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Accounting for baseline targets in NDCs: Issues and options for guidance

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Foreword

This document was prepared by the OECD and IEA Secretariats in response to a request from the Climate Change Expert Group (CCXG) on the United Nations Framework Convention on Climate Change (UNFCCC). The Climate Change Expert Group oversees development of analytical papers for the purpose of providing useful and timely input to the climate change negotiations. These papers may also be useful to national policy-makers and other decision-makers. Authors work with the CCXG to develop these papers. However, the papers do not necessarily represent the views of the OECD or the IEA, nor are they intended to prejudice the views of countries participating in the CCXG. Rather, they are Secretariat information papers intended to inform Member countries, as well as the UNFCCC audience.

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Abstract

Accounting for baseline targets in NDCs: Issues and options for guidance

Many Parties to the Paris Agreement have expressed greenhouse gas mitigation targets relative to a baseline scenario, or “baseline targets”. Baseline targets in nationally determined contributions (NDCs) could potentially change over time including to update assumptions of emission drivers or reflect improved methodologies. This paper examines issues that can arise under Articles 4 and 6 of the Agreement when baseline targets are updated, such as potential implications of using consistent methodologies throughout the NDC implementation period. The paper also examines transparency-related issues, e.g. information needed for accounting that would be reported and reviewed under Article 13 of the Agreement. Past baseline and reference scenario reporting experience highlights relevant lessons for accounting for baseline targets, including on transparent reporting of baseline scenarios. The paper identifies reporting and accounting guidance options, including when certain types of updates could be applied to baseline targets, that could help Parties address some of these issues.

JEL classification: F53, O44, Q54, Q56, Q58

Key words: accounting, mitigation, NDC, baseline targets, UNFCCC, guidance

Résumé

Comptabilisation des objectifs par rapport à un niveau de référence dans les CDN : problèmes et solutions possibles

De nombreuses Parties à l’Accord de Paris ont fixé leurs objectifs de réduction des gaz à effet de serre par rapport à un scénario de référence. Ces objectifs exprimés par rapport à un niveau de référence dans les contributions déterminées au niveau national (CDN) pourraient être modifiés dans le temps, y compris pour mettre à jour les hypothèses concernant les facteurs déterminants des émissions, ainsi que pour tenir compte de l’amélioration des méthodes. La présente étude examine les problèmes liés à la mise à jour des niveaux de référence, au titre des articles 4 et 6 de l’Accord, telles que maintenir la cohérence méthodologique pendant toute la période de mise en œuvre des CDN, et les implications de cette obligation. Cette étude examine aussi le lien avec les informations nécessaires à la comptabilisation, qui sont communiquées et soumises à un examen au titre de l’article 13 de l’Accord. L’expérience passée en matière de scénarios et de niveaux de référence permet de dégager des enseignements utiles pour comptabiliser les objectifs par rapport à un niveau de référence, y compris pour rendre compte des scénarios de référence de manière transparente. L’étude propose des options possible de communication et de comptabilisation pour aider les Parties à remédier à certains de ces problèmes, y compris les types d’actualisation à appliquer aux objectifs par rapport à un niveau de référence.

Classification JEL: F53, O44, Q54, Q56, Q58

Mots-clés : comptabilisation, atténuation, CDN, objectifs par rapport à un niveau de référence, CCNUCC, directives

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List of acronyms

AI	Annex I
APA	Ad Hoc Working Group on the Paris Agreement
BAU	Business-as-usual
BR	Biennial Report
BTR	Biennial Transparency Report
CAIT	Climate Access Indicators Tool
CCXG	Climate Change Expert Group
CO ₂	Carbon dioxide
CTU	Clarity, transparency and understanding
EU ETS	European Union Emissions Trading System
FMRL	Forest Management Reference Level
FREL	Forest Reference Emissions Level
FRL	Forest Reference Level
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GST	Global Stocktake
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
ITMO	Internationally Transferred Mitigation Outcome
kT	Kilotons
LULUCF	Land Use, Land-Use Change and Forestry
MRV	Monitoring, Reporting, Verification
Mt	Megatons
NAI	Non-Annex I
NC	National Communications
NDC	Nationally Determined Contributions
NM	No Measures or “without measures” scenario
QA/QC	Quality Assurance/Quality Control
REDD+	Reducing Emissions from Deforestation and forest Degradation
SBSTA	Subsidiary Body for Scientific and Technological Advice
TACCC	Transparency, Accuracy, Completeness, Comparability and Consistency
WAM	“With additional measures” scenario
WM	“With measures” scenario
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

A large proportion of Parties have communicated mitigation targets relative to an emissions baseline (“baseline targets”) in their nationally determined contributions (NDCs). Baseline targets express the mitigation contribution of a Party relative to a counterfactual baseline scenario (e.g. a business-as-usual scenario).

Accounting for NDC mitigation targets is required under the Paris Agreement (Article 4.13) and can assist Parties in understanding their own and others’ mitigation targets as well as individual and collective progress toward mitigation goals. There are specific elements involved in accounting for baseline targets: the information that is needed to clearly communicate baseline scenarios, and consideration of how to construct and update baseline scenarios in a manner that promotes environmental integrity, transparency, accuracy, completeness, comparability and consistency (TACCC), and avoids double counting, as specified in Article 4.13.

Accounting for baseline targets could benefit from a clear understanding of the baseline scenarios, as reported by Parties; the provision of information to provide clarity, transparency and understanding (CTU) of NDCs is mandated under Article 4.8 of the Agreement. A variety of informational choices feed into baseline setting, including the start date (i.e. the time period when the baseline starts); which policies are included in the baseline; key parameters affecting emissions estimates, i.e. drivers of emissions (e.g. fuel prices, GDP); methodologies used; assumptions and uncertainties.

Some Parties have indicated that the level of their emissions baseline may be updated over the NDC implementation period. Updates made to the emissions estimates of baseline scenarios can be categorised broadly into two categories: technical updates and fundamental changes. Technical updates could include updates to parameter values (e.g. revised estimates of GDP growth), and the use of the latest inventory guidelines. Fundamental changes include changes to the definition of the baseline (e.g. which policies included in the baseline), or the method of calculating the baseline (e.g. adopting a different methodological tool). Technical updates and fundamental changes could both potentially provide more accuracy in estimating implied baseline emissions.

Updating the baseline and target emissions value can, however, raise certain accounting issues, for example the possible implications for methodological consistency. Such updates could potentially also have implications for the overall mitigation effort undertaken by the Party. Greater transparency in reporting on the baseline scenario, baseline setting and updating could provide more clarity to facilitate accounting for the baseline target. Paragraph 31 of Decision 1/CP.21 requests the Ad Hoc Working Group on the Paris Agreement (APA) to elaborate accounting guidance that ensures Parties account with methodological consistency, including on baselines, between communication and implementation of NDCs. Technical updates during the NDC cycle may be easier to make consistent with this provision than fundamental changes. Clear accounting and reporting guidance under Article 4.13 (accounting for NDCs), 4.8 (CTU

of NDCs) and Article 13.7 (reporting on information to track progress in implementing and achieving NDCs) could assist Parties in accounting for baseline targets.

Annex I, as well as some non-Annex I, Parties have experience in reporting and accounting for projections and baseline scenarios under UNFCCC processes. The two processes examined in the paper are Annex I Party reporting on projections within National Communications (NC) and submission of Forestry Reference Emission Levels/Forestry Reference Levels (FRELs/FRLs) under the Reducing Emissions from Deforestation and forest Degradation (REDD+) programme. Lessons learned from such experiences that could be applied to NDC baseline targets include that:

- There is significant technical difficulty, as well as uncertainty in estimating counterfactual emissions.
- Guidance on what pieces of information to report could be helpful (e.g. key drivers, assumptions, implemented or planned policies, uncertainty analysis, and how any updates affect the baseline emissions). Such guidance could facilitate the understanding of Parties' baseline scenarios and targets. This guidance could be particularly useful for Parties with less reporting experience as related to baseline targets.
- Guidelines along with expert review recommendations on how to make step-wise improvements while maintaining methodological consistency could encourage Parties to adopt latest information or methodologies to enhance accuracy of emissions estimates.
- Access to results-based financing is a possible large motivation for Parties to improve monitoring, reporting and verification of FRELs/FRLs. The prospect of benefitting from Article 6 mechanisms could act as an analogous incentive for participating Parties to meet the associated requirements for robust reporting and accounting.

The participation in Article 6 co-operative approaches of Parties with baseline mitigation targets raises two potential challenges. Firstly, the potential sale of surpluses from NDC over-achievement could incentivise communication of inflated baselines, or updating of baselines to create a surplus. Secondly, the uncertainty in final target levels (in terms of the absolute number of tonnes) could raise the risk of Parties selling projected surpluses that later do not occur. If Parties choose to trade under Article 6, the use of internationally transferred mitigation outcomes (ITMOs) arising from mechanisms (e.g. emissions trading systems or crediting mechanisms) that have robust verifiable unit quality could be key in lowering such uncertainties.

This paper identifies three approaches for accounting-related guidance in line with issues and lessons outlined in the paper. The three approaches offer a range of level of details, and a trade-off between Parties using more detailed guidance versus providing more explanatory information to provide clarity on accounting for their NDC target. Approach 1 (least detailed) guidance is based purely on transparency. Approach 1 guidance could ask Parties to provide more explanations to allow for understanding the NDC and progress towards baseline target. Three examples of the options for guidance under the three Approaches are provided in Table 1 below.

