) which is an ongoing debate in Article 6.4 negotiations.

If the host country develops a comprehensive Article 6 strategy, its engagement in defining the baseline approach and specifying a BAT/BATq should form part of it. In the JI context, carbon market cooperation was often used as a transition tool until more stringent legislation was implemented. The host country could thus embed Article 6 cooperation strategically in national legislative processes.

Capacity building programmes for host countries set up in the context of the A6.4M should include guidance and tools on the strategic use of benchmarking/BAT in domestic and international contexts and interlinkages therein.

A challenge to host country ownership is that technical assistance in many developing countries is provided by external consultants. This is also reflected in NDCs, which are often based on international models with little grounding in the countries' reality. Attention therefore needs to be paid that BAT benchmarking does not lead to a situation where the host countries become even more dependent on international consultancies. Here, synergies with experiences in technology needs assessments and technology action plans promoted by the UNFCCC Secretariat as well as lessons learned in this regard could be explored further.

Any capacity-building programme for host countries in the context of the A6.4M should promote a holistic and long-term training of domestic experts, introduction of processes and development of concrete guidance and tools and go beyond ad-hoc workshops for a limited number of staff provided by international consultancies. Synergies with other ongoing processes under the Convention should be exploited.

5.3.4. Data availability and confidentiality

As has been outlined in section 3.4, data availability and confidentiality can constitute a significant and possibly prohibitive barrier to BAT and benchmark approaches. This holds especially true for sectors with strong competition. There are different options in which data can be gathered. Sometimes data might not even be collected, as the determination process relies on modelling exercises. In many cases, though, the BAT determination process was based on a multi-stakeholder process.

Third parties can play an important role in this process, either as data collectors or as independent verifiers. In general, there will be a need to build trust with private sector actors regarding the use of provided data and the implications for future sectoral policies. International sectoral associations have played an important role in overcoming governmental distrust and providing anonymised data, thus also preserving the interest of participating private actors. The A6.4SB and programme developers could cooperate with these associations in the data collection and verification process. Technical experts could be mandated by the A6.4SB and its support structure to collect data across a sector or industry group at the regional level to develop BAT-derived default benchmarks, which could be applicable to several host countries. The A6.4SB should put in place stringent regulations on dealing with confidential data to increase trust of private sector actors when engaging with these processes. DOEs in their role as independent auditors can assess the plausibility of underlying data from national BAT assessments in the respective host country by building on related work in other countries in the region. Even if industry associations are in place, DOEs could increase governments' trust in the industry data by acting as a verifier.

Technical experts should be trained through the UNFCCC Regional Collaboration Centres to undertake data collection for BAT assessments across sectors at the regional level to ensure enhanced transparency. Designated Operational Entities (DOEs) should be trained and certified to verify the data. Specific protocols to deal with confidentiality of sensitive data must be developed. DOEs should not be chosen *by activity participants but assigned by the A6.4SB to activities randomly and required to closely collaborate with national stakeholders.*

The question of transparency of the assumptions will, however, not be entirely resolvable through such sectoral associations or improved cooperation with private sector actors in general. Therefore, cross-checks with performance data or other gathered data for national or international reporting processes could be introduced. In this manner, gaming could probably not be entirely avoided but at least minimised.

The A6.4SB should be mandated to check for consistency of reported information on performance data or national inventory data in BTRs and information reported on methodologies and assumptions in submitted Article 6.4 activity registration requests, as far as relevant and feasible.

5.4. Governance of BAT benchmarking in the Article 6.4 context

There is a need to clearly define responsibilities and obligations of host country Parties, the Article 6.4SB, DOEs, a potential future methodology panel or a group of methodology experts, the UNFCCC Secretariat and the RCCs as well as other entities providing capacity building support in setting and approving a BAT-derived baseline to avoid the politicisation of baseline setting. The processes described in this chapter assume that we will see similar bodies and roles under the A6.4M as in the CDM context. This includes the assumption that there will potentially also be a methodology panel (hereafter: A6.4 methodology panel) in place and that the Secretariat will also play an important technical role, as it has done under the CDM.

As outlined above, the draft RMPs stipulate that BAT benchmarks may be developed by the SB at the request of the host Party or may be developed by the host Party and approved by the SB. In the end, the host Party and SB will need to approve the activity before MOs can be generated.

5.4.1. From the host country perspective

For its reporting requirements under the PA, the host country needs to set up regular data collection processes to be able to provide up-to-date information on national GHG emissions and climate action. In the following, the different data gathering processes are outlined, including the role of the host Party and the potential links to a BAT/BATq determination process.

- **National MRV system**: Under the enhanced transparency framework, Parties will need to submit national inventory reports (NIRs) on a regular basis, information to track progress in implementing and achieving their NDCs, information on climate change impacts and adaptation as well as information on financial, technology transfer and capacity-building support provided or received (UNFCCC 2016). For the preparation of BTRs and NIRs, Parties will thus need to have in place a national overarching MRV system comprising MRV of support, MRV of emissions and MRV of mitigation actions. The government is the entity that sets up the different MRV strands and organises the coordination between them, including inter-ministerial coordination as well as coordination with sub-national government entities. The MRV system for mitigation actions can provide many synergies with the identification of BAT as it will gather data on ongoing mitigation actions in all sectors and can thus provide information on mitigation actions and the most recent technological developments in this context.

- **NDC planning and update processes**: NDC update processes are often separate to ongoing MRV processes. NDC update processes can involve the development of marginal abatement cost curves for the identification of the best mitigation options. Such an assessment or other related assessments that take place for the NDC update provide important insights for the identification of BAT. The host country government is usually the entity that initiates such assessments, oversees the NDC update process and takes the final decision on mitigation actions to be pursued. As identified by Michaelowa et al. (2021a), Parties preparing for Article 6 cooperation should closely embed their strategy and governance in the NDC planning and implementation processes.

