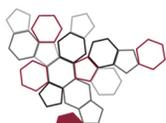




**ISPRA**

Istituto Superiore per la Protezione  
e la Ricerca Ambientale



**Sistema Nazionale  
per la Protezione  
dell'Ambiente**

# Proposed indicators for domestic MRV purposes and tracking progress of NDCs

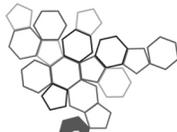


RAPPORTI



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**ICAT** | INITIATIVE FOR  
**Climate Action  
Transparency**

# Proposed indicators for domestic MRV purposes and tracking progress of NDCs

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## OVERVIEW

The adoption of the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) set a turning point in the international climate regime, guided by the urgent need to enhance ambition so as to ensure the global temperature increase remains well below 2°C above pre-industrial levels. To achieve its goals in a globally evolving context, the Agreement marked a shift in the rules and their applicability: differentiated requirements and guidelines between developed and developing country Parties, which characterized the Convention and the Kyoto Protocol, were largely replaced by new common systems. In this framework, the Paris Agreement has shed a new light on the importance of all countries to act and report transparently through the establishment of an Enhanced Transparency Framework for action and support (ETF). The ETF introduced a new set of robust and common transparency rules applicable to all its Parties, with built-in flexibility for those developing countries that need it in the light of their capacities. The specific rules and guidance to operationalize the ETF were defined in the “Modalities, Procedures and Guidelines for the ETF” (MPGs), adopted at COP24 as part of the so-called “Paris Rulebook”. Further technical elements to finalize the ETF, including common reporting tables and formats that countries shall use to report on their GHG emissions and tracking progress of Nationally Determined Contributions (NDCs), are currently being negotiated under the Subsidiary Body for Scientific and Technological Advice (SBSTA) for the adoption of relevant decisions by COP26. In preparation to their transition towards the ETF, which will require the submission of the first Biennial Transparency Reports (BTRs) by 31st December 2024 at the latest, countries are undertaking domestic analyses to assess gaps and needs to meet the new requirements, with substantially different starting points emerging between developed and developing country Parties. In particular, developing country Parties will be called to a significant increase in their domestic efforts to adhere to the MPGs in terms of institutional arrangements, data collection, methodologies and indicators to monitor their progress.

The overall objective of this report, “**Proposed indicators for domestic MRV purposes and tracking progress of NDCs**”, is to provide countries with relevant examples of indicators, which may be used in pursuing domestic monitoring tasks as well as in reporting on progress towards implementation and achievement on Parties’ NDCs. Such indicators may be particularly helpful to developing countries as a reference to further develop and increase national indicators they will intend to use in pursuing domestic monitoring tasks, as well as in reporting on progress towards implementation and achievement on NDCs in the framework of the Paris Agreement. As explained in the report, one set of indicators can serve the dual purpose of domestic and UNFCCC reporting, while observing that the two activities are highly complementary. To this purpose, this document first provides an overview of the current reporting provisions relevant for monitoring progress and using indicators, for both Annex I and non-Annex I Parties (Chapter 1). This section is crucial to understand the requirements for reporting under the UNFCCC, as they contribute to defining the minimum effort that countries are requested to undertake in monitoring their existing actions. Moreover, such overview offers the basis to defining the different starting points in the process of aligning to the new corresponding provisions set by the Paris Agreement and relevant subsequent decisions, which are briefly introduced and discussed (Chapter 2), as they will become applicable by the end of 2024 at the latest. Subsequently, a short description of different existing NDC types is presented, along with some considerations emerging from main Parties and negotiating groups’ UNFCCC submissions on the “structured summary” to track progress of implementation and achievement of NDCs and the use of indicators. This information is introduced to provide readers with an understanding of how reporting requirements under the Paris Agreement will require a greater effort and level of detail from countries in terms of monitoring and reporting progress towards their goals. The challenges introduced by different types of NDC are also discussed, in conjunction with the available types of indicators and the requirements they will have to meet. Building on the previous considerations, a non-exclusive nor exhaustive list of indicators for both mitigation and adaptation is finally suggested (Chapter 3) based on the authors’ experience and expertise, along with relevant descriptions and remarks. Such indicators may be used by countries to track progress towards their NDC, as relevant, and also to improve domestic monitoring of climate change actions, including policies and measures, regardless of information they may wish to submit within the UNFCCC process.