Table 1. Options for guidance related to accounting for baseline targets

	Approach 1	Approach 2	Approach 3	Comments
Guidance on reporting of information to underpin accounting of baseline targets				
Information to be included that describes emission baselines	Guidance does not specify what information to ask Parties to demonstrate adherence to the TACCC principles and avoidance of double counting in describing the baseline, as mandated in Article 4.13.	Guidance identifies categories of information to be reported (e.g. key drivers, assumptions, modelling methodology, policy assumptions), in line with TACCC and avoidance of double counting, without detailing exactly which pieces of information are included within these categories. (see Table 2).	Guidance contains detailed list of specific elements of information to be reported in line with TACCC and avoidance of double counting. For example, a list of key driver and their data sources including GDP, population, fuel prices, electricity exports/imports, carbon prices (see Table 2), as well as more detailed information on policies included in scenarios, and modelling methodologies.	<p>These guidelines, though necessary to enable baseline accounting, could be addressed within the CTU and transparency framework discussions (if not through possible reporting under Article 4.13).</p> <p>Under Approach 1 guidance, Parties could interpret the information required for TACCC and avoidance of double counting.</p> <p>For any level of guidance, providing definitions on TACCC and avoidance of double counting, as related to baselines, could be useful to Parties.</p>
Guidance on the construction and updating of emission baselines				
Type of updates that could be applied, and when	Guidance could suggest to Parties to communicate when and on what basis they would apply updates within NDC implementation periods.	<p>Guidance could suggest to Parties that updates during the NDC implementation period be limited to the following:</p> <ul style="list-style-type: none"> - activity and inventory data - emissions factors - assumptions on key drivers etc. - technical corrections - voluntary increased coverage (fundamental change) <p>Other updates including fundamental changes such as policies included in the baseline could be made between NDC implementation periods.</p>	<p>Guidance could suggest limiting updating of baselines to only occur at communication/updating of NDCs (as part of five year cycle), and/or that the baseline should be fixed a certain time ahead of the target year.</p> <p>Detailed guidance could suggest a list of conditions (e.g. change in modelling framework, change in data estimates, updates in policies included in baselines) when revisions could be made.</p>	There could also be guidance on whether and how to update the target value of an NDC if baselines are updated (i.e. whether a Party chooses to maintain a percentage or absolute reduction as the target), keeping Articles 4.3 and 4.11 in mind.
Ensuring methodological consistency (methods and data sources) at different stages of the NDC	Guidelines could highlight the importance of being consistent with the original data and methodologies used to communicate the NDC.	Guidelines could include general definitions of consistency, as related to baselines, including a distinction between technical updates and fundamental changes. Parties could strive to apply this definition.	Guidelines could include detailed methodologies for various types of updating, spelling out in detail what is meant by methodological consistency in each case, and potentially restricting certain types of updates to between NDC cycles.	For any level of guidance, Parties could be encouraged to communicate whether methodologies, data or key assumptions have changed. In case Parties have used updated methodologies/data/assumptions, guidance could encourage Parties to explain why and to provide explanations on impacts of the changes.

Source: Authors

1. Introduction

As Parties consider how to implement the mitigation targets in their nationally determined contributions (NDCs), they will also need to consider how to account for progress and achievement of those targets,¹ as required by the Paris Agreement (Article 4.13). The Ad Hoc Working Group on the Paris Agreement (APA) has been charged with elaborating accounting guidance for Parties' NDCs to support Parties in this process (paragraph 31 of Decision 1/CP.21).

Accounting guidance could elaborate how to account for mitigation targets and assessment of progress towards these targets in line with Article 4.13. Article 4.13 calls for Parties to account for their NDCs with transparency, accuracy, completeness, comparability and consistency (TACCC), environmental integrity, and avoidance of double counting. Accounting of mitigation targets could assist Parties in understanding their own and others' progress and achievement. Simultaneously, guidelines on the clarity, transparency and understanding (CTU) of NDCs (paragraph 28 of Decision 1/CP.21 and Article 4.8), and reporting and review (under Article 13.7 and 13.11) could support the accounting process. CTU and reporting and review guidance could identify what information is important to report in the accounting process, which outputs from accounting calculations might be reported through the Article 13 "Biennial Transparency Reports" (BTRs), and how this information would be reviewed.

This paper focuses on outlining and elaborating the particular issues that could arise during the accounting of NDC mitigation targets that are referenced to a GHG emissions baseline ("baseline targets"), for example, targets expressed as a percentage reduction from business-as-usual (BAU) emissions. The paper also considers the information that may need to be reported through BTRs to enable accounting of this type of NDC target, or to provide transparency on how countries are accounting.

In this paper, Section 2 explains what baseline targets are, and discusses issues related to accounting for these targets. Section 3 looks into current experience in accounting and reporting related to emissions projections and baselines, including the experience of the forestry sector, to identify lessons learned. Section 4 addresses specific issues that may arise in accounting where Parties using BAU-referenced mitigation targets participate in co-operative approaches under Article 6 of the Paris Agreement. Section 5 identifies three approaches for guidance (e.g. guidance on what information Parties could report on baseline scenarios, how methodological consistency can be ensured), drawing on the previous sections. Worked examples, developed throughout the paper, illustrate the issues discussed.

¹ In this paper, references to Parties' targets are to their mitigation targets.

2. Issues related to the accounting of NDC targets that use baselines

Accounting– and related reporting – is needed to understand Parties’ progress toward and eventual achievement of NDC mitigation targets. There is a diversity of mitigation target types in NDCs (see Box 1). Accounting-related guidance may need to include specific elements that apply to the particular characteristics of these different target types.²

Box 1. Diversity of mitigation targets in NDCs

There is a range of different types of mitigation targets in NDCs. These include:

- fixed level reduction targets (e.g. Argentina, Ethiopia),
- reduction targets that reference a base year (in terms of absolute emission reductions (e.g. Brazil, Canada) and emissions intensity reductions (e.g. Chile, China)),
- targets expressed relative to business-as-usual (BAU) scenarios (e.g. Indonesia, Mexico),
- trajectory targets that express the trajectory of future GHG emissions, which can include a target for peaking of emissions. For example, South Africa’s target expresses that GHG emissions trajectory range includes a peak between 2020 and 2025, a plateauing of emissions for around a decade and a decline in absolute emissions thereafter.
- non-GHG targets e.g. renewable energy targets, energy efficiency or forestry targets or mitigation actions (e.g. Nepal, Egypt).

Some Parties have defined multiple mitigation-related targets within the same NDC (e.g. China has expressed an emissions intensity and trajectory target as well as non-GHG targets). Some Parties express a target in absolute emissions as well as a percentage reduction (e.g. a target value at 2030 expressed in ‘X’ tonnes or ‘Y’% reduction from business-as-usual emissions at 2030).

Some convergence in the type of NDCs may occur in the future, as called for by Article 4.4, which recommends Parties to shift “towards economy-wide emission reduction or limitation targets”. However, subsequent rounds of NDC submissions are likely to continue to include a diverse set of NDC targets (Hood and Soo, 2017_[1]).

² Previous CCXG work has examined accounting issues that are relevant to all mitigation target types (Hood and Soo, 2017_[1]).

2.1. Accounting for NDC mitigation targets in the Paris Agreement

Article 4.13 of the Paris Agreement states that

Parties shall account for their nationally determined contributions. In accounting for anthropogenic emissions and removals corresponding to their nationally determined contributions, Parties shall promote environmental integrity, transparency, accuracy, completeness, comparability and consistency, and ensure the avoidance of double counting, in accordance with guidance adopted by the Conference of the Parties serving as the meeting of the Parties to this Agreement.

Paragraph 31 of Decision 1/CP.21 requests the APA to elaborate accounting guidance which ensures that:

- Parties account for anthropogenic emissions and removals in accordance with IPCC methodologies and common metrics;
- Parties ensure methodological consistency, including on baselines, between the communication and implementation of NDCs;
- Parties strive to include all categories of anthropogenic emissions or removals and to continue to include categories that were previously included in NDCs;
- Parties provide explanations as to why anthropogenic emissions or removals have been excluded in NDCs.

The principal purpose of accounting is to enable Parties to understand their own and others' progress toward their respective NDC mitigation targets. The outputs of accounting could likely be reported under Article 13.7b (unless separate reporting is established associated with Article 4.13). These outputs can provide a more complete and accurate picture of collective progress, including for the purposes of the Global Stocktake (GST) (Hood, Briner and Rocha, 2014^[2]; Hood and Soo, 2017^[11]).

Accounting for the achievement of an NDC would occur only after the NDC target year/period. However, the accounting guidance could also be applied by the Party at two earlier stages. Guidance could be applied at the communication of NDCs, so that NDCs are expressed in a manner that allows for later accounting of progress toward and achievement of the target. Guidance could also be applied during the preparation of biennial transparency reports (BTRs), so that progress is tracked in the same manner that achievement will later be assessed. Other guidance on enhancing CTU of NDCs (Article 4.8 and paragraph 28 of Decision 1/CP.21) and modalities, procedures, guidelines under the transparency framework (Article 13.7) would also be applied at these stages, so that reported information facilitates accounting and allows for other Parties to understand the NDC. Clear guidance under both Articles 4 and 13 of the Paris Agreement could address the particular challenges faced with respect to the diverse range of mitigation target types at these different stages (Hood and Soo, 2017^[11]).

2.2. Baseline targets in NDCs

Baseline scenarios can be defined as a future projected reference level of emissions against which a goal can be established or progress can be measured (Clapp and Prag, 2012^[4]). Baseline scenarios can be provided for information only ("information baselines"), to demonstrate emissions that would have occurred in the absence of certain mitigation policies (WRI, 2014^[3]). Information baselines can be relevant to any mitigation target type. Baselines can also be used as a reference to set a target ("target baselines"); this paper will focus on baseline targets as communicated within Parties'

NDCs. A large proportion of Parties – around 41% or 80 out of 197 Parties – have expressed (I)NDC targets in relation to baseline scenarios (WRI, 2015_[4]).³ Examples of Parties that express baseline targets in their NDC include Mexico (unconditionally reduce 25% of its GHGs and short-lived climate pollutants emissions below BAU for 2030), Indonesia (unconditionally reduce 29% of GHGs against BAU by 2030) and South Korea (reduce GHG emissions by 37% below BAU scenario by 2030, also expressed as an equivalent of 850.6 MtCO₂eq.).⁴

Baseline targets express a Party’s mitigation response relative to a counterfactual baseline scenario, under which certain emission reductions and associated policies (that could have a direct or indirect effect on emissions) do not take place. Accounting for baseline targets thus depends on a clear understanding of the baseline scenario. Greater clarity, transparency and understanding of a baseline and thus, the baseline target, could facilitate greater understanding of the NDC, and of progress towards and achievement of the mitigation target. Baselines could be static or dynamic. Static baselines are fixed in advance of the time period they cover and can provide some certainty to those making policy or investment decisions over the chosen time period. Dynamic baselines can include recalculations based on updated activity data,⁵ or changes in other drivers (fuel, technology costs) that take place within the chosen time period. Table 2 summarises the information that is needed to construct and clearly communicate the baseline scenario and baseline target, for both static and dynamic baselines.