The determination of BAT/BATq will require specific activity-level data on abatement options associated with certain technologies and techniques. In some sectors, it will be difficult to access such data. The same holds true for small and/or rural actors. For example, in the industry sector, many entities do not have an interest in sharing such data with the government, as they fear stricter provisions. However, it needs to be noted that private sector actors also have an incentive in the form of revenues from ITMO/A6.4ER sales to share more data. This should also be emphasised in data gathering processes.

In the following, some actions are outlined to facilitate data gathering processes on specific technologies at the host country level:

- **Establishment of initiatives on enhanced transparency**: It would be important that the host country government promotes the formation of initiatives or the participation in already existing (inter)national, regional, or rural initiatives that strive for enhanced transparency on GHG emissions.
- **Capacity building and awareness raising**: Capacity building and awareness raising measures can play an important role in linking national interests with the move from BAU to BAT benchmarks, which will also impact the data gathering process.
- **Involvement of third entities for data collection processes:** As outlined in section 3.5, industry entities might be reluctant to share activity-level data, as they fear stricter provisions and competitive disadvantages. The latter could be overcome by involving DOEs, which ensures that the data gathering process remains anonymous and no ex-post allocation of collected data is possible. This is also relevant for other sectors.

In case the host country develops the BAT/BATq approach, it will need to provide insights into the underlying data and assumptions to the SB for granting approval. Host countries thus need to be aware that their own derivation of BAT benchmarks comes with certain transparency requirements.

Next to improving synergies between data gathering processes and promoting access to data, it is important that the host country government has the capacity to understand the data and to develop BAT/BATq-derived benchmarks for those sectors and sub-sectors where they are deemed appropriate. Even if the host country requests that the SB develop the benchmark, it will still be important for the host country government to be able to follow the process and to assess whether the SB-established benchmark is appropriate for its specific national context. The SB will rely on the expertise of international experts or a potential A6.4 methodology panel to develop a BAT benchmark. These experts will base the BAT development on their respective expertise but most likely also on national data and documents that have been submitted to the SB in the process. It is therefore pivotal that the host country provides detailed data in its submissions to ensure that the developed BAT/BATq benchmark is aligned with the national context.

In the CDM context, the UNFCCC Secretariat established a structure for supporting developing countries in methodological issues. Especially the RCCs played an important role in that. Against the background that the level of aggregation for deriving a BAT/BATq baseline is set at the regional and sub-regional level in the draft negotiation text, RCCs will most likely also play a significant role in supporting host countries in determining BAT. This will be outlined in more detail in the next sub-section. The support of host countries by RCCs in the development of standardised baselines, however, also highlights the question of local capacities. Even though baseline development mostly relied on international consultancy work, there are good examples of technical know-how developed locally under the CDM, as for example in India. A well-designed process can contribute to enhanced local capacities in such developing processes.

5.4.2. The role of the A6.4SB and A6.4M support structure

The A6.4SB can either have an oversight role in terms of approving the proposed BAT/BATq baseline methodology by the host Party or develop the benchmark itself at the request of the host Party. The SB receives support in the operation of the mechanism from the UNFCCC Secretariat. In the following, the potential roles and responsibilities are outlined in more detail, assuming a similar process as for the development of standardised baselines (see CDM 2013b).

The SB's role in a potential top-down BAT/BATq benchmark development process would be:

- Receive a submission of a BAT/BATq development agreement by the DNA showing that the sector/sub-sector is appropriate for performance benchmarking.
- Take a decision on developing a BAT/BATq benchmark following the receipt of the agreement with the DNA of a host Party.
- The Secretariat prepares a draft development plan for the benchmark, directly involving at least one member of the A6.4 methodology panel.
- The A6.4 methodology panel approves the development plan.
- If the development plan is approved, the Secretariat is to prepare a BAT benchmark in accordance with the development plan, directly involving at least one member of the A6.4 methodology panel and drawing on support from DOEs in the data gathering process, as necessary, as well as further external and national expertise as required.
- The A6.4 methodology panel assesses the BAT benchmark and issues its recommendation to the SB.
- If approved, the Secretariat forwards the BAT/BATq benchmark to the SB and host Party, making it publicly available on the respective website.

The SB's role in a potential bottom-up BAT/BATq benchmark development process would be:

- Receive a submission of a proposed BAT/BATq benchmark by the DNA of a Party together with all additional documentation supporting the submission including an assessment report on the quality of the data collection, processing, and compilation.
- UNFCCC Secretariat undertakes an initial assessment of the submission informs the DNA of the outcome.
- If the initial assessment shows that the submission principally complies with the RMPs, the Secretariat launches the A6.4 methodology panel to assess the issue.
- The recommendation is developed by the relevant panel or working group. The panel can delegate elaboration of the recommendation to specific members but needs to vote on it.
- The recommendation by the panel is considered by the A6.4SB.
- A decision is taken by the A6.4SB and communicated to the host Party.

Oversight from the A6.4SB will be in place for the bottom-up process and is inherent to the top-down process. In this manner, the SB can support the host country in embedding BAT benchmarking in NDC implementation processes and ensure that the proposed BAT benchmark methodology complies with the requirements outlined in the finalised RMPs.

Most likely the A6.4M will also be dependent on entities and initiatives that support its implementation worldwide. In the CDM context, the RCCs have played an important role in promoting carbon pricing instruments and building local capacities. Regarding the role of the RCCs in the development of BAT/BATq benchmarks, their role could be comparable to the one for the development of standardised baselines (UNFCCC 2017). Many standardised baselines were developed in a bottom-up manner, meaning that the host Party developed the standardised baseline to be approved by the CDM EB. RCCs provided the following support (UNFCCC 2017):

- Capacity building of DNA and relevant national stakeholders.
- Direct technical support to develop, revise or update the standardised baseline.
- Facilitate the expression of interest for a top-down approach.
- Provide clarification to understand the issues identified by DOEs.