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## PREMESSA (Italian)

L'adozione dell'Accordo di Parigi nell'ambito della Convenzione Quadro delle Nazioni Unite sui Cambiamenti Climatici (UNFCCC) ha rappresentato un punto di svolta nella diplomazia climatica a livello internazionale, guidato dalla sempre crescente urgenza di porre in essere politiche ambiziose in grado di contenere l'aumento delle temperature medie globali "ben al di sotto dei 2°C" rispetto ai livelli preindustriali. Per raggiungere gli obiettivi dell'Accordo di Parigi nel mutevole contesto globale, il negoziato UNFCCC ha introdotto significative innovazioni in termini di regole e relativa applicazione. In particolare, i requisiti e le linee guida per la trasparenza - precedentemente differenziati tra Paesi sviluppati e Paesi in via di sviluppo nell'attuazione della Convenzione UNFCCC e del Protocollo di Kyoto - sono stati rafforzati nell'ottica di accrescerne il rilievo, con l'istituzione di un unico Quadro Rafforzato per la Trasparenza ("Enhanced Transparency Framework" o "ETF"). Nello specifico, l'ETF ha introdotto un nuovo quadro di regole robuste e applicabili a tutti i Paesi, con la previsione di specifiche flessibilità per quei Paesi in via di sviluppo che ne necessitano in base alle proprie capacità. Tale quadro è stato reso operativo con l'adozione delle Modalità, Procedure e Linee Guida ("Modalities, Procedures and Guidelines" o "MPGs"), adottate alla COP24 come parte del cosiddetto "Libro delle Regole" dell'Accordo di Parigi. Ulteriori elementi tecnici per finalizzare il nuovo quadro di trasparenza, tra cui i formati e le tabelle comuni che i Paesi dovranno utilizzare per la propria rendicontazione all'UNFCCC, sono attualmente in fase di negoziazione affinché possano essere adottati alla COP26. In vista della transizione alle nuove regole previste dall'ETF, che richiederà tutti i Paesi di presentare il primo Rapporto Biennale di Trasparenza ("Biennial Transparency Report" o "BTR") entro il 31 dicembre 2024, i Paesi stanno attualmente intraprendendo analisi a livello nazionale per valutare i gap esistenti e le azioni necessarie per allinearsi ai nuovi requisiti, che vedranno punti di partenza sostanzialmente diversi tra Paesi sviluppati e Paesi in via di sviluppo. In particolare, questi ultimi saranno chiamati ad accrescere in maniera significativa i propri sforzi per allinearsi alle MPG, rafforzando a livello nazionale le proprie disposizioni istituzionali, la raccolta dei dati, le metodologie e gli indicatori per monitorare il proprio progresso nelle azioni.

Il presente rapporto, **"Proposte di indicatori per attività di trasparenza nazionali e monitoraggio del progresso degli NDC"**, ha lo scopo di fornire esempi concreti e rilevanti di indicatori che possano essere utilizzati dai Paesi sia per attività di monitoraggio, rendicontazione e verifica propedeutiche a necessità nazionali sia per adempiere ai requisiti specifici previsti in seno all'UNFCCC, specialmente per verificare l'attuazione e il conseguimento dei Contributi Determinati su base Nazionale ("Nationally Determined Contributions" o "NDC"). Il rapporto può risultare utile, in particolare, a quei Paesi in via di sviluppo che dovranno compiere uno sforzo maggiore per allinearsi ai nuovi requisiti di trasparenza nell'ambito dell'Accordo di Parigi, con la possibilità di utilizzare gli indicatori proposti come base di riferimento da sviluppare e raffinare ulteriormente in linea con le necessità e circostanze nazionali. Nel dettaglio, il capitolo 1 fornisce un'analisi delle attuali disposizioni in sede UNFCCC che abbiano rilevanza in materia di monitoraggio dei progressi e utilizzo degli indicatori, sia per i Paesi "Annex-I" sia per i Paesi "non-Annex I". Tale trattazione è cruciale per comprendere i requisiti di rendicontazione di natura internazionale che, concretamente, contribuiscono a definire il minimo sforzo che i Paesi devono intraprendere nel monitoraggio delle proprie azioni su base nazionale. Il capitolo 2 introduce e discute brevemente le basi su cui misurare i differenti punti di partenza nel processo di allineamento ai nuovi requisiti previsti dall'Accordo di Parigi e dalle successive Decisioni attuative, che diventeranno applicabili entro la fine del 2024. Successivamente è presentata una breve descrizione delle diverse tipologie di NDC esistenti, congiuntamente ad alcune considerazioni che emergono dalle posizioni formalizzate da parte dei principali Paesi e gruppi negoziali sul tema dell'utilizzo degli indicatori e del "sommario strutturato" ("structured summary"), che i Paesi dovranno utilizzare per rendicontare circa il progresso verso l'attuazione e il conseguimento degli NDC, comportando un maggiore impegno e livello di dettaglio rispetto alle pratiche attuali. Il capitolo discute inoltre le sfide introdotte dalle diverse tipologie di NDC esistenti, fornendo altresì una panoramica delle più comuni tipologie di indicatori disponibili per monitorarne il progresso nonché dei requisiti che questi dovranno garantire. Infine, sulla base delle considerazioni illustrate e dell'esperienza degli autori nell'espletamento delle attività di trasparenza in ambito nazionale, il capitolo 3 suggerisce una lista, non-esaustiva né esclusiva, di indicatori di mitigazione e adattamento. Tali indicatori possono essere utilizzati dai Paesi, in base alle proprie circostanze e considerazioni nazionali, per monitorare il progresso degli NDC o semplicemente accrescere il monitoraggio nazionale di azioni e politiche sul cambiamento climatico, a prescindere dalle informazioni che il Paese decida di presentare in sede UNFCCC.