³ The Climate Access Indicators Tool (CAIT) database has taken into account the target types included in NDCs of Parties for those who have submitted one (WRI, 2015_[4]). For example, the database records the fixed level reduction target of Argentina’s NDC, which it has changed from the baseline target in its INDC. Also, some Parties have expressed their primary targets to imply other target types. The database makes note of this but only counts the primary target. Where Parties express multiple distinct targets, the database counts all.

⁴ The majority of Parties refer to their baselines as business-as-usual scenarios; a few others refer to a general baseline scenario. For example Albania’s target is “to reduce CO₂ emissions compared to the baseline scenario in the period of 2016 and 2030 by 11.5%” or an equivalent of 708 kT CO₂ emission reduction in 2030.

⁵ Activity data is defined as data on different human activities that result in emissions or removals over a period of time.

Table 2. Information needed to clearly communicate a baseline target

Categories of information	Comments
Static or dynamic baseline choice	Explanation of why static baseline was chosen or explanation of how often, when, and on what basis the dynamic baseline will be updated during the NDC commitment period
If dynamic baseline is chosen, explanations on circumstances under which baselines will be recalculated.	Parties could communicate their views on what constitutes a technical update of a baseline. Parties could specify threshold values (e.g. in changes to parameter values) that would be considered as significant enough to revise a baseline (WRI, 2014 ^[3]). Parties using a static baseline could potentially also identify some limited cases for updating e.g. errors in calculations or improvements in inventory methodologies.
Start year or period	Start year or period of the baseline scenario can be relevant in terms of what policies (mitigation or otherwise) are included in the baseline.
Emissions drivers, their values and assumptions and data sources	Parties could communicate the key drivers that affect their calculation of baseline emissions of different sectors and gases, including drivers of economic activity (GDP, sectoral composition), structural changes in economic sectors, energy prices, supply and demand of fuel type, land-use practices, and technology development. For key drivers, the data sources could also be communicated. Information on assumptions could address how changes in the driver are likely to be reflected in changes to the baseline scenario in the given time frame. Projections associated with the drivers could be compared with international data sources and projections to test robustness in the cases where the national data sources are equally or less reliable than international ones.
Policies and actions (planned and implemented) to include in the baseline	This information could include a list of policies that are included within the baseline, policies that have or are likely to have a significant effect of emissions (whether they reduce or increase emissions), status of policies (implemented, adopted or planned), impact of policies as well as how these impacts are estimated, duration of policies and if any significant policies have been excluded from baseline scenario along with appropriate justification.
Methodologies ⁶ , latest available data, emissions factors	This could include information on modelling analyses and tools, data sources and explanation of whether most appropriate methodologies and latest data were used as well as a justification for when latest methodologies and data were not used.
Uncertainty analysis	Parties could highlight inherent uncertainties in baselines by identifying the possible uncertainties and how they could impact baselines. Parties could include sensitivity analysis which demonstrates the effect of changes in parameter values. Some Annex I Parties have included alternative scenarios for a range of parameters set at different values in their National Communications reporting on projections (see Table 7 in Annex).
Implied emissions in a baseline scenario in NDC target year	Understanding the implied emissions under a baseline scenario for the NDC target year could provide clarity to Parties and reviewers, particularly to verify if potential updates made to the baseline scenario and target enhance or maintain the level of ambition, as called for in Article 4.11.

Source: Authors, based on (DEA, OECD, 2013^[5]).

⁶ Many Parties with baseline targets in their NDCs have not provided a description of BAU methodology in their NDC (Herold, 2018^[19]).

Dynamic baselines could involve recalculations of factors subject to frequent, unforeseen and/or significant fluctuations (see Worked Example 1). For a Party, there are certain pros and cons to updating its baseline target which are summarised in Table 3 below.

Table 3. Pros and cons of updating baseline targets

	Updating baseline targets (Dynamic baseline targets)	Keeping baseline targets constant (Static baseline targets)
Pros	<p>Updates could facilitate greater accuracy in defining the target as information changes over time.</p> <p>Updates could be made to preserve the original ambition of the target if revised BAU levels are lower than the original forecast.</p>	<p>A fixed target could provide more certainty for policymakers and non-State actors.</p> <p>A fixed target could be easier to track progress against.</p>
Cons	<p>Updating could raise questions on a Party's level of ambition; some consideration may be needed for how Parties could demonstrate and/or reviewers could verify that updates made maintain ambition (or at least, do not lower ambition).</p> <p>Changes in the baseline target could generate policy uncertainty as the measures needed to meet the updated target may have to be adapted.</p>	<p>A fixed target could be significantly inaccurate if expectations of BAU change substantially.</p> <p>If a fixed baseline and target are not reflecting the best understanding of emissions, there is a risk that domestic policies could be outdated or misaligned.</p> <p>Having to maintain a fixed target could incentivise an overestimation of baseline scenario emissions.</p>

Note: Static baseline targets could allow for updates that make technical corrections.

Source: Authors, based on (Feng, 2018_[6])

Emissions estimates under a baseline scenario can change due to two main reasons: technical updates or fundamental changes to the baseline definition and/or calculation.

- **Technical updates** could include updating the values of key parameters (e.g. fuel prices) used in the baseline calculation, errors being rectified and updating baselines to reflect continuous improvement in emissions inventories (e.g. to apply the latest IPCC guidelines), emissions factors and data sources. Technical updates to baselines could allow Parties to demonstrate improved technical capacities and can improve the accuracy of estimates.
- **Fundamental changes** relate to changes in the definition of the baseline itself, or its method of calculation. For example, this could be to change the set of policies that are included in the baseline scenario (e.g. to change the start-year for inclusion of policies, to reflected an updated state of progress). Another example could be to replace the modelling framework used with a more sophisticated one to improve accuracy in emissions estimates. Voluntary increases in coverage could also be seen as a fundamental change.

It could be less clear whether certain updates would be considered technical updates or fundamental changes. For example, if the estimated emission reductions arising from a policy included in the baseline scenario change, perhaps because the policy has been more or less successful than anticipated, a Party could argue that this is an update of a data input, or it could be considered a change to the assumptions of the baseline (a fundamental change). Technical updates and fundamental changes potentially have different implications for methodological consistency during the NDC period. Thus, these two categories of updates could be treated differently in terms of whether updates can be made during implementation of the NDC, or only at the communication of the subsequent NDC. These implications will be explored further in Section 2.4.

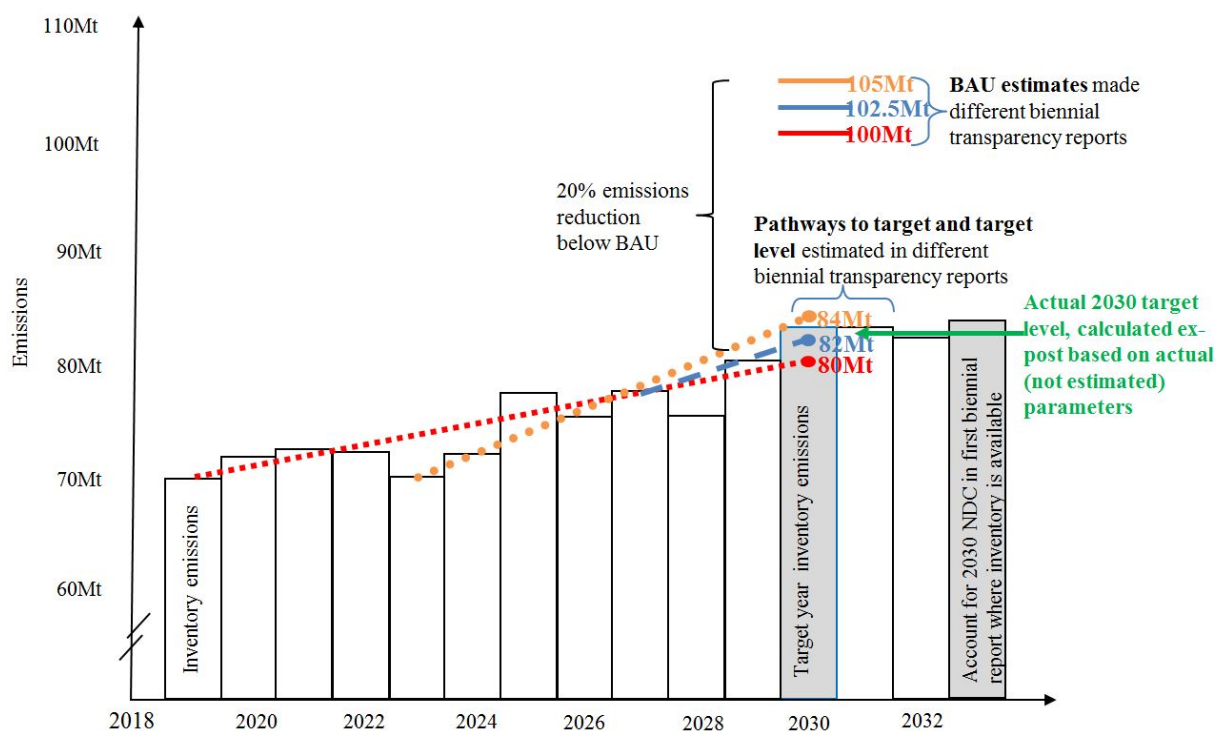
2.3. Worked Example 1: Revising estimates of key drivers of emissions

A Party (referred to as Party A) communicates an NDC mitigation target of 20% below BAU emissions in 2030 for its energy sector. The target is clarified in 2019 (as part of the process of communication of NDCs) with the following information:

- Party A has chosen a dynamic baseline.
- Circumstances for updates to dynamic baseline: The Party communicated that it reserves the right to update its target level if it has improved data i.e. if there are significant changes in major inputs to its BAU calculation or if improved inventory methodologies significantly affect projected BAU emissions. The Party reserves the right to make a final update to the baseline target after the target year to reflect actual (rather than projected) target-year data parameters, if this has a significant impact on the calculation of the BAU counterfactual for the target year.
- Start year: 2015
- Emissions drivers, assumptions: The Party communicated that the data inputs that are the main drivers of emissions in its BAU scenario are the relative costs of energy technologies (i.e. fossil fuel prices, technology costs), and the rate of energy demand growth (which is in turn connected to the rate of GDP and population growth). The Party also communicated the data sources that will be used for these inputs. The Party communicated that if it sees unexpected changes in these parameters that have a major impact on the BAU emission calculations, it could choose to update its target level.
- Policies and actions: The BAU scenario will exclude policies implemented since 2015 to support clean energy or reduce energy demand growth, i.e. policies put in place in response to the Paris Agreement are not considered “business as usual”.
- Methodologies, data sources: The calculation of BAU uses a simple scenario-based model, based on energy sector developments that are anticipated to meet energy demand growth. Quantifications of emissions will, at least initially, use 1996 IPCC inventory guidelines and 2nd IPCC assessment report global warming potentials (GWP).