Besides, the RCC has provided support throughout the entire process from submission until approval (UNFCCC 2017).

We would propose to check in the work plan whether the UNFCCC Secretariat support structure for the development of standardised baselines should be replicated for the development of standardised baselines or for the development of BAT/BATq- and performance-based benchmarks in the context of the A6.4M. A more country-driven approach may be warranted, given the larger role of host countries in the A6.4M. Initiatives such as the Collaborative Instruments for Ambitious Climate Action (CiACA) initiative, which aids Parties in the development of carbon pricing instruments for implementing their NDCs, could develop projects to create synergies between national MRV processes and BAT/BATq assessments. The technical support provided by the RCC in the form of the CiACA project, for example, should thereby also outline best practices for data gathering processes from different sectors and recommendations on how to incentivise enhanced transparency and data availability in some sectors. Besides, the RCCs could play an important role in incentivising sector associations at the regional level to promote enhanced transparency on GHG emissions. RCCs would thus represent the link between the A6.4SB and the secretariat with the host country's DNA.

6. Conclusions and recommendations

The analysis of benchmarking in broader environmental policy setting and under baseline and credit mechanisms for GHG mitigation reveals that performance-based and BAT-derived benchmarks can take various forms and build on more or less complex determination processes. It should particularly be noted that basic definitions, like 'technology' (BAT) and 'technique' (BATq) need to be derived in a careful manner to ensure a high level of environmental integrity. The level of stringency comes down to a policy decision in the end. Most importantly, it needs to be recognised that performance benchmarks are not the most appropriate baseline setting method for highly heterogenous sectors and subsectors. Therefore, the consideration of applying BAT/BATq-derived performance benchmarks under the A6.4M needs to build on a solid assessment of BAT-appropriate (sub-)sectors.

Regarding the ongoing Article 6.4 negotiations, the reasons that speak in favour of promoting BAT approaches need to be better aligned with underlying rationales, including supporting host countries in their NDC implementation, enhancing national capacities, and improving transparency in order to achieve an increased mitigation ambition level. The application of BAT/BATq will face some key challenges, such as distributional issues, a lack of host country experience with the derivation of benchmarks as well as data availability and confidentiality. Developing countries' fears that certain technologies will be imposed upon them through BAT approaches should be met with a clear definition of 'available' that highlights the context-specificity and the consideration of costs in the concept's definition, as well as 'technique' that sufficiently considers operational characteristics while not serving as a loophole to undermine environmental integrity. The other two challenges can be met by certain governance arrangements, which are outlined in in Table 5. Further work will be needed to operationalise a BAT-derived baseline setting approach in the A6.4M.

In Table 5 below, we summarise our key recommendations for the rules, their operationalisation, and future actions necessary to enable BAT-derived benchmarking to uphold environmental integrity under the A6.4M.

Table 5: Key recommendations for BAT/BATq-derived benchmarking in the A6.4M

Aspect	Recommendations for promoting BAT/BATq-derived benchmarking
Assess for which sectors and subsectors benchmarks are appropriate	Work programme to contain technical work to assess in which sectors/sub-sectors performance benchmarking and BAT/BATq-derived versions of that approach are appropriate, and what alternatives are available to align baseline setting with the long-term target of the PA.

Aspect	Recommendations for promoting BAT/BATq-derived benchmarking
Rules for baseline setting set by the CMA	The current draft RMPs list performance-based and BAT benchmarks separately. To clarify the relationship, the final RMPs could introduce general principles for benchmarking and then include the option of a performance benchmark set at the highest 10th or 20th percentile of performance or a BAT-derived performance benchmark. As we show above, the results could very well be similar, with non-BAT performance benchmarking sometimes entailing lower transaction costs. Following this, the RMPs should further specify BAT and BATq: In those sectors for which benchmarking is deemed appropriate, benchmarks shall be derived from an assessment of BAT and BATq, as appropriate in each context. To be considered best, the identified technology or technique must contribute to the host Party's NDC implementation, as well as the long-term objectives of the PA and relevant LT-LEDS of the host Party (as applicable), while resulting in a general high level of environmental protection. To be identified as available, the technology or technique shall represent the most effective and advanced option used under economically and technically viable conditions in each country or regional context, which is reasonably accessible to the economic actors. BAT or BATq assessments should be done at the highest appropriate level of aggregation and regularly updated in line with NDC implementation periods.

Aspect	Recommendations for promoting BAT/BATq-derived benchmarking
Mandate given by Parties to the A6.4SB and related support structure	The A6.4SB should support the host country in setting performance-based or BAT/BATq-derived benchmarks by providing a support structure that facilitates the data gathering process and ensures its alignment with country-specific NDC implementation plans. The A6.4SB should oversee the setting of the crediting period in reference to a country-specific BAT/BATq-derived benchmark and ensure this benchmark is well below a credible BAU pathway of action. Based on further technical work (see below), the A6.4SB should be mandated to: - develop guidance and procedures for BAT assessments and updates in different sectors. - collaborate with relevant international organisations and entities such as the United Nations Environment Programme or the United Nations Development Programme. - include BAT-related requirements and tasks in the accreditation processes of DOEs. - either assess a BAT/BATq benchmark submitted by host Parties or develop BAT/BATq-benchmarks upon request by the host country and in close cooperation therewith. - identify and promote synergies of BAT-identification with NDC planning and update processes. - check for consistency of reported information on performance data or national inventory data in BTRs and information reported on methodologies and assumptions in submitted Article 6.4 activity registration requests, as far as relevant and feasible.
Requests to the UNFCCC Secretariat for further technical work	The Secretariat shall develop a standard process for BAT/BATq determination involving the host country government, activity participants, DOEs and the A6.4SB and support structure. This work should be undertaken based on a review of international experiences with BAT/BATq assessments and in coordination with relevant international organisations (e.g., OECD). The UNFCCC Secretariat should be mandated to take on preliminary cost estimations and identify options to fund the process through SOPs. This technical report shall be considered by the A6.4SB.