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# 1 INTRODUCTION TO THE CURRENT REPORTING FRAMEWORK

The current transparency requirements under the UNFCCC provide for a set of differentiated guidelines between Annex I and non-Annex I Parties to the Convention. While reporting provisions focus on similar matters for the two groups, main differences occur in terms of obligations, level of detail, frequency and format of reporting. Such overarching considerations generally apply also to areas relevant to monitoring Parties' progress in meeting their goals. In particular, since Annex I Parties are subject to specific targets under the Convention and the Kyoto Protocol, reporting on progress towards the achievement of those Parties' targets is of utmost importance.

In this chapter, the main features of existing arrangements in the area of monitoring progress towards implementation and fulfilment of GHG emission reduction targets and goals are illustrated, for both Annex I and non-Annex I Parties. As it will be noted, the current bifurcated requirements provide for significantly different starting points in dealing with some of the new provisions of the enhanced transparency framework (ETF) under Paris Agreement, including on monitoring and reporting on progress.

## 1.1 Annex I

For developed country Parties, most of the requirements concerning reporting on progress towards target(s) and domestic climate action arise from the Convention, specifically from: Article 4, paragraph 2(a), which requires developed country Parties and other Parties included in Annex I "to adopt national policies and take corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs"; and Article 4, paragraph 2(b), which states that, in order to promote progress to this end, each of these Parties shall periodically communicate detailed information on its policies and measures and on its resulting GHG emissions projections. These are specifically referenced in the "[National Communication \(NatCom\) reporting guidelines for Parties included in Annex I to the Convention](#)"<sup>1</sup>, for the submission of NatComs every four years. The NatCom guidelines established, inter alia, the following objectives:

- *Promote the provision of **consistent, transparent, comparable, accurate and complete** information in order to enable a thorough review and assessment of the implementation of the Convention by Parties, and to monitor the progress that Annex I Parties are making towards meeting their goals under the Convention*;
- *Assist the Conference of the Parties (COP) in carrying out its responsibility to review the implementation of the Convention pursuant to its Article 7, paragraph 2(a), and **the adequacy of the commitments under Article 4, paragraph 2(a) and (b), in accordance with Article 4, paragraph 2(d), of the Convention.***

To meet such objectives in Article 4, paragraph 2(a) and 2(b), Annex I Parties have to include in their NatCom, among others, information about policies and measures, their total effect and projections.

Similar requirements are introduced by the "[Biennial reporting guidelines for developed country Parties](#)", guiding the submission of Biennial Reports (BRs) every two years. Among their objectives, BR reporting guidelines include:

- *To ensure the provision of **consistent, transparent, comparable, accurate and complete** information by developed country Parties;*
- *To ensure that the biennial reports include **information on the progress made by Annex I Parties in achieving their quantified economy-wide emission reduction targets, projected emissions, and the provision of financial, technological and capacity-building support to Parties not included in Annex I to the Convention (non-Annex I Parties);***
- *To facilitate the international assessment of emissions and removals related to **progress towards the achievement of the quantified economy-wide emission reduction targets.***

The use of robust indicators is made particularly relevant by the need to implement and ensure the use of TACCC<sup>2</sup> principles, which are embodied in the objectives of both the above-mentioned guidelines. More specifically, the use of quantitative indicators has been useful to providing a detailed picture of countries' concrete progress over time, especially for developed country Parties, who have largely

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<sup>1</sup> Originally adopted in 1999 to implement the requirements arising from Articles 4 and 12 of the Convention, further revised in 2019 as an outcome of COP25.

<sup>2</sup> Transparency, accuracy, completeness, consistency and comparability are key IPCC principles in preparing and reporting GHG inventories and are also indicators of inventory quality.

used data from their most recent greenhouse gas inventory (GHGI) to respond to their reporting obligations. In this regard, it is important to distinguish between the use of GHG emissions and removals levels to compiling and submitting GHGIs and the use of such data as an indicator to monitoring progress in achieving quantified economy-wide emission reduction targets. In fact, the two activities respond to different scopes and requirements, may substantially differ in coverage and lead to different implications, as it will be described in relation to the structured summary under the Paris Agreement in the next chapter. An additional source that several Parties have been using to demonstrate progress in pursuing domestic climate action are information on policies and measures, including their status and mitigation impact, although it is important to emphasize that these mainly represent static information which have rarely been used as indicators to track progress towards Annex-I Parties targets.