The Party communicates an initial estimate of BAU emissions for 2030 at 100Mt of CO₂-eq, so its initial estimated target level for 2030 is 80Mt. The Party updates its estimates of the key drivers (e.g. GDP) across the period in certain BTRs, with a corresponding recalculation of the expected BAU emissions and target level for the target year, if there have been significant changes. The Party calculates its final estimate of target year BAU emissions after the target year, using actual numbers instead of estimates (Figure 1). The Party then uses this final calculation of BAU to fix its final target level.

Figure 1. Worked Example 1: Updating key information inputs that underpin BAU calculation can change the resulting BAU and target estimate made in different reports



Source: Authors

In RED, Figure 1 shows the calculated BAU level (horizontal bar, 100Mt), target level (dot, 80Mt), and pathway to target (square dotted line) estimated in 2019, ahead of implementation. The Party foresees that it can meet its target while having a gradual increase in emissions from 70Mt in 2019 to 80Mt in 2030.⁷

Shown in ORANGE are the revisions that the Party makes to its BAU calculation (horizontal bar, 105Mt), pathway (round dotted line) and projected target level (dot, 102Mt) as part of its 2023 BTR. In the period to 2023, Party A has seen GDP demand grow more strongly than originally anticipated, so its BAU calculation now projects higher baseline emissions in 2030. This projection uses the same methodology as was used in 2019, but updated numbers for the key drivers. Party A now anticipates that it can have a steeper increase in emissions while still meeting its (revised) target level.

Shown in BLUE (pathway is dashed line) is the result of a further revision made during the 2027 BTR. Strong economic growth in the early 2020s eased off. This has the effect of scaling back the calculated BAU emissions (horizontal bar, 102.5Mt) and target (82Mt). This means that a slower rise in inventory emissions would be needed to stay within the target level compared to the previous (orange) scenario.

⁷ The Party would not actually know its 2019 inventory emissions at this point: emissions inventories would not be available before two years. The expected trajectory to the target is shown from the 2019 inventory emissions level for simplicity.

The GREEN arrow shows the actual target level that the Party calculates ex-post, once actual data for the key data inputs to the BAU calculation are known (82.5Mt): this is calculated using the original modelling methodology, but with updated numbers for key drivers reflecting the actual (rather than forecast) numbers across the implementation period and in the target year. Accounting – comparison of emissions to the target level – would occur in the first BTR where target year inventory emissions are available (i.e. at least two years after the target year). In this example, the Party narrowly misses its target (emissions at 83Mt exceed the target by 0.5Mt).

This example illustrates that while updating the BAU target and trajectory allows the Party to take account of unforeseen circumstances, it also can result in significant uncertainty during implementation for the Party (as the emissions target, and the pathway to the target level can change) as well collectively (as the final target level, and hence contribution to collective mitigation goals, is uncertain). If the baseline were static (i.e. fixed ex ante), then there would be less ability for the target to respond to changing circumstances, but greater certainty for both the Party and for collective emission levels as the target levels would be fixed and known ex ante.

2.4. Issues arising during accounting for baseline targets

The cycle of communicating, reporting, and accounting of baseline targets includes supplementary steps, relative to those for quantified greenhouse gas targets. Table 4 below identifies these supplementary steps, which relate to estimating and updating the baseline and target levels.

Table 4. Possible processes informed by accounting guidance at different stages of the NDC cycle

	Communication of NDC	Implementation of NDC	Achievement of NDC
Processes involved (for all target types quantified in terms of GHG levels)	<ul style="list-style-type: none"> Formulating NDC (e.g. choice of metrics, LULUCF and ITMOs accounting). Communicating information to underpin accounting (e.g. timeframes, coverage, methodologies e.g. GWPs used).⁸ Calculating emission projections for the target year/period.⁹ 	<ul style="list-style-type: none"> Calculating of current accounting balance / tracking balance as a snapshot of progress. Calculating of projections for the target year/period. 	<ul style="list-style-type: none"> Calculating accounting balance, and compare with the NDC target level. Calculating final NDC achievement after true-up if ITMO transfers are used (for both transferring and acquiring Parties).
Processes involved (supplementary for baseline targets)	<ul style="list-style-type: none"> Calculating estimate of baseline scenario, including explanation on data used, methodology and assumptions for calculating baselines. Indicating process for revising the target, if at all, and as it relates to baseline scenario calculations. 	<ul style="list-style-type: none"> If necessary to update baseline, ensuring consistency in methodology and data sources used. 	<ul style="list-style-type: none"> Calculating final NDC target level, ensuring consistency in methodology and data sources used.

Source: Authors, based on (Hood and Soo, 2017^[1])

⁸ Briner and Moarif (2016) provide more details on the information that should be communicated at each stage in the NDC cycle.

⁹ Irrespective of the type of mitigation target in their NDC, some Parties include projections in NDCs to show the effect of mitigation policies and demonstrate the ambition of their NDC.

As highlighted in Table 4, accounting of baseline targets can involve recalculating or revising baseline within the NDC implementation period. Certain key issues thus arise while accounting for baseline targets and are discussed below.

Strong transparency is needed on the communication and updating of baseline targets to explain choices made by Parties. Parties could make choices related to drivers and other factors involved in baseline calculations that take into account political or technical considerations. For example, a Party could choose optimistic economic growth assumptions to fit with a political narrative or mandate. A technical consideration affecting the nature of a baseline could be to choose a start year based on the availability of data or latest inventory. Such choices that affect baseline scenarios can also lead to perverse incentives. For example, a Party could have an incentive to update its baseline if this works in its favour (i.e. makes the target easier to achieve) or leave it fixed otherwise. Overall, this could lead to an erosion of ambition. Communicating how a baseline has been established, why and how revisions have been or may be made and how this has impacted the baseline and target values can provide more credibility in the accounting for baseline targets. Specification ex ante of when and how any baseline revisions will be made could address this concern. Some updates could be less useful to apply to baseline targets within an NDC implementation period if they do not have a significant impact on BAU calculations. On the other hand, some Parties may decide to apply certain updates anyway to keep the NDC aligned with national policymaking e.g. updating the solar photovoltaic costs. It could be helpful for Parties to discuss in the communication of their NDC how they plan to address certain possible developments e.g. in technology.

A trade-off between using a consistent methodology and using the latest methodologies over the NDC target period could be a disincentive to undertake baseline revisions. Improvements in GHG inventory methodologies can facilitate greater accuracy in baseline estimations. For example, in 2019 the IPCC will release its latest GHG inventory methodology guidance. This is likely to change the levels calculated for a given emissions inventory. Thus, Parties could choose whether to update their baseline calculations in accordance with the latest inventory data (see Worked Example 2 below). At the same time, Parties are also asked to strive for methodological consistency, including on baselines throughout the NDC implementation period (paragraph 31, Decision 1/CP.21). Methodological consistency (1/CP.21 para 31 (b)) implies using the same methods and data sources to calculate ex ante estimates and the final target levels (Hood and Soo, 2016), which could be calculated using ex post data (i.e. the actual GDP, population data). Specifically, consistency means that if improved inventory methodologies or data values are updated, the previous estimates need to be updated using the new methods and data. As such, to facilitate continuous improvement in inventory reporting, the accounting guidance relating to methodological consistency may need to distinguish between “technical updates” (e.g. moving to more recent IPCC inventory methodologies) and fundamental changes such as adopting new modelling tools (see Section 2.2 and Worked Example 3). Guidelines could also enable transparency, accuracy, completeness, comparability and consistency as related to baselines by providing definitions or highlighting preferred practices.

There can be **uncertainty related to measuring progress** against a given target, if the target is expressed in multiple different ways or can be revised. Some baseline NDC targets express an absolute target level and an equivalent percentage reduction. If a revised baseline implies a different percentage reduction than the original absolute target level, it is unclear which should be considered the primary target. Reporting guidelines (Article 4 and Article 13) could suggest to Parties to clarify which expression of the target

should be used for accounting of their NDCs. Specification of a principal target could also be useful in the cases where Parties communicate multiple targets of different types (e.g. China's NDC contains an emissions intensity and trajectory target). Furthermore, Parties may have different perspectives on whether their NDC target should be revised at all. Updating a target level along with updating the baseline could better capture the Party's original and intended level of effort. However, keeping the NDC level fixed could provide certainty (e.g. policy, investment) to stakeholders making decisions on this basis.

Some of these aforementioned issues and others have been explored and captured in the form of questions in Table 5. Some questions could help identify issues that could be addressed via accounting, reporting or other guidance (e.g. what minimum baselines-related information could Parties report). Other questions could be useful for Parties to address at the national level (e.g. when does a revised baseline and target count as a new NDC).