Aspect	Recommendations for promoting BAT/BATq-derived benchmarking
Capacity building programmes for host Parties	Capacity building programmes shall be designed to identify and promote synergies of BAT/BATq-identification with NDC planning and update processes in host countries. They should be developed in a broad manner and include capacity building on BAT/BATq-assessments in the context of strategic use of domestic market mechanisms and international market-based cooperation. RCCs should be involved in such capacity building programmes, based on experience accumulated in the processes of establishing standardised baselines. In addition, the exploitation of synergies with support provided to developing countries in the context of the technology mechanism of the UNFCCC and the technology framework of the PA should be explored. Technology needs assessments aim to build national capacity on determining appropriate technologies, their prioritisation and implementation and may offer important insights on BAT/BATq.

References

ADB (2016): Handbook for developing Joint Crediting Mechanism Projects, https://www.adb.org/sites/default/files/institutional-document/219486/handbook-developing-joint-crediting-mechanism-projects.pdf (accessed on March 26, 2021)

BEE (2020): PAT cycle, Bureau of energy Efficiency, Government of India, Ministry of Power, https://beeindia.gov.in/content/pat-cycle (accessed on August 26, 2021)

CDM (2012): Guidelines for the establishment of sector specific standardized baselines, EB 65 Report, Annex 23, Bonn

CDM (2013a): Large-scale Consolidated Methodology. N_2O abatement from nitric acid production, version 2.0, ACM0019, Bonn

CDM (2013b): Development, revision, clarification and update of standardized baselines, CDM-EB63-A28-PROC, Bonn

CDM (2015): Standardized baseline: Methane emissions from rice cultivation in the Republic of the Philippines, CDM ASB0008, Bonn

CDM (2018): Establishment of sector specific standardized baselines, CDM-EB101-A05-STAN, Bonn

CDM (2020): Concept note: Consistent use of market penetration metrics for additionality, common practice and FOIK, Version 01.0, CDM-MP83-A09, Bonn

CDM Methodologies Panel (2011): Information Note. Benchmark for the N_2O emission factor from nitric acid plants, Forty-ninth meeting Report, Annex 12, Bonn

CDM Methodologies Panel (2012): Information note on proposed draft guidelines for determination of baseline and additionality thresholds for standardized baselines using the performance penetration approach, Fifty-eighth meeting report, Annex 20, Bonn

Cinti, Giovanni (2019): BAT in the cement industry, including cost/benefit effects, https://unece.org/fileadmin/DAM/env/documents/2019/AIR/Capacity_Building/BAT_workshop_2019/3_1_BAT_Cement_Cinti.pdf (accessed on June 2, 2021)

Cook, Gregory; Ponssard, Jean-Pierre (2011): A proposal for the renewal of sectoral approaches building on the Cement Sustainability Initiative, in: Climate Policy, 11, p. 1246-1256

CSI (2016): Cement industry energy and CO2 performance: Getting the numbers right (GNR), https://docs.wbcsd.org/2016/12/GNR.pdf (accessed on May 18, 2021)

Delise, Marie; Villot, Jonathan; Gaucher, Rodolphe; Amardeil, Anne; Laforest, Valérie (2020): Challenges in assessing Best Available Techniques (BATs) compliance in the absence of industrial sectoral reference, in: Journal of Cleaner Production, 263

Deore, Milind (2017): Implementation of PAT scheme in petroleum refineries, https://beeindia.gov.in/sites/default/files/MD_PPT_Vadodara_7_July_2017.pdf (accessed on May 25, 2021)

Ecofys, Fraunhofer Institute for Systems and Innovation Research, Öko-Institut (2009): Methodology for the free allocation of emission allowances in the EU ETS post 2012. Sector report for the iron and steel industry, https://ec.europa.eu/clima/sites/default/files/ets/allowances/docs/bm_study-iron_and_steel_en.pdf (accessed on June 11, 2021)

Egenhofer, Christian; Fujiwara, Noriko (2008): Global sectoral industry approaches to climate change: The way forward, CEPS Task Force report, Centre for European Studies, Brussels

Egenhofer, Christian; Fujiwara, Noriko (2009): Sectoral approaches to address climate change: more than wishful thinking?, in: European Review of Energy Markets, 3

EIPPCB (2021): Reference documents, https://eippcb.jrc.ec.europa.eu/reference/ (accessed on May 31, 2021)

Environment and Parks (2021): Ministerial order: Technology innovation and emissions reduction regulation high-performance benchmark and benchmark unit order, https://www.qp.alberta.ca/Documents/MinOrders/2021/Environment_and_Parks/2021_043_Environment_and_Parks.pdf (accessed on June 2, 2021)

EU Science Hub (n.d.): Sustainable production: best available techniques, https://ec.europa.eu/jrc/en/research-topic/sustainable-production-best-available-techniques (accessed on May 18, 2021)

European Commission (2011): Commission Decision of 27 April 2011 determining transitional Union-wide rules for harmonised free allocation of emission allowances pursuant to Article 10a of Directive 2003/87/EC of the European Parliament and of the Council (notified under document C(2011) 2772), 2011/278/EU, Brussels

European Commission (2012): Commission Implementing Decision of 10 February 2012 laying down rules concerning guidance on the collection of data and on the drawing up of BAT reference documents and on their quality assurance referred to in Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions, 2012/119/EU, Brussels