### 1.1.1 Progress towards target(s): greenhouse gas emissions and removals

As part of their BRs, developed country Parties have to include information on their **quantified economy-wide emission reduction target** (e.g. description, conditions or assumptions, institutional arrangements), **as well as on progress towards its achievement**. Some of those requirements, specific to monitoring and reporting on progress, are further translated into the complementary “[common tabular formats](#)” (CTF). To meet the above requirements, data on GHG emissions and removals represent the most relevant indicator.

Under **CTF Table 1**, developed country Parties have to report on their GHG emissions trends, including changes from base to the latest reported year (Table 1.1 below). The summary column indicating changes from base to latest reported year provides for a quantitative indication of the status of country’s GHG emissions levels in a given year compared to a base year. While a similar figure may provide for an effective indication of the country’s performance in reducing GHG emissions, it does not imply a direct comparison against any specific target nor an indication of whether the reductions achieved are driven mainly by structural mitigation measures or by the effects of economic downturns. Additional information for these purposes can be retrieved by **CTF Table 2**, featuring a description of the quantified economy-wide emission reduction target (Table 1.2). Similarly, under **CTF Table 4**, developed country Parties have to report on their overall progress, by providing details on their total GHG emissions, contributions from LULUCF and market-based mechanisms both inside and outside the Convention (Table 1.3). These elements contribute complementing the information that can be derived from GHG emissions trends.

**Table 1.1 - Common tabular formats (CTF) for developed country Parties under the Convention: CTF 1 – GHG emission trends summaries.**

<b>CTF TABLE 1 - EMISSION TRENDS: SUMMARY</b>				
Greenhouse gas emissions	Base year	1990	(from 1991 to latest reported year)	Change from base to latest reported year
	(kt CO <sub>2</sub> eq)			(%)
Greenhouse gas source and sink categories	Base year	1990	(from 1991 to latest reported year)	Change from base to latest reported year
	(kt CO <sub>2</sub> eq)			(%)

**Table 1.2 - Common tabular formats (CTF) for developed country Parties under the Convention: CTF 2(a) – Description of QEERT**

<b>CTF TABLE 2(A) - DESCRIPTION OF QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET (QEERT): BASE YEAR</b>		
Party		
Base year / base period		
Emission reduction target	% of base year / base period	% of 1990
Period for reaching target		

**Table 1.3 - Common tabular formats (CTF) for developed country Parties under the Convention: CTF 4 – Reporting on progress**

<b>CTF TABLE 4 - REPORTING ON PROGRESS</b>				
Year	Total emissions excluding LULUCF (kt CO <sub>2</sub> eq)	Contribution from LULUCF (kt CO <sub>2</sub> eq)	Quantity of units from market-based mechanisms under the Convention (number of units and kt CO <sub>2</sub> eq)	Quantity of units from other market-based mechanisms (number of units and kt CO <sub>2</sub> eq)
Base year/base period				
2010				
2011				
2012				

### 1.1.2 Domestic climate action: status of policies and measures

Reporting on the status of policies and measures (PaMs) is prescribed, through similar provisions, by both NatCom and BR guidelines. However, while NatComs require a more extensive and broad description of PaMs, BRs feature a deeper focus on mitigation actions. Requirements in this regard are further specified by CTF Table 3 (also included, labelled as “Table 1”, in the revised NatComs guidelines) which binds developed country Parties to report on their progress in achievement of the quantified economy-wide emission reduction target, by providing information on their mitigation actions and related effects (Table 1.4 below).

**Table 1.4 - Common tabular formats (CTF) for developed country Parties under the Convention: CTF 3 - progress in achievement of QEERT**

<b>CTF 3 - PROGRESS IN ACHIEVEMENT OF THE QUANTIFIED ECONOMY-WIDE EMISSION REDUCTION TARGET: INFORMATION ON MITIGATION ACTIONS AND THEIR EFFECTS</b>									
Name of [mitigation action] / [policy or measure]	Sector(s) affected	GHG(s) affected	Objective and/or activity affected	Type of instrument	Status of implementation	Brief description	Start year of implementation	Implementing entity or entities	Estimate of mitigation impact (not cumulative, in kt CO <sub>2</sub> eq)
									20XX - 2020

In this table, two main elements can be identified as relevant indicators to measure progress in achieving QEERT: the status of implementation of policies and measures (e.g. implemented, adopted, planned, or no longer in place), which represents a qualitative indicator; and the estimated mitigation impact associated to each or a group of PaMs, which provides a non-cumulative value expressed in terms of kt CO<sub>2</sub>eq to be avoided in 2020 and 2030. While both indicators provide for static information of Parties’ action, their evolution could potentially be analysed over time across subsequent submissions of the same reports. However, for the estimated mitigation impact of PaMs in particular, this has rarely been the case in the practice as the ex-ante quantification (where undertaken) was rarely updated by Parties in their subsequent BR submissions, even when changes had eventually occurred.