Table 5. Possible accounting-related issues at different stages of the NDC cycle

Communication	Implementation	Achievement
<p>Calculation of baselines:</p> <ul style="list-style-type: none"> Which modelling methodologies have been used for calculating baselines? Which existing and planned policies are included in baselines? What efforts should be taken to reduce uncertainty in estimates? How/whether to incorporate high degree of uncertainty in estimating emissions, or with lack of data? What incentives are there for Parties to adopt stringent/ambitious baselines? How can TACCC principles be defined as related to baselines? What are the challenges in elaborating the key drivers of emissions and their impacts? <p>Updating baselines:</p> <ul style="list-style-type: none"> Should a cycle for updates be selected? Which assumptions and parameters should be updated? <p>Communication of baselines:</p> <ul style="list-style-type: none"> What is the minimum information that should be provided by Parties in their NDCs to facilitate clarity? Could Parties communicate intended and possible technical updates and fundamental changes to baselines in NDCs? Could Parties define significant threshold values (e.g. changes in key parameter values) to determine when a baseline would be revised? <p>Communication of NDC:</p> <ul style="list-style-type: none"> In the case of multiple targets identified in an NDC, which would be the principal target that Parties' progress would be measured against? If a revised baseline implies an absolute target value or reduction that is no longer equivalent to the percentage reduction expressed originally, which target would the Parties' progress be measured against? 	<p>Updating baselines:</p> <ul style="list-style-type: none"> Under what circumstances could technical updates of baselines be made? When and how should the target value be changed as a consequence of updated modelling methodologies? When might a revised baseline count as a potentially new NDC, if at all? Would this require political approval? If a baseline is revised, what considerations should be met to ensure equal or higher ambition of the NDC? If mitigation actions assumed in the baseline are not implemented, how would this affect updating? How can the impact of changes in the broad policy context (e.g. changes in economic structure) be considered within a revised baseline, if at all? 	<p>Updating final baseline:</p> <ul style="list-style-type: none"> Should the baseline be fixed at some point before the target year, or updated all the way up to the target year with actual parameters? Should the principal target's value (in tonnes or % below BAU) always be kept constant to provide short-, medium-term certainty?

Source: Authors

The questions summarised in Table 5 can be broadly categorised into three key issues as related to accounting for baseline targets:

1. what information related to baselines can be communicated for greater transparency,
2. how can baselines be constructed robustly, and
3. when and how could updates to baselines be made and what impact does this have on target values.

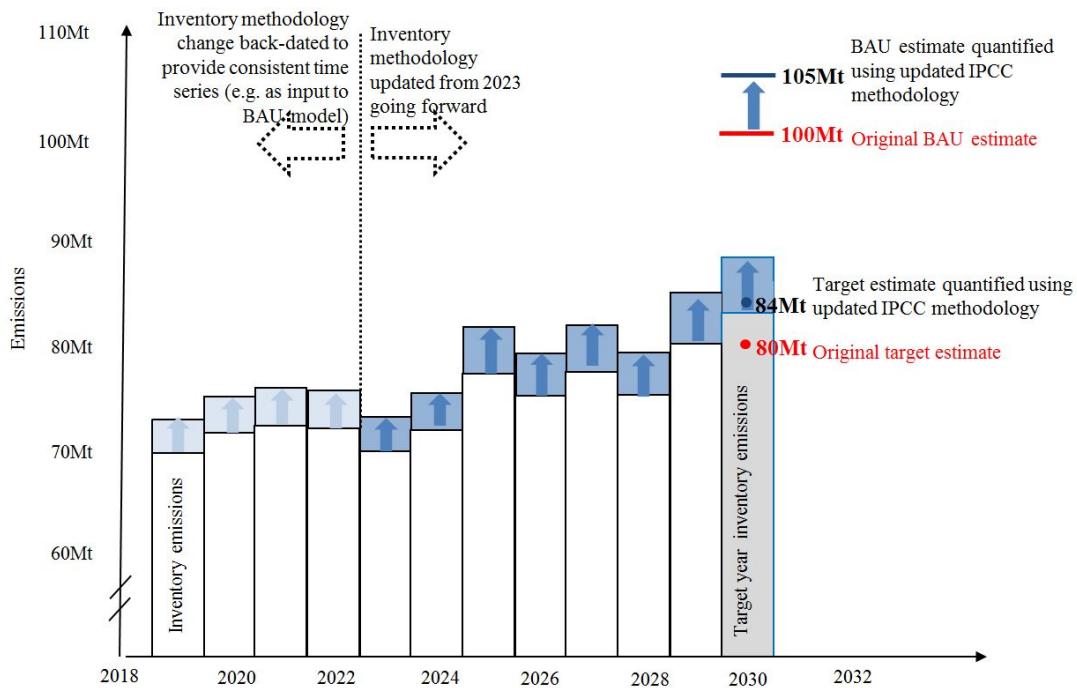
These three categories can be seen as the key areas where guidance could be provided to facilitate a clear, accurate and transparent accounting process for baseline targets.

2.5. Worked Example 2 - Technical update of inventory methodologies

In this example, the same Party that was considered in Worked Example 1 (i.e. same BAU reference scenario, target, inventory emissions etc.) benefits from capacity building to be in a position to move to the latest IPCC methodologies and global warming potentials starting from its 2023 BTR (Figure 2). The Party's energy sector emissions include a sizeable share of methane, so given the higher global warming potential for

methane in newer IPCC reports, the apparent level of energy sector emissions reported in the inventory is increased by around 5% in CO₂-eq terms (blue/upward arrows).

Figure 2. Worked Example 2: Technical update of inventory methodologies



Source: Authors

The change to inventory methodology could also flow through into calculation of the target: historical emissions (which would be an input to the BAU and target calculations), projections, and future emissions inventories could adopt the adjusted methodology. In this example, the revision leads to an apparent increase in BAU emissions to 105Mt and target level to 84Mt. It should be emphasised however that this does not result in an actual emissions increase – it is purely a result of applying the updated measurement methodology to the same emissions. For methodological consistency, it is important to provide updated base year (time series) data in the new methodology, so that comparisons can be made on a like-for-like basis between base year and target year emissions.

If the target level were fixed at the start of the period, and was not updated in conjunction with the inventory update, the target would remain 80Mt even though the apparent inventory emissions had increased due to the change in methodology. In the case of the example shown here, the Party could be disadvantaged by having a fixed target that is not updated at the same time as the inventory (i.e. it is more difficult to meet the target, as inventory emissions move further away from the fixed 80Mt target). However if the inventory update had resulted in a downward revision in inventory emissions then a fixed NDC target would be easier for the Party to achieve.

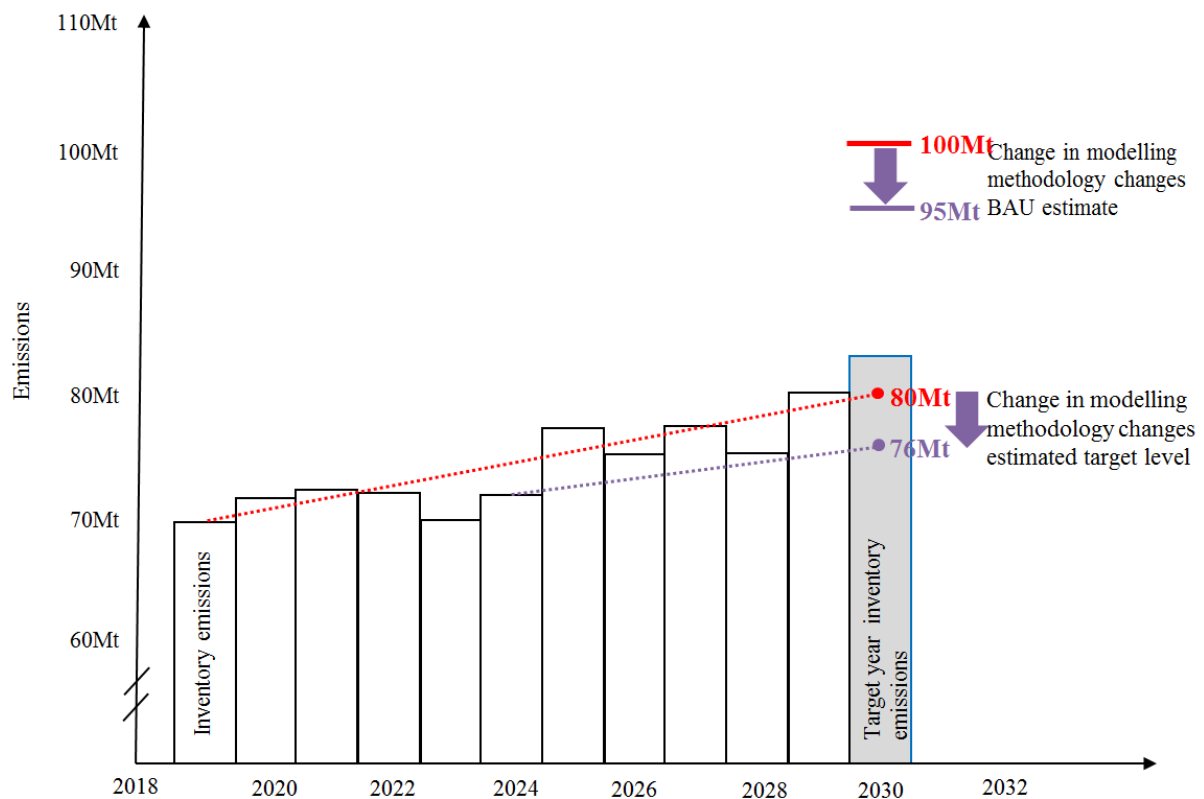
2.6. Worked Example 3 – Improvements to modelling frameworks

The third and final possibility explored for a revision of the BAU baseline, and hence the target level, is as a result of improved modelling capacity i.e. a fundamental change. A

number of Parties have developed their initial NDC BAU target levels using relatively simple scenario tools (e.g. the LEAP model), and with capacity building could move to more sophisticated planning tools that enable optimisation of investments for least-cost pathways. A shift to improved modelling frameworks would be valuable for national planning. If this shift results in significantly different BAU calculations, the Party may want to also update its NDC baseline and target level to reflect the improved modelling capacity. Incorporating improved modelling capacity could be seen as analogous to the step-wise improvement approach encouraged through FREL/FRL guidelines for the forestry sector (see Section 3.2 below). However, Article 1/CP.21 paragraph 31(b) states that guidance should ensure that “Parties ensure methodological consistency, including on baselines, between the communication and implementation of nationally determined contributions”, implying that the same modelling methodology should be used for communication and accounting of the NDC, and that any updates to modelling tools should occur between subsequent NDCs. One motivation for such explicit guidance on methodological consistency is to avoid Parties whose emissions may be trending above target levels in the final years of an NDC to make a last-minute change to their model before the NDC achievement is assessed, and “cherry-pick” a modelling methodology that gives a higher BAU and hence an easier target. The adoption of improved modelling methodology thus can affect the level of effort or ambition that the target represents.