European Commission (2013): JRC reference reports: Best Available Techniques (BAT) reference document for the production of cement, lime and magnesium oxide, Industrial Emissions Directive 2010/75/EU, Brussels

European Commission (2015): EU ETS Handbook, https://ec.europa.eu/clima/sites/clima/files/docs/ets_handbook_en.pdf (accessed on May 18, 2021)

European Commission (2021a): Evaluation and revision under industrial emission directive (IED), https://ec.europa.eu/environment/industry/stationary/ied/evaluation.htm (accessed on May 27, 2021)

European Commission (2021b): Allocation to industrial installations, https://ec.europa.eu/clima/policies/ets/allowances/industrial_en (accessed on August 18, 2021)

European Commission (2021c): Commission implementing regulation (EU) 2021/447 of 12 March 2021 determining revised benchmark values for free allocation of emission allowances for the period from 2021 to 2025 pursuant to Article 10a(2) of Directive 2003/87/EC of the European Parliament and of the Council, EU 2021/447, Brussels

European Parliament and Council (2009): Regulation No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS), repealing Regulation (EC) No 761/2001 and Commission Decisions 2001/681/EC and 2006/193/EC, Brussels

European Parliament and Council (2010): Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control), Brussels

Fischer, Carolyn (2019): Market-based clean performance standards as building blocks for carbon pricing, Policy proposal 2019-13, Amsterdam

Forth, Thomas (2021): Options for baseline methodological approaches, presentation held at CCXG session 3, online conference, March 16, 2021

Fuels Europe et al. (2020): Energy intensive industries' statement on GHG abatement measures: Interaction with the Industrial Emissions Directive, https://www.fuelseurope.eu/wp-content/uploads/2020-04-15-EIIs-on-GHG-abatement-measures.pdf (accessed on May 24, 2021)

Fuels Europe et al. (2021): Joint statement with regard to the climate change related policy options considered in context of the Targeted stakeholders Survey (TSS) on the revision of the Industrial Emissions Directive, https://www.fuelseurope.eu/wp-content/uploads/IEA-2021.04.06_IED-revision_final-joint-industry-statement_final.pdf (accessed on May 24, 2021)

Füssler, Jürg; Oberpriller, Quirin; Duscha, Vicky; Lehmann, Sascha; Arens, Marlene (2019): Benchmarks to determine baselines for mitigation action under the Article 6.4 mechanism, Discussion Paper, INFRAS & Fraunhofer ISI, Zurich and Karlsruhe

GIZ (n.d.): India: Energy efficiency scheme: Perform, Achieve and Trade (PAT), https://clifit.org/sites/clifit.org/files/documents/policyanalysis_handout_india_2015-06-04.pdf (accessed on May 24, 2021)

Government of Alberta (2020): TIER Regulation Fact Sheet, Calgary, https://www.alberta.ca/assets/documents/ep-fact-sheet-tier-regulation.pdf (accessed on June 10, 2021)

Government of Costa Rica (2019): National Decarbonization Plan 2018-2050, https://unfccc.int/sites/default/files/resource/NationalDecarbonizationPlan.pdf (accessed on May 18, 2021)

Grubb, Michael; Counsell, Thomas (2010): Tackling carbon leakage: Sector-specific solutions for a world of unequal carbon prices, https://www.carbontrust.com/resources/tackling-carbon-leakage-sector-specific-solutions-for-a-world-of-unequal-prices (accessed May 24, 2021)

IAI (2021a): Home, https://www.world-aluminium.org/ (accessed on May 17, 2021)

IAI (2021b): Aluminium sectors greenhouse gas pathways to 2050, https://www.world-aluminium.org/media/filer_public/2021/03/16/iai_ghg_pathways_position_paper.pdf (accessed on May 17, 2021)

ICAP (2021): China National ETS, https://icapcarbonaction.com/en/?option=com_etsmap&task=export&format=pdf&layout=list&systems%5B%5D=55 (accessed on May 19, 2021)

IEA (2020): (Alberta) Technology Innovation and Emissions Reduction Regulation, https://www.iea.org/policies/11754-alberta-technology-innovation-and-emissions-reduction-regulation (accessed on May 19, 2021)

IEA and Tsinghua University (2021): The role of China's ETS in power sector decarbonisation, https://iea.blob.core.windows.net/assets/61d5f58d-4702-42bd-a6b6-59be3008ecc9/The_Role_of_China_ETS_in_Power_Sector_Decarbonisation.pdf (accessed on May 24, 2021)

JCM (2017): Joint Crediting Mechanism approved methodology TH_AM003: "Energy saving by introduction of high efficiency invert type centrifugal chiller", https://www.jcm.go.jp/th-jp/methodologies/42/approved_pdf_file (accessed on May 18, 2021)

JISC (2011): Guidance on criteria for baseline setting and monitoring (Version 03), Joint Implementation Supervisory Committee, Bonn

JISC (2016): Reflections and analysis on experiences and lessons learned from joint implementation (Version 01.0), JI-JISC39-A02-RECO, Bonn

Karschunke, Karsten (2021): Stringent baseline setting to generate host country mitigation benefits, presentation held at CMM-WG workshop, online meeting, May 3, 2021

Koakutsu, Kazuhisa (2021): Tailoring activities and methodologies through bilateral cooperation – lessons from the JCM, presentation held at the CMMWG-I4C Workshop, online conference, May 26, 2021

Kollmuss, Anja; Schneider, Lambert; Zhezherin, Vladyslav (2015): Has Joint Implementation reduced GHG emissions?: Lessons learned for the design of carbon market mechanisms, Stockholm Environment Institute, Stockholm

Korea Legislation Research Institute (2015): Act on the integrated control of pollutant-discharging facilities, http://extwprlegs1.fao.org/docs/pdf/kor167967.pdf (accessed on 31 May, 2021)