As an additional requirement, NatComs guidelines bind developed country Parties to provide information on how they believe their policies and measures are modifying longer-term trends in anthropogenic GHG emissions and removals consistent with the objective of the Convention. However, this information is generally descriptive and does not necessarily imply an assessment of the country’s expected GHG emissions trends against its target(s).

## 1.2 Non-Annex I

As not featuring a target under the Convention, developing country Parties are currently subject to less stringent reporting requirements. Details of information to be reported are provided by the “[Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention](#)”, which non-Annex I Parties should submit every four years taking into account a prompt

provision of financial resources<sup>3</sup>; and by the “[Biennial update reporting guidelines for Parties not included in Annex I to the Convention](#)”, for the preparation of Biennial Update Reports (BURs) which shall be submitted every two years, consistent with their capabilities and the level of support provided for reporting<sup>4</sup>. In this context, it is worth noting that while only a restricted number of countries (i.e. Small Islands Developing States and the Least Developed Countries) had been granted an additional discretion on the reporting frequency of both reports, a significant amount of developing countries experienced challenges in meeting reporting deadlines: as of December 2020, only 63 developing countries were able to finalize the submission of their first BUR and just 31 of those managed to submit a second BUR; similarly, nearly half of developing countries Parties have not been able to move beyond their second NatCom submission (Table 1.5). Nevertheless, developing countries have gradually improved their capacity to meet reporting requirements over time and are currently making efforts to prepare their final BURs by the end of 2024.

**Table 1.5 - Status of Biennial Update Reports (BUR) and National Communications (NatCom, or NC) submissions by developing country Parties as of December 2020. For BURs, a common deadline applies since non-Annex I Parties were all requested to submit their first BUR by 2014 and every two years thereafter. Contrarily, NatComs have individual country deadlines since it was decided that each non-Annex I Party should submit its first NC within three years after joining the UNFCCC Convention, and every four years thereafter. Source: UNFCCC website, “National Reports from non-Annex I Parties”.**

<b>STATUS OF BIENNIAL UPDATE REPORTS AND NATIONAL COMMUNICATIONS SUBMISSIONS BY DEVELOPING COUNTRY PARTIES</b>						
NC - National Communication	NC1	NC2	NC3	NC4	NC5	NC6
	154	142	82	10	2	1
BUR – Biennial Update Report (year due submission)	BUR1 (2014)	BUR2 (2016)	BUR3 (2018)	BUR4 (2020)	-	-
	63	31	10	0	N/A	N/A

General objectives established by the NatCom guidelines for non-Annex I Parties include the following elements:

- *To assist non-Annex I Parties in meeting their **reporting requirements under the Convention**;*
- *To encourage the presentation of information in a **consistent, transparent and comparable**, as well as **flexible**, manner, taking into account specific national circumstances.*

It should be noted that, compared to those applicable to Annex I Parties, the objective of non-Annex I NatComs is limited to a more generic reporting on progress in enhancing developing countries’ capacity to address climate change. Moreover, guiding principles do not encompass accuracy and completeness, replaced with a flexibility provision.

On the other hand, overarching objectives in the more recent BUR reporting guidelines include, inter alia:

- *To encourage the presentation of information in a **consistent, transparent, complete, accurate and timely** manner, taking into account specific national and domestic circumstances;*
- *To enable enhanced reporting by non-Annex I Parties on **mitigation actions and their effects**, needs and support received, in accordance with their national circumstances, capacities and respective capabilities, and the availability of support.*

In this case, guiding principles are more comprehensive with the inclusion of accuracy and timeliness, while comparability is not embodied, reflecting developing countries’ discretion in the choice of contents and formats of reporting. Furthermore, the absence of individual country targets under the Convention to monitor progress against, substantially reduces opportunities for quantitative monitoring and thus reduces the relevance of using levels of GHG emissions and removals as a progress indicator. In fact, most of the information reported by developing countries to address the above mentioned NatCom and BUR requirements are often presented in terms of implementation of mitigation actions or measures and respective results achieved, although some developing countries have voluntarily chosen to define and indicate domestic goals they intend to track progress for. As it will be illustrated in the next paragraph, the different approaches adopted – also due to the non-

<sup>3</sup> Developing country Parties were requested to produce their first NatCom within three years after joining the UNFCCC Convention, and their subsequent ones every four years thereafter (Decision 1/CP.16).

<sup>4</sup> At COP17, it was agreed that the first BUR should have been submitted by 2014, while subsequent reports shall be submitted every two years thereafter (Decision 2/CP.17).