In the third worked example (Figure 3), the switch to an improved modelling methodology would therefore only flow through into potential changes to the NDC baseline and target at the point of updating an NDC, which can occur as part of the five-year cycle. In this example, the Party updates (re-communicates) its 2030 NDC in 2024 to keep the same 20% reduction on BAU, but with a revised BAU estimate resulting from its now more advanced model that, in this case, calculates lower 2030 BAU emissions (and hence a lower target level).

Figure 3. Worked Example 3: Updating due to improved modelling frameworks



Source: Authors

3. Lessons learned from existing reporting related to baselines

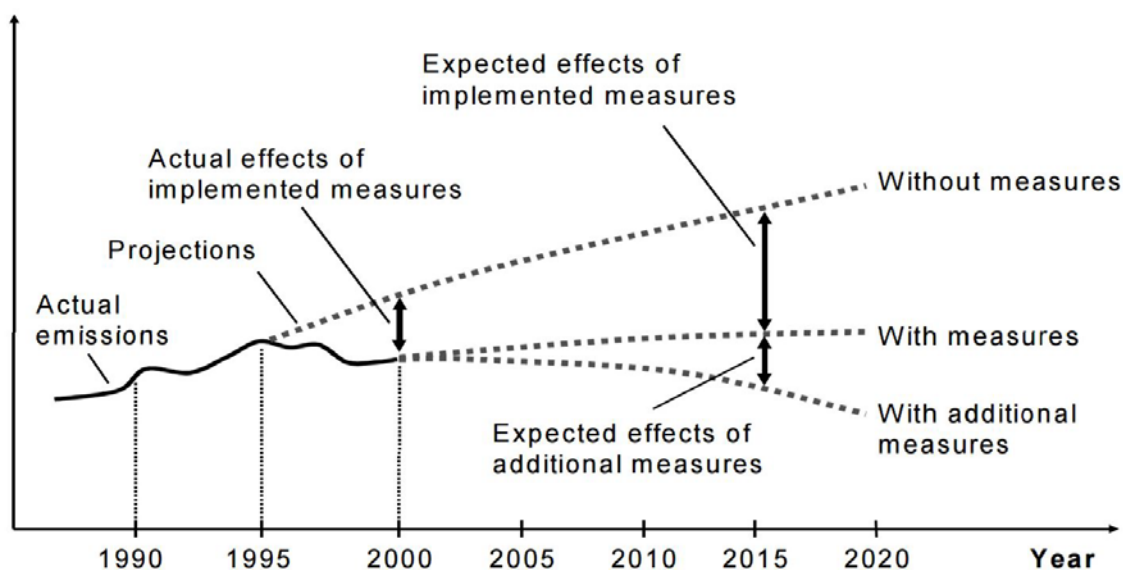
There has not been any explicit guidance on accounting for baseline mitigation targets under the UNFCCC to date. However baselines or projections have featured in a number of UNFCCC processes, and lessons could be drawn from these. Some of these UNFCCC processes include reporting under National Communications (NCs) and Biennial Reports and the Reducing Emissions from Deforestation and forest Degradation (REDD+) programme. The Kyoto Protocol’s Forest Management Reference Level (FMRL) system also offers relevant lessons learned but has not been explored in this paper.

3.1. Lessons learned from NC reporting

Although Annex I (AI) Parties do not have BAU targets, they report on emissions projections and in some cases baseline scenarios in their National Communications and Biennial Reports. AI Parties are required to report projections for “with measures” (WM) scenario and can voluntarily report projections for “with additional measures” (WAM) and “without measures” (or “no measures”, abbreviated as NM) scenarios (see Figure 4

below). According to the NC guidelines, projections for “with measures” scenarios include currently implemented and adopted policies and/or measures. Projections for “with additional measures” scenario include planned policies. “Without measures” scenarios exclude all policies and/or measures implemented, adopted or planned after a certain start year. According to the NC guidelines, Parties could refer to their NM scenario as a baseline scenario and are encouraged to explain the nature of these projections.

Figure 4. Projections under different scenarios included in Annex I National Communications



Source: (UNFCCC, 1999_[7])

Some Parties have pointed to the technical difficulty of building counterfactual projections for the NM scenarios. Lessons learned on NM scenarios – including that some Annex I Parties have found them difficult to construct in a meaningful manner – could be instructive, as some Parties have chosen to construct their NDC BAU baseline targets in this manner – with a start year that excludes subsequent mitigation policies from the baseline. Thus, accounting for these Parties’ baseline targets would include estimating the impacts on emissions as if the already-implemented policies were not in place.

Non-Annex I (NAI) Parties are not currently required to report on projections within NAI National Communications or Biennial Update Report guidelines. NAI Parties may thus need capacity building to be able to develop and report baseline scenarios and emissions projections. Nevertheless, a few NAI Parties (e.g. Indonesia) included projections for key sectors in their latest NC submissions.

Some elements drawn from existing guidelines on AI NCs as related to projections could provide be useful to inform future guidelines on reporting and accounting for baseline targets for both developed and developing country Parties. Key elements have been highlighted below (UNFCCC, 1999_[7]).

- The AI NC guidelines suggest that the start year for projections should be the latest year of available inventory data.

- Parties are encouraged to include projections on a quantitative basis for specific years (for example, the 1999 guidelines suggested the years 2005, 2010, 2015 and 2020). The objective was to facilitate modifying longer-term trends in emissions and removals.
- Guidelines suggest for Parties to use any models and/or approaches that suit their needs. Guidelines however specify that sufficient information should be reported in the NC to allow for a basic understanding of such models and/or approaches. To achieve this, guidelines provide a list of information related to methodologies, which includes:
 - type and characteristics of model;
 - the original purpose of the model and how it has been modified to fit climate change purposes;
 - strengths and weaknesses of model
 - whether models account for overlap or synergies existing between policies and measures.
- Parties should report the main differences in the assumptions, methods employed, and results between projections in the current and earlier National Communications.
- Parties should report on the sensitivity of projections to the assumptions identified on a qualitative and where possible quantitative basis. Some Parties identify alternative scenarios depending on how and low levels of assumptions (e.g. fuel prices). However, the guidelines also recommend Parties to limit the number of such scenarios presented.
- To encourage transparency, Parties should report information about key underlying assumptions and values of variables such as GDP growth, population growth, tax levels and international fuel prices. Table 7 in the Annex looks at NC reporting of a few selected Annex I Parties and summarises information on key parameters, assumptions, and uncertainty analysis. Table 7 also highlights which scenarios were reported and whether and what changes have been made to projections relative to previous reporting.

A UNFCCC workshop in 2004 was organised to identify the reporting of emissions projections in Annex I Parties' NC submissions to inform subsequent reporting (UNFCCC, 2004_[8]). A summary of discussions highlighted certain issues and areas of improvement related to reporting and methodologies, which are summarised below.

Need for common understanding of and consistency with scenario definitions: The report highlighted that Parties “should have a common understanding” of what policies are to be included in which scenarios and that the reporting on these scenarios should be consistent with the definition. Specifically, the report emphasised the clear identification of policies included in scenarios. The guidelines also specified including all implemented policies and measures, “irrespective of whether mitigation was the primary objective” for the mandatory (“with measures”) scenario.

Difficulty in preparing baseline scenarios: Preparing the “without measures” scenarios was reportedly particularly difficult because of its counterfactual character and difficulties in distinguishing between past climate- and non-climate-related measures. However, the scenario was considered useful at enabling the identification of past efficient mitigation measures.

Need for transparent reporting to improve understanding of projections: The need for transparency in reporting information on projections was identified to provide insight on methods or models used. Specifically, Parties were encouraged to report sectoral and gas-by-gas GHG projections data and summary information on methodologies, models and key assumptions used in projections.

Minimal impact of time-lag between inventory data and GHG projections: There is a time lag in the availability of latest inventory data and GHG projections in NCs. However in most cases it was found that inconsistency between data used and latest data available would not critically impact the credibility of projections.

Usefulness of explanations on projection uncertainties: The key causes for uncertainty in projections were “assumptions about future behaviour of multiple variables”, “uncertainty about future effects of GHG-related policies and measures” and drawbacks of the models used. Parties preferred method for explaining uncertainty was the sensitivity analysis, which was considered useful information by the Secretariat in the summary report. Some Parties presented ‘high’ and ‘low’ scenarios to show influence of key parameters or drivers whereas others used or planned to use more complex techniques such as Monte-Carlo simulations.

3.1.1. Implications for Paris Agreement guidance

Providing specific guidance on what information to report (e.g. on key drivers), on definitions of key terms as relevant to baselines could be helpful to Parties with less reporting experience on baselines (at least, in the context of UNFCCC reporting). As reporting obligations on projections and baselines have been different for AI and NAI Parties, it could be beneficial to include clear and detailed guidelines where possible on elements that are more prone to uncertainty and are most important for baseline target calculations. In cases where Parties are not able to report as per guidelines, they could provide explanations and highlight possible means of improvement as related to baseline accounting. Guidelines could suggest to Parties to limit uncertainties by highlighting preferred practices.

As noted previously, the counterfactual nature and inherent uncertainties of baseline targets can present particular challenges for Parties as they define and account for such targets. For example, some Annex I Parties do not include projections on “without measures” or NM scenarios in their latest NCs.¹⁰ Some Parties have cited high costs to preparing a “without measures” scenario while others have pointed to the technical difficulty in producing such a scenario. This highlights the technical difficulty in robustly defining baseline scenarios that have to capture effects of absence of policies. As this may be a particular challenge for countries starting from a lower level of capacity, these Parties could choose to define baselines taking into account existing measures. Guidance could also take into account such difficulties by highlighting ways to provide technical assistance to Parties who signal a need. For example, Annex II Parties are asked to provide technical assistance to Annex I economies in transition in the preparation of their

¹⁰ As mentioned previously, a “without measures” scenario was defined under the AI NC guidelines as a projection that “excludes all policies and measures implemented, adopted or planned after the year chosen as the starting point for this projection”. The particular challenge of projecting impacts in the absence of policies relative to a particular reference year is likely why AI Parties choose not to report on these projections.