Latvian Presidency of the Council of the European Union (2015): Submission by Latvia and the European Commission on behalf of the European Union and its member states, https://www4.unfccc.int/sites/SubmissionsStaging/Documents/75_121_130707288626901101-LV-03-12-%20JI%20submission.pdf (accessed on March 26, 2021)

Lindley, Andrew (2004): Response to DuPont letter to CDM Methodology Panel concerning AM0001, https://cdm.unfccc.int/public_inputs/inputam0001/Comment_AM0001_IneosFluor_LettertoMP_05July2004.pdf (accessed on May 25, 2021)

Lo Re, Luca; Ellis, Jane; Vaidyula Manasvini; Prag, Andrew (2019): Designing the Article 6.4 mechanism: assessing selected baseline approaches and their implications, Climate Change Expert Group Paper No. 2019(5), OECD, Paris

Matthes, Felix (2015): EU and Germany's experience with ETS benchmarking, Öko-Institut, Seoul

Michaelowa, Axel (1998): Joint Implementation - the baseline issue, in: Global Environmental Change, 8, p. 81-92

Michaelowa, Axel; Buen, Jorund; Eik, Arne; Lokshall, Elisabeth (2007): The Kyoto Protocol and beyond: The market potential of large-scale non-CO_2 CDM projects, T.M.C. Asser Press, The Hague

Michaelowa, Axel; Greiner, Sandra; Espelage, Aglaja; ,t Gilde, Lieke; Ahonen, Hanna-Mari; Dalfiume, Sandra; Krämer, Nicole; De Lorenzo, Federico; Censkowsky, Philipp; Hoch, Stephan (2021a): Promoting Article 6 readiness in NDCs and NDC implementation plans, Perspectives and Climate Focus, Freiburg and Amsterdam

Michaelowa, Axel; Michaelowa, Katharina, Hermwille, Lukas; Espelage, Aglaja (2021b): Towards net zero: Dynamic baselines for international market mechanisms; CIS Discussion Paper 107, Zurich

Ministerio de Medio Ambiente, y Medio Rural y Marino (2010): Resolution of the Designated National Authority approving guidelines that will rule the approval by the Designated National Authority of the voluntary participation of Spain in Joint Implementation projects aimed at reduction of N2O emissions in nitric acid plants in Spain, https://ji.unfccc.int/UserManagement/FileStorage/XFLZMOPB675WTYNE8VC1J4KS2HIAGD (accessed on August 06, 2021)

Müller, Adrian; Meier, Matthias; Horka, Patrick; Heeb, Florian (2014): Entwicklung eines Methodologies-Tools für CO_2-Zertifikate im Rahmen einer benchmarkbasierten N-Reduktion in der Schweizer Landwirtschaft: Schlussbericht zum Vorprojekt [Development of a Methodology Tool for CO2 Certificates in the Context of a Benchmark-Based N-Reduction in Swiss Agriculture: Final Report on the Preliminary Project], Forschungsinstitut für biologischen Landbau, Frick

OECD (2017): Best available techniques (BAT) for preventing and controlling industrial pollution, Activity 1: Policies on BAT or similar concepts across the world, Environment, Health and Safety, Environment Directorate, OECD, Paris

OECD (2018): Best Available Techniques (BAT) for Preventing and Controlling Industrial Pollution, Activity 2: Approaches to Establishing Best Available Techniques Around the World, Environment, Health and Safety, Environment Directorate, OECD, Paris

OECD (2020): Best Available Techniques (BAT) for Preventing and Controlling Industrial Pollution, Activity 4: Guidance Document on Determining BAT, BAT Associated Environmental Performance Levels and BAT-Based Permit Conditions, Environment, Health and Safety, Environment Directorate, OECD, Paris

OSPAR Convention (1992): Convention for the protection of the marine environment of the North-East Atlantic, OSPAR Commission, Paris

Panda Standard Association (2011): Panda standard sectoral specification for agriculture, forestry and other land-use (PS-AFOLU), https://winrock.org/wp-content/uploads/2016/03/PandaStandard_AFOLU_Sectoral_Specification.pdf (accessed on August 26, 2021)

Peters-Stanley, Molly (2011): China transacts first Panda standard VER, Ecosystem Marketplace, https://www.ecosystemmarketplace.com/articles/china-transacts-first-panda-standard-vers/ (accessed on August 26, 2021)

PMR (2017): A guide to greenhouse gas benchmarking for climate policy instruments, Technical note, https://newclimate.org/wp-content/uploads/2017/05/pmr-technicalnote-benchmark_web.pdf (accessed May 24, 2021)

Ranjan, Kaushik (2016): Emission trading in India: A study of two schemes, https://core.ac.uk/download/pdf/229611622.pdf (accessed on May 31, 2021)

Ruggiero, Agnese (2020): How the EU carbon market's lesser-known cousin could help drive industrial transformation, https://carbonmarketwatch.org/2020/04/29/how-the-eu-carbon-markets-lesser-known-cousin-could-help-drive-industrial-transformation/ (accessed on June 2, 2021).

Schneider, Lamber; Cames, Martin (2014): Options for Continuing GHG Abatement from CDM and JI Industrial Gas Projects, Öko-Institut e.V. Institute for Applied Ecology, Berlin

Schneider, Lambert (2011): Perverse incentives under the CDM: an evaluation of HFC-23 destruction projects, in: Climate Policy, 11, p. 851-864.