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mandatory nature of requirements, mostly made of “should” and “are encouraged to” provisions – have resulted in a certain degree of heterogeneity across developing countries’ reported information.

### ***1.2.1 Mitigation actions/measures and results achieved***

The basis for information that developing country Parties shall report in relation to their mitigation measures are provided by the NatComs guidelines for non-Annex I Parties, which require, among other, reporting a **general description of the steps taken or envisaged to implement the Convention** and any other information they consider to be relevant to the achievement of the objective of the Convention<sup>5</sup>. Specifically, such information shall be provided on steps for formulating, implementing, publishing and regularly updating national and, where appropriate, regional policies containing **measures to mitigate climate change**. Based on their national circumstances, non-Annex I Parties are specifically encouraged to provide, to the extent their capacities allow, information on policies and measures implemented or planned which are relevant to climate change mitigation. This may also include information on methodologies applied and results obtained.

A similar requirement arises from BUR guidelines, which established that developing country Parties should report, inter alia, information on **mitigation actions and their effects**, including associated methodologies and assumptions. Specifically, information that developing countries shall provide on mitigation actions, to the extent possible, include:

- (a) Name and description of the **mitigation action**, including information on the nature of the action, coverage (i.e. sectors and gases), **quantitative goals and progress indicators**;*
- (b) Information on **methodologies and assumptions**;*
- (c) **Objectives of the action and steps taken or envisaged to achieve that action**;*
- (d) Information on the **progress of implementation of the mitigation actions and the underlying steps taken or envisaged, and the results achieved, such as estimated outcomes (metrics depending on type of action) and estimated emission reductions, to the extent possible**.*

While the above required information should be submitted in a tabular format, no arrangements were agreed for the provision of a set of **common** tabular formats, nor by more detailed prescriptions on how the evaluation of progress shall be conducted or on any indicator to be used. For this reason, information reported by developing countries in their submissions vary significantly in substance, methodologies and formats. This consideration was also embodied in the provisions for methodological approaches in the NatCom guidelines, which encourages non-Annex I Parties, based on their national circumstances, to use whatever methods are available and appropriate in order to formulate and prioritize policies containing **measures to mitigate climate change**.

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<sup>5</sup> In accordance with Article 12, paragraphs 1 (b) and (c), of the Convention.

## 2 THE NEW REPORTING REQUIREMENTS UNDER THE PARIS AGREEMENTS

### 2.1 Shifting to the Enhanced Transparency Framework

The adoption of the Paris Agreement (PA) in 2015 set a turning point in the international climate regime. The urgent need to enhance global ambition to ensure the world does not exceed the temperature goals, which the PA acknowledged as holding global warming to well below 2°C above pre-industrial levels, has shed a new light on the importance of all Countries to act and report transparently.

For this reason, the PA introduced a new set of robust and common transparency rules to be applicable to all Parties. The main element of this set of rules consists of specific provisions arising from the Agreement itself, which established an enhanced transparency framework for action and support (ETF), with built-in flexibility for those developing countries that need it in the light of their capacities. Further rules and guidance to operationalize the ETF, building on Article 13 of the Paris Agreement, are contained in the so-called “Paris Rulebook” adopted at COP24, as well as in further specific Decisions adopted under the COP and the CMA.

Additionally, with a view of avoiding overlaps, duplications and undue burden on Parties, a [COP24 Decision](#) has introduced provisions to manage the transition from the current measurement, reporting and verification (MRV) system to the new arrangements under the ETF. Specifically, it has been established that following the submission of the final BRs and BURs, the “[Modalities, Procedures and Guidelines](#)” (MPGs) for the ETF will supersede the relevant provisions under the current MRV system<sup>6</sup>.

For developed country Parties, this means that following 31st December 2022 at the latest, the new requirements under the Paris Agreement regime will apply for monitoring, reporting and review of information on climate action and support; while for developing country Parties, the new requirements will be applicable by 31st December 2024 at the latest<sup>7</sup>. However, in light of a “no-backsliding” provision, Parties will continue to be subject to some of the existing mandatory requirements from the Convention which are not specifically addressed by the MPGs and, accordingly, will not be superseded. This mainly affects the submission of National Communications, and specifically those chapters that will not be directly included in Parties’ BTRs<sup>8</sup>. The main changes from the current MRV system to the new framework introduced by the ETF are illustrated in Table 2.1 below.