National Communications, under the Annex I National Communication Guidelines (UNFCCC, 1999_[7]). Guidance could also highlight preferred practices and aim to provide flexibility, wherever possible while aiming for TACCC.

3.2. Lessons learned from accounting of REDD+ forestry reference levels

Developing country Parties participating in REDD+ program and REDD+ activities that reduce emissions are able to receive funds based on verified emission reductions. Parties seeking to access financing for emissions reductions can only receive funds once their actions are “fully measured, reported and verified (MRV)”.

Under REDD+, Parties submit benchmark forestry levels used to assess the performance of a Party in reducing emissions. REDD+ defines the benchmark levels – Forest Reference Emission Levels (FRELs)/Forest Reference Levels (FRLs) – as “benchmarks for assessing each country’s performance in implementing REDD+ activities”. Forest Reference Emission Levels are used for activities that “reduce emissions” whereas Forest Reference Levels include activities that can “enhance carbon stocks”. There is a strong preference in FREL/FRLs submitted so far for using an average of historic levels or extrapolations of historic data rather than modelled projections to general reference levels. Most Parties calculate and use an average or rolling average of historic emissions from the relevant area, pools¹¹, gases and activities as a reference level. Other reference levels have been constructed as a linear extrapolation of historic emissions.¹²

Several guidelines on reporting on FRELs/FRLs spell out the information needed to enable this MRV, including on drivers of deforestation and degradation (UNFCCC, 2013_[9]; UNFCCC, 2011_[10]). As the guidance provided on modalities relating to FREL/FRLs is still fairly general, an interactive process of technical expert review helps inform Parties on updates to the FREL/FRL (UNFCCC, 2011_[10]; UNFCCC, 2013_[11]). The FREL/FRLs are subject to two rounds of technical analyses by expert reviewers that assess the proposed FRELs/FRLs and compare the actual results with the assessed FREL/FRL. The review processes allow for Parties to undertake improvements to improve transparency, methodological consistency and accuracy of reporting and estimations, where possible. Should a significant pool be excluded from the initial FREL/FRL, the reviewers encourage Parties to include this pool within their revised FREL. Technical reviews focus less on verifying the reference levels and more on consistency of methodologies used to calculate FREL/FRL and results as well as the transparency of reported information to better understand how the reference levels are generated (UNFCCC, 2013_[11]). Thus, the REDD+ experience does not necessarily shed light on how to tackle discrepancies in results (or how to account where there are shifting target levels).

The timing of updates to FREL/FRL is particular to the UN REDD+ system as FREL/FRLs are only submitted if a need for financing is identified. Thus, the options for making specific updates at certain times – as in the case of NDC updates – are limited.

¹¹ A pool or carbon pool refers to a reservoir (units measured in mass), according to the IPCC. Specifically, it refers to “a system which has the capacity to accumulate or release carbon”. Forest biomass and wood products are two examples of pools related to forestry.

¹² Some Parties have considered the application of a percentage adjustment – to reflect national circumstances – to the linear extrapolation of emissions for determining the reference level.

Updates are made during the technical analysis after which a modified FREL/FRL can be submitted. If other changes are identified, they will be applied to the next FREL/FRL.

Under the REDD+ system, there is also a focus and concern for precision and accuracy, which are defined differently. A submission could be accurate but could simultaneously contain a certain level of uncertainty. Reporting on uncertainties is thus key in a REDD+ system and is motivated by the fact that some funding organisations such as the Green Climate Fund could base financing decisions on the degree of uncertainty of calculated reference levels i.e. the more uncertain the project, the less attractive it could become for funders.

Guidelines also affirm the usefulness of a step-wise approach (i.e. continuous improvement) to the development of national FRELs/FRLs (UNFCCC, 2011_[10]). This step-wise approach concept aims at improving the quality of FRELs/FRLs submitted through “better data, improved methodologies and, where appropriate, additional pools”. Parties are encouraged to update their reference levels regularly while taking into account latest knowledge, methodologies and trends. Most current FREL/FRL are based on extrapolating emissions and removals from historical periods with the remaining few using modelling to project for the future (UNFCCC, 2018_[12]).

3.2.1. Implications for Paris Agreement

Voluntary guidelines to support the MRV processes – as related to accounting for baseline targets – could be useful in helping Parties set up the required institutional frameworks and technical capacities. Putting the focus on transparent reporting could help identify relevant improvements to ensure methodological consistency and provide more clarity to better understand Parties’ baseline targets. It could be useful to include guidance on step-wise approaches and methodological consistency and provide definitions where possible. Under the Paris Agreement, it is unsure as to whether stepwise changes would be limited to occurring between NDCs, and how to simultaneously encourage continuous improvement in projection methodologies. The REDD+ experience highlights that the accounting of baseline targets could have strong implications on other elements of the Paris Agreement. For example, if the Article 13 technical expert review has the responsibility of checking that the Party has demonstrated NDC BAU updates are aligned with TACCC and avoidance of double counting, Article 13 negotiators would need to reflect this in the guidance being developed for implementation of Article 13.

A possible large motivation in enhancing MRV in the forestry context was the possibility to access results-based financing. The Paris Agreement does not foresee analogous reward for overachievement of NDCs – except perhaps for Parties involved in Article 6 mechanisms. Thus, Article 6 mechanisms could be key to encouraging robust accounting of targets and enhanced reporting to support the accounting process for participating Parties.

4. Interactions between Article 6 transfers and accounting of NDC baseline targets

Article 6 of the Paris Agreement provides for voluntary co-operation in the implementation of NDCs, which can result in international transfer of mitigation outcomes (ITMOs). Co-operation involving transfers could occur either through the new mechanism outlined in Article 6.4 (seen by some as a successor to the Kyoto Protocol’s Clean Development Mechanism) or directly among Parties via domestically established market mechanisms (crediting systems or linked emissions trading systems) under Article 6.2. Some Parties may also wish to trade directly between NDC targets using Article 6.2, i.e. if one Party has inventory emissions below its NDC target level, it may wish to trade with another Party that is above its target.

Article 6.2 refers to guidance that would support Parties in their obligation to “apply robust accounting, to ensure, inter alia, the avoidance of double counting” when “engaging in co-operative approaches that involve the use of internationally transferred mitigation outcomes”. Rules, modalities and procedures for the Article 6.4 mechanism are also to be developed. This guidance is being developed by SBSTA, under a separate process to the more general accounting guidelines under Article 4.13. As explained in further detail in (Hood and Soo, 2017^[11]), accounting for transfers under Article 6 will be complex due to the diversity of NDC types (with single-year NDCs a particular challenge), and because developing countries hosting emission-reduction projects generating ITMOs now have their own NDCs. The transferring and the acquiring Party would therefore both need to account for the transfer (through a “corresponding adjustment”) in order to avoid double counting (as required by Article 4.13, 6.2 and 6.5) (Hood and Soo, 2017^[11]).

While the mechanics of accounting for transfers at one level relates simply to additions and subtractions corresponding to ITMO transfers, some Parties may be concerned about the implications of baseline targets for the broader environmental integrity of ITMO transfers. First, the potential ability to sell “surplus” from NDC over-achievement to another Party potentially raises the stakes in terms of baseline quality: Parties could have an incentive to communicate baselines that are inflated to create a greater surplus.¹³ Second, the uncertainty in the eventual target level (i.e. the absolute number of tonnes) for dynamic baselines means that if commitments to sell surplus to another Party are entered into early, a Party could inadvertently commit to sell too many ITMOs, and subsequent downward revisions to the baseline could leave it with a lower surplus than anticipated, or in deficit. These together could have practical implications for direct Party-to-Party trade of NDC surplus:

- There may need to be increased attention to review of baselines for those Parties intending to sell “surplus” relating to NDC overachievement under Article 6 –

¹³ This is a concern for all target types, but is exacerbated with baseline targets that could to be updated, potentially creating additional surplus.

where a financial benefit for overachievement can be realised. A parallel could be drawn here to the review processes instituted for FREL/FRL through guidelines in the forestry sector, which are intended to promote robust baselines where there may be crediting or payment for overachievement.

- Ex ante Party-to-Party trade of NDC overachievement could be limited (e.g. to a certain percentage of the anticipated surplus) until after the final accounting is completed, to avoid over-selling.

However direct Party-to-Party trade of NDC surplus is not the only, or even perhaps the main potential type of ITMO under Article 6. Trade could also be in units arising from market mechanisms – either crediting mechanisms or emissions trading systems under Article 6.4 or 6.2 – that have their own internal methodologies, baselines, MRV, and enforcement that establish the environmental integrity of units, irrespective of the type of NDC the country’s government has put forward. As long as the market mechanisms themselves have stringent, conservative baselines or caps, each unit transferred should correspond to at least one tonne of domestic emission reductions that would otherwise have been counted in the national inventory.¹⁴ For example, even if a host country sells all units issued by a crediting system and makes a “corresponding adjustment” for these in its NDC accounting, its domestic emissions would (with a conservative baseline) be reduced by more than this amount, and participation in the market therefore brings it closer to achieving its NDC. For these types of transfers, the characteristics of the mechanisms themselves, rather than the level of the NDC baseline, is what would provide assurance of environmental integrity. The ongoing trade associated with robust internationally-linked market mechanisms could therefore be counted toward NDCs, even for baseline-referenced NDCs.

Some Parties may also wish to purchase units in order to comply exactly with the mitigation component of their NDC. As inventory emissions would not be known until after the target year, a period for making final purchases would need to be provided after this information is available, analogous to the true up period of the Kyoto Protocol. If Parties with dynamic baseline targets are involved in Article 6 co-operative approaches, there is additional uncertainty in the quantity of units that may be needed to achieve the target, as the precise target level itself may remain uncertain until after the target year. Some of this uncertainty could diminish over the NDC implementation period as Parties report their emissions and any updates to their target level every two years under the transparency framework (Article 13.7).