Schneider, Lambert; Broekhoff, Derik; Füssler, Jürg; Lazarus, Michael; Michaelowa, Axel; Spalding-Fecher, Randall (2012): Standardized baselines for the CDM – Are we on the right track?, https://carbonmarketwatch.org/wp-content/uploads/2012/11/Schneider-Broekhoff-Fuessler-Lazarus-Spalding-Fecher-2012-Standardized-Baselines-in-the-CDM-Are-we-on-The-Right-Track.pdf (accessed May 24, 2021)

Schneider, Lambert; Lazarus, Michael; Kollmuss, Anja (2010): Industrial N_2O projects under the CDM: Adipic Acid – a case of carbon leakage?, Stockholm Environment Institute, Working paper WP-US-1006

Secretariat of the Minamata Convention on Mercury (2017): Guidance on best available techniques and best environmental practices, Guidance document, Geneva

Shishlov, Igor; Bellassen, Valentin; Leguet, Benoît (2012): Joint Implementation: A frontier mechanism within the borders of an emissions cap, CDC climate report No 33

Spalding-Fecher, Randall; Kohli, Anik; Fuessler, Jürg; Broekhoff, Derik; Schneider, Lambert (2020): Practical strategies to avoid over-selling, Report, Carbon Limits AS, Oslo

Tikhonova, Irina; Guseva, Tatiana; Averochkin, Eugene; Shchelchkov (2021): Best Available Techniques and Best Environmental Management Practices: Collaboration between industries and regions, in: Procedia Environmental Science, Engineering and Management, 8, p. 495-505

UNCED (1992): Agenda 21, United Nations Conference on Environment & Development, https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf (accessed on June 2, 2021)

UNECE (2019): Comparing the best available techniques to reduce air pollution form industry, https://unece.org/environment/news/comparing-best-available-techniques-reduce-air-pollution-industry (accessed on May 31, 2021)

UNEP (2001): Appendix II: Stockholm Convention on persistent organic pollutants, Stockholm

UNEP (2019): Minamata Convention on Mercury: Text and annexes, Geneva

UNFCCC (2002a): Modalities and procedures for a clean development mechanism, as defined in article 12 of the Kyoto Protocol, Decision 17/CP.7. FCCC/CP/2001/13/Add.2, Bonn

UNFCCC (2002b): Guidelines for the implementation of Article 6 of the Kyoto Protocol, Decision 16/CP.7. FCCC/CP/2001/13/Add.2, Bonn

UNFCCC (2006): Guidelines for the implementation of Article 6 of the Kyoto Protocol, Decision 9/CMP.1, FCCC/KP/CMP/2005/8/Add.2, Bonn

UNFCCC (2016): Review of the joint implementation guidelines: Draft conclusions proposed by the Chair, FCCC/SBI/2016/L8, Annex, Bonn

UNFCCC (2017): Session 7: CDM projects baseline and additional, Standardized baselines development, https://unfccc.int/files/na/application/pdf/07a_overview_baseline_additionality_sbs.pdf (accessed on May 28, 2021)

UNFCCC (2019a): Draft text on matters relating to Article 6 of the Paris Agreement - Rules, modalities and procedures for the mechanism established by Article 6, paragraph 4, of the Paris Agreement. Version 1 of 13 December 11:45, UNFCCC COP 25, Madrid

UNFCCC (2019b): Draft text on matters relating to Article 6 of the Paris Agreement - Rules, modalities and procedures for the mechanism established by Article 6, paragraph 4, of the Paris Agreement, Version 2 of 14 December 9:00, UNFCCC COP 25, Madrid

Valderrama, César; Granados, Ricard; Cortina, Jose Luis; Gaosl, Carles M.; Guillem, Manel; Josa, Alejandro (2012): Implementation of best available techniques in cement manufacturing: a life-cycle assessment study, in: Journal of Cleaner Production, 25, p. 60-67

Verra (2010): VCS approves performance benchmark for calculating emission reductions from weatherisation of homes, https://verra.org/mainehousing_methodology_approved/ (accessed on May 25, 2021)

Verra (2012): Approved VCS Methodology VM0008: Version 1.1 Sectoral Scope 3, https://verra.org/wp-content/uploads/2017/10/VM0008v1.1.pdf (accessed on May 25, 2021)

Verra (2013a): Guidance for standardised methods, https://verra.org/wp-content/uploads/2018/03/VCS-Guidance-Standardized-Methods-v3.3_0.pdf (accessed on May 25, 2021)

Verra (2013b): VCS standardized methods: Scaling up GHG reductions, https://verra.org/wp-content/uploads/2016/05/FactSheet-STAMAS-2013-FINAL_0.pdf (accessed on May 25, 2021)

Verra (2020): Methodology for improve forest management. Version 1.0, https://verra.org/wp-content/uploads/2020/08/FFCP_Methodology_10Aug2020.pdf (accessed on May 25, 2021)

World Cement (2021): CEMEX to deploy hydrogen technology throughout its cement operations, https://www.worldcement.com/europe-cis/23022021/cemex-to-deploy-hydrogen-technology-throughout-its-cement-operations/ (accessed on June 1, 2021)

Worldsteel (2021a): Who we are, https://www.worldsteel.org/about-us/who-we-are.html (accessed on June 7, 2021)

Worldsteel (2021b): CO2 data collection, https://www.worldsteel.org/en/dam/jcr:9dd44705-6b4a-496e-8f8f-14cc1158752d/CO2_User_Guide_V10.pdf (accessed on June 7, 2021)

Annex A: Pollutants covered by the IED

List of polluting substances (European Parliament and Council 2010, Annex II)

AIR

1. Sulphur dioxide and other sulphur compounds
2. Oxides of nitrogen and other nitrogen compounds
3. Carbon monoxide
4. Volatile organic compounds
5. Metals and their compounds
6. Dust including fine particulate matter
7. Asbestos (suspended particulates, fibres)
8. Chlorine and its compounds
9. Fluorine and its compounds
10. Arsenic and its compounds
11. Cyanides
12. Substances and mixtures which have been proved to possess carcinogenic or mutagenic properties or properties which may affect reproduction via the air
13. Polychlorinated dibenzodioxins and polychlorinated dibenzofurans