**Table 2.1 - Changes from the current MRV system towards new Enhanced Transparency Framework (ETF).**

CHANGES FROM THE CURRENT MRV SYSTEM TOWARDS NEW ENHANCED TRANSPARENCY FRAMEWORK (ETF)				
	2.1.1.1 Annex I Parties	2.1.1.2 Non-Annex I Parties		2.1.1.4 All Parties
<b>Rules overview</b>	Specific mandatory requirements	Mostly non-mandatory requirements	2.1.1.3 →	Common mandatory requirements with built-in flexibility for those developing countries who need it in light of their capacities
<b>Reporting vehicles</b>	National Inventory Report (annual)	National Inventory (jointly with NatComs or BURs)		National Inventory Report (at least every 2 years with BTRs – annual for developed countries)
	National Communications	National Communications		National Communications
	Biennial Reports (BR)	Biennial Update Reports (BUR)	Biennial Transparency Reports (BTR)	

<sup>6</sup> Current MRV system is primarily composed by arrangements established by decision 1/CP.16 and decision 2/CP.17.

<sup>7</sup> Submission deadline for the final biennial update reports.

<sup>8</sup> According to Decision 1/CP.24, paragraphs 42 and 43.

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## 2.2 Reporting requirements and formats

The key reporting vehicle under the ETF will be the new biennial transparency report (BTR), whose first submission is due by 31<sup>st</sup> December 2024 at the latest. While the detailed structure of the BTR's outline is currently being negotiated at the UNFCCC under the Subsidiary Body for Scientific and Technological Advice (SBSTA), provisions embodied in the MPGs have already defined that the BTR will have to include, among others<sup>9</sup>, the following components relevant to the scope of this report:

- a **National Inventory Report (NIR)** of anthropogenic emissions by sources and removals by sinks of greenhouse gases<sup>10</sup>;
- **information necessary to track progress made in implementing and achieving NDCs** under Article 4 of the Paris Agreement<sup>11</sup>; and
- **information on Mitigation Actions, Policies and Measures (APM)** that support the implementation and achievement of its NDC under Article 4 of the Paris Agreement<sup>12</sup>.

The NIR will be composed by a **National Inventory Document (NID)**, providing narrative and methodological information, and **Common Reporting Tables (CRTs)** including summary, sectoral and cross-sectoral tables. While the mandatory requirement for all Parties is to submit a NIR every two years within their BTR submission, in the light of a no-backsliding provision developed country Parties will continue to be bound to an annual submission timeline. In any case, the NIR can also be provided as a standalone report and, in such case, a summary of GHG emissions and removals shall be provided in the BTR. Similar to current practices, especially to those for Annex I Parties, the provision of detailed information on GHG emissions and removals, strictly in line with the 2006 IPCC Guidelines and TACCC principles, will prove essential to have a clear picture of countries' concrete achievements. Nevertheless, the same data will also be a relevant indicator for many Parties in tracking progress of their NDCs, as it will be described below.

Regarding Mitigation Actions, Policies and Measures to be reported in BTRs, all countries will be bound to focus on those that have the most significant impact on GHG emissions and removals and those impacting key categories in the GHG inventory. APMs will have to be presented in both a **narrative and common tabular format**<sup>13</sup> and, to the extent possible, be organized by sector (i.e. energy, transport, IPPU, agriculture, LULUCF, waste management and other) and complemented with **estimates of expected and achieved GHG emissions reductions**. As for the case of the GHG inventory, while information on APMs is needed to meet a specific requirement of the MPGs, some of their features (e.g. status of APMs, or GHG emission reduction of individual APMs) may be used by some Parties to track progress of their NDCs as relevant, particularly for those NDCs that showcase a target that is not linked to an economy-wide quantified GHG emissions reduction.

Finally, the MPGs defined specific information which all Parties shall report in relation to **progress in the implementation and achievement of their NDCs**, in accordance with a detailed list of information on indicators and relevant methodologies and accounting approaches, including on targets. Such information will have to be reported through a **structured summary**, whose format is also being negotiated under SBSTA. Nevertheless, major Parties and negotiating groups have shared their views on the format of the structured summary through a number of submissions to date. In particular, it is the view of several Parties that the relevant paragraphs of the MPGs (chapter III, paragraphs 77 and 79) shall be interpreted as requiring the structured summary to be in a tabular format, as well as a format able to accommodate information that is primarily quantitative in nature. Within those Parties, most consider that there should be only one common tabular format for the structured summary, applicable to all NDCs; while some others consider that there could be different, yet common, tabular formats for each NDC type. However, a few other Parties consider that the

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<sup>9</sup> Other components part of the BTR include “information related to climate change impacts and adaptation”, “Information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the Paris Agreement”, “Information on financial, technology development and transfer and capacity-building support needed and received under Articles 9–11 of the Paris Agreement”. Possible additional components, to be agreed upon within SBSTA, may include as applicable “Information to be reported when the NC and BTR are submitted jointly every four years” and “Information on flexibility”.

<sup>10</sup> According to requirements set in paragraphs 17–58 of the MPGs.

<sup>11</sup> According to requirements set in paragraphs 65–79 of the MPGs.