This set of challenges posed for accounting for Article 6 co-operative approaches with baseline targets has led some Parties to propose that Parties should be required to convert their NDC to a fixed budget in order to trade. Other Parties consider that it would undermine the nationally determined nature of NDCs if some types of NDCs could not participate in Article 6 mechanisms. On a practical level, many Parties interested in hosting projects associated with the new Article 6.4 mechanism (including least-developed countries) do not have absolute mitigation targets, so any rules that would require absolute targets in NDCs could significantly limit the use of Article 6.

¹⁴ There may be some projects where emission reductions are not reflected in the national inventory (e.g. where inventory methodologies are too coarse-grained to capture specific interventions). Specific rules for corresponding adjustment in NDC accounting may be needed for these cases.

5. Options for accounting guidance

Previous sections have highlighted issues and lessons learned as relevant to accounting of mitigation baseline targets. The paper identifies key issues that could be addressed in part through guidance: what information should be communicated related to baselines and issues surrounding the formulation and revision of baselines (and the impact on target values). Clear guidance on these key areas could facilitate a greater understanding of Parties' baseline targets and progress towards their targets. Guidance could also elaborate on making calculations related to accounting more robust.

Table 6 presents some options for guidance in these key areas: information reported to underpin accounting of baseline targets, and the construction and updating of baselines. Table 6 presents three approaches for guidance (Approach 1, 2 and 3) on each topic, and provides comments on implications of these options. The different approaches represent different levels of detail, as well as a trade-off between providing more guidance for Parties and asking Parties to provide more explanations. Approach 1, which is closer to a transparency-based approach, could allow Parties to choose which specific information they report and how they set and update baselines. However greater transparency could be needed from Parties to explain their choices and provide a better understanding of their baseline target and its accounting. Less information would be needed if Parties' choices are constrained – Approach 3 guidance could provide detailed guidance on reporting and setting and updating baselines. For example, Approach 3 guidance could list all conditions under which Parties could update baselines (from listing types of acceptable technical updates to guidance on threshold values to make revisions). In this case, Parties would need to provide less explanatory information, as the guidelines spell out the key information.

Experience in reporting has found that at a technical level, a lack of clear guidance makes reporting more challenging, as it requires each Party to develop its own processes and assessments of how to report (Vallejo, Moarif and Halimanjaya, 2017^[13]; Hood and Soo, 2017^[11]). A lack of clear guidance can also cause uncertainty at the point of review or assessment, which become more dependent on the interpretations of individual reviewers.

Table 6. Options for guidance related to accounting for baseline targets

	Approach 1	Approach 2	Approach 3	Comments
Guidance on reporting of information to underpin accounting of baseline targets				
Information to be included that describes emission baselines	Guidance does not specify what information to include but asks Parties to demonstrate adherence to TACCC principles and avoidance of double counting in describing the baseline, as mandated in Article 4.13.	Guidance identifies categories of information to be reported (e.g. key drivers, assumptions, modelling methodology, policy assumptions), in line with TACCC and avoidance of double counting, without detailing exactly which pieces of information are included within these categories. (see Table 2).	Guidance contains detailed list of specific elements of information to be reported in line with TACCC and avoidance of double counting. For example, a list of key driver and their data sources including GDP, population, fuel prices, electricity exports/imports, carbon prices (see Table 2), as well as more detailed information on policies included in scenarios, and modelling methodologies.	<p>These guidelines, though necessary to enable baseline accounting, could be addressed within CTU and transparency framework discussions (if not through possible reporting under Article 4.13).</p> <p>Under Approach 1 guidance, Parties could interpret the information required for TACCC and avoidance of double counting.</p> <p>For any level of guidance, providing definitions on TACCC and avoidance of double counting, as related to baselines, could be useful to Parties.</p>
Addressing uncertainties in emission baseline estimations	No guidance.	Guidance asks Parties to provide explanations on the nature of uncertainties (economic, data-related) and how uncertainties could affect baseline estimates.	Guidance suggests Parties to report sensitivity analyses.	As above, the reporting of this information could be through CTU and Transparency Framework reporting guidelines.
Information on revisions made during implementation period alongside original values and calculations	Guidelines suggest to Parties to provide updated implied baseline emissions and target value, if revised.	Guidelines suggest Parties to provide qualitative explanations of revisions (e.g. that revised numbers are based on updated key parameter values) in addition to updated implied baseline emissions and target value, if revised.	Guidance contains detailed list of what updated information should be included. For example, in addition to revised implied baseline emissions and target value, the list could suggest to provide recalculated and original implied baseline emissions, target values, key parameter values.	-

Table 6 (cont.). Options for guidance related to accounting for baseline targets

	Approach 1	Approach 2	Approach 3	Comments
Guidance on the construction and updating of emission baselines				
Formulation of robust baselines	No guidance provided.	Guidance could include principles (e.g. baselines to be conservative, informed by best available information).	More detailed best-practice guidance on preferred modelling frameworks and data sources (including on start dates, policy inclusion in baselines).	Approach 3 guidance could highlight which policies should be included in baselines and how. This would be similar to the AI NC guidelines which provided definitions of scenarios based on what policies would be included or excluded.
Type of updates that could be applied, and when	Guidance could suggest to Parties to communicate when and on what basis they would apply updates within NDC implementation periods.	Guidance could suggest to Parties that updates during the NDC implementation period be limited to the following: <ul style="list-style-type: none"> - activity and inventory data - emissions factors - assumptions on key drivers etc. - technical corrections - voluntary increased coverage (fundamental change) Other updates including fundamental changes such as policies included in the baseline could be made for subsequent NDC implementation periods.	Guidance could suggest limiting updating of baselines to only occur at communication/updating of NDCs (as part of five year cycle), and/or that the baseline should be fixed a certain time ahead of the target year. Detailed guidance could suggest a list of conditions (e.g. change in modelling framework, change in data estimates, updates in policies included in baselines) when revisions could be made.	There could also be guidance on whether and how to update the target value of their NDC if baselines are updated (i.e. whether a Party chooses to maintain a percentage or absolute reduction as the target), keeping Articles 4.3 and 4.11 in mind.
Ensuring methodological consistency (methods and data sources) at different stages of the NDC	Guidelines could highlight the importance of being consistent with the original data and methodologies used to communicate the NDC.	Guidelines could include general definitions of consistency, as related to baselines, including a distinction between technical updates and fundamental changes.	Guidelines could include detailed methodologies for various types of updating, spelling out in detail what is meant by methodological consistency in each case, and potentially restricting certain types of updates to between NDC cycles.	For any level of guidance, Parties could be encouraged to communicate if methodologies, data or key assumptions have changed. In case Parties have used updated methodologies/data/assumptions, guidance could encourage Parties to explain why and to provide explanations on impacts of the changes.

Source: Authors

Annex

Table 7. Information reported in selected Annex I National Communications

Country (Latest NC used)	WM, WAM, NM projections included?	Information in NCs to support projections	Information on whether and how projections were updated since previous NC or BR
Australia	Only WM	Summary of key variables and assumptions including on GDP, population, oil price, coal production, electricity generation, iron and steel production, LNG production, ; Kaya identity and analysis (demonstrating trends in important drivers of emissions); sensitivity analysis (scenarios prepared based on performance in electricity, transport sectors and on demand for LNG and coal exports); methodology and assumptions; data sources; information on models including summary of sectoral models; strengths and weaknesses of projections methodology. Internal audit on the projections was conducted (quality control and assurance (QA/QC) with conclusions.	Changes in projections since NC6 and BR2 reported. Changes attributed to updates to inventory estimates, sectoral data and models and impact of policies and measures.
Austria	WM, WAM	Key parameters or drivers including GDP, population, oil, coal and gas prices, CO ₂ certificate price, heating degree days; information on models; information on models; sensitivity analysis (scenarios based on changed parameter values)	Updates attributed to recalculations in the GHG inventory, changes in activity forecasts assumptions, changes in models used. The economic crisis in 2009/09 was taken into account by updating input parameters including using lower GDP growth rate for coming decades.
Canada	WM, WAM, baselines data and projections of data e.g. GDP growth assumptions (but no overall baseline scenario projections)	Key drivers of GHG emissions (oil and gas prices, economic growth) and key assumptions. Alternative scenarios to reflect uncertainties focusing on future economic growth and population projections and evolution of oil and gas prices. Sensitivity analysis of GDP and oil prices is also included. Main sources of uncertainty for GHG projections with explanation provided. Information on models and methodologies, model limitations and explanations on inter alia treatment of interaction effects, additionality in their E3MC model (Energy, Emissions and Economy model).	Differences relative to BR2 due to modelling and methodological differences with explanations.
EU (NC7 referenced BR3 for more details)	WM, WAM, EU Reference Scenario 2016 up to 2050 in BR3 that covers the EU energy system, transport and GHG emission developments from all sectors)	Methodological information (countries have projections based on own methodologies which are compiled and quality tested); key parameters - to improve consistency in different parameters used by Member States, the European Commission recommended values for evolution of EU ETS CO ₂ price and international fuel and import prices; a weighted average of assumptions of Member States are used in the EU NC projections; sensitivity analysis – mandatory for Member States to produce who do so with their own assumptions and methodologies, which is difficult to aggregate at EU level and is thus not provided; QA/QC procedures	No changes in methodologies or QA/QC procedures were mentioned relative to BR3.

Country (Latest NC used)	WM, WAM, NM projections included?	Information in NCs to support projections	Information on whether and how projections were updated since previous NC or BR
U.K.	WM, WAM, NM baseline definition: excluding impact of measures adopted from 2009-2015)	Methodological information, key assumptions (GDP and other economic growth assumptions, demographic changes, fossil fuel and carbon prices); uncertainty analysis included scenarios for high and low fossil fuel price (crude oil, gas, coal) and GDP growth assumptions, GDP rates; strengths and weaknesses of projection methodology; quality assurance and control procedures.	Revised projections provided. Differences from the last NC noted to be mainly related to additional implemented and adopted policies, re-estimations of impact of policies, improved modelling, revised fossil fuel price and economic growth assumptions).

Source: Authors, based on latest National Communications of selected Annex I Parties

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