WATER

1. Organohalogen compounds and substances which may form such compounds in the aquatic environment
2. Organophosphorus compounds
3. Organotin compounds
4. Substances and mixtures which have been proved to possess carcinogenic or mutagenic properties or properties which may affect reproduction in or via the aquatic environment
5. Persistent hydrocarbons and persistent and bio accumulable organic toxic substances
6. Cyanides
7. Metals and their compounds
8. Arsenic and its compounds
9. Biocides and plant protection products
10. Materials in suspension
11. Substances which contribute to eutrophication (in particular, nitrates and phosphates)
12. Substances which have an unfavourable influence on the oxygen balance (and can be measured using parameters such as BOD, COD, etc.)
13. Substances listed in Annex X to Directive 2000/60/E

Annex B: Draft Article 6.4 RMPs development at COP25

Table 6: Evolution of of negotiation text on methodologies

Draft CMA decision on the RMPs for the mechanism established by Article 6, paragraph 4, of the Paris Agreement, Version 1 of 13 Dec 11:45 hrs	Draft CMA decision on the RMPs for the mechanism established by Article 6, paragraph 4, of the Paris Agreement, Version 2 of 14 Dec 9:00 hrs
Option A 38. Each mechanism methodology shall require the application of one of the following approaches to setting a baseline [that is below 'business as usual',] for calculating emission reductions, taking into account relevant national, regional or local circumstances, and providing justification for the choice: (a) A performance-based approach, taking into account: (i) [Technologies that represent an economically feasible [and environmentally sound] course of action;] (ii) The emissions of activities providing similar outputs and/or services in similar social, economic, environmental and technological circumstances; (iii) Barriers to investment; (b) [An approach based on 'Business as usual' emissions;] (c) An approach based on historical emissions.	**Option A** 38. Each mechanism methodology shall require the application of one of the following approaches to setting a baseline that is below 'business as usual', for calculating emission reductions, taking into account relevant national, regional or local circumstances, and providing justification for the choice, while ensuring environmental integrity: (a) An approach taking into account **best available technologies** that represent an economically feasible and/or environmentally sound course of action; (b) Performance-based approach, where a baseline is based on the emissions of activities providing similar outputs and/or services in similar social, economic, environmental and technological circumstances; (c) The benchmark baseline approach, where a baseline is based on an ambitious benchmark representing a level of GHG emissions for activities within a defined scope and boundary; (d) Where the approach referred to in paragraphs 38(a)−(c) above is not considered to be economically and technologically viable, an approach based on: (i) Projected emissions; or (ii) Historical emissions.
Option B 39. Each mechanism methodology shall require the application of one of the following approaches to setting a baseline [that is below 'business as usual',] for calculating emission reductions, taking into account relevant national, regional or local circumstances, and providing justification for the choice [, while ensuring environmental integrity]: (a) An approach [base on] [taking into account] **best available technologies** that represent an economically feasible and/or environmentally sound course of action (b) Performance-based approach, where a baseline is based on the emissions of activities	**Option B** 41. Each mechanism methodology shall require the application of one of the following approaches to setting a baseline: (a) A performance based approach where the baseline is set at least at the average emission level of the best performing comparable activities providing similar outputs and services within a defined scope and boundary in the past three years and where the host Party may determine a more ambitious level at its discretion. (b) Where such an approach cannot be applied, an alternative approach can be proposed, with the approval from the host Party and a justification. The justification shall include information on how the application of the proposed baseline

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providing similar outputs and/or services in similar social, economic, environmental and technological circumstances; (c) [The benchmark baseline approach, where a baseline is based on an ambitious benchmark representing a level of GHG emissions for activities within a defined scope and boundary;] (d) [Where the approach referred to in paragraphs 39(a)−(c) above is not [considered to be] [[economically and] technologically viable] [feasible or appropriate], an approach based on: (i) [Projected emissions; or] (ii) Historical emissions.]	approach is consistent with paragraph 40 above. 42. Standardized and/or regional and/or subregional performance based-baselines may be developed by the Supervisory Body at the request of the host Party or may be developed by the host Party and approved by the Supervisory Body. Standardized baselines and/or regional and/or subregional performance based baselines shall be established at the highest applicable level of aggregation in the relevant sector of the host Party.
Option C 42. Each mechanism methodology shall require the application of one of the following approaches to setting a baseline: (a) A performance based approach where the baseline is set at least at the average emission level of the best performing comparable activities providing similar outputs and services within a defined scope and boundary in the past three years and where the host Party may determine a more ambitious level at its discretion. (b) Where the above approach cannot be applied, an alternative approach can be proposed, with approval from the host Party and a justification. The justification shall include information on how the application of the proposed baseline approach is consistent with paragraph 43 above. 43. Standardized and/or regional and/or subregional performance based-baselines may be developed by the Supervisory Body at the request of the host Party or may be developed by the host Party and approved by the Supervisory Body. Standardized baselines and/or regional and/or subregional performance based baselines shall be established at the highest applicable level of aggregation in the relevant sector of the host Party.	-
46. Standardized baselines [and regional and sub-regional **best available technologies** and/or performance benchmark] may be developed by the Supervisory Body at the request of the host Party, or may be developed by the host Party and approved by the Supervisory Body.	43. Standardized baselines may be developed by the Supervisory Body at the request of the host Party, or may be developed by the host Party and approved by the Supervisory Body. Standardized baselines shall be established at

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Standardized baselines shall be established at the highest possible level of aggregation in the relevant sector of the host Party.	the highest possible level of aggregation in the relevant sector of the host Party.

Source: UNFCCC 2019a; UNFCCC 2019b

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