<sup>12</sup> In the MPGs, this information is indicated as a subset of the broader “information necessary to track progress of NDCs under Article 4 of the Paris Agreement” (paragraphs 59–103 of the MPGs), however, the two matters are then detailed distinctly (section II.C for tracking progress, and section II.D for Mitigation APM).

<sup>13</sup> Currently being negotiated by SBSTA (although it will likely largely mirror the current Annex I CTF Table for reporting on policies and measures)

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format of the structured summary should be discretionary to each Party and not necessarily tabular (i.e. a narrative summary).

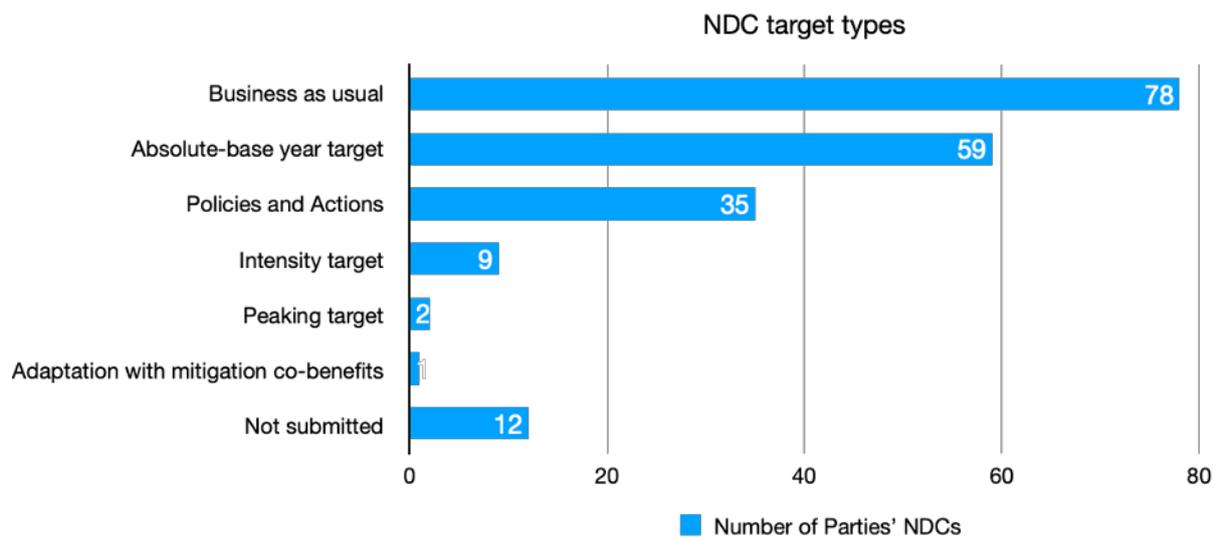
Regardless of the format the structured summary will assume, there is no doubt that a greater effort will be needed by developing country Parties for monitoring progress towards their domestic targets compared to the current arrangements, but some higher level of detail will also be required by developed country Parties. As anticipated, some of the challenges to complete the development of the structured summary are also related to the wide variety of Parties' NDC targets. In fact, while under the Kyoto Protocol targets assigned to Annex I Parties were all expressed as percentage "quantified emission limitation or reduction commitment" compared to a base year or period, NDC targets under the Paris Agreement are different in nature or expressed in different manners, especially with regards to their mitigation component. As a result, indicators selected and to be used by Parties to track progress towards implementation and achievement of their NDCs may turn out substantially different in some cases, depending on their NDC type, the final reporting formats to be developed under SBSTA and ultimately Parties' choices of indicators. Moreover, some Parties have expressed their willingness to use different sets of indicators to track progress of implementation compared to those to assess achievement of NDCs, thus potentially increasing the degree of heterogeneity. Examples of main NDC GHG target types include the following:

- **Business-as-usual (BAU)**, where GHG emissions reductions are calculated compared to a baseline scenario compared in a future year (e.g. 20% reduction compared to BAU levels in 2030).
- **Absolute target**, which provides for GHG emissions reductions to be achieved in a given year compared to a defined level in the past (e.g. 40% reduction compared to 1990 levels, by 2030).
- **Policies and actions**, which are not necessarily linked to a quantified GHG emissions reduction (e.g. implementation of renewable energy or energy efficiency policies over a given period).
- **Intensity target**, where GHG emissions reduction goals are linked with a socio-economic indicator (e.g. reducing emissions per unit of GDP or population).
- **Peaking target**, which implies a commitment to reach a peak in GHG emissions in a single year or period, to be followed by lower emissions levels (e.g. reaching a peak of GHG emissions in 2025 and to undertake a gradual reduction thereafter).
- **Adaptation with mitigation co-benefits**, where any GHG emissions reduction is to be achieved as a co-benefit of an adaptation action (e.g. afforestation policies to increase adaptation and resilience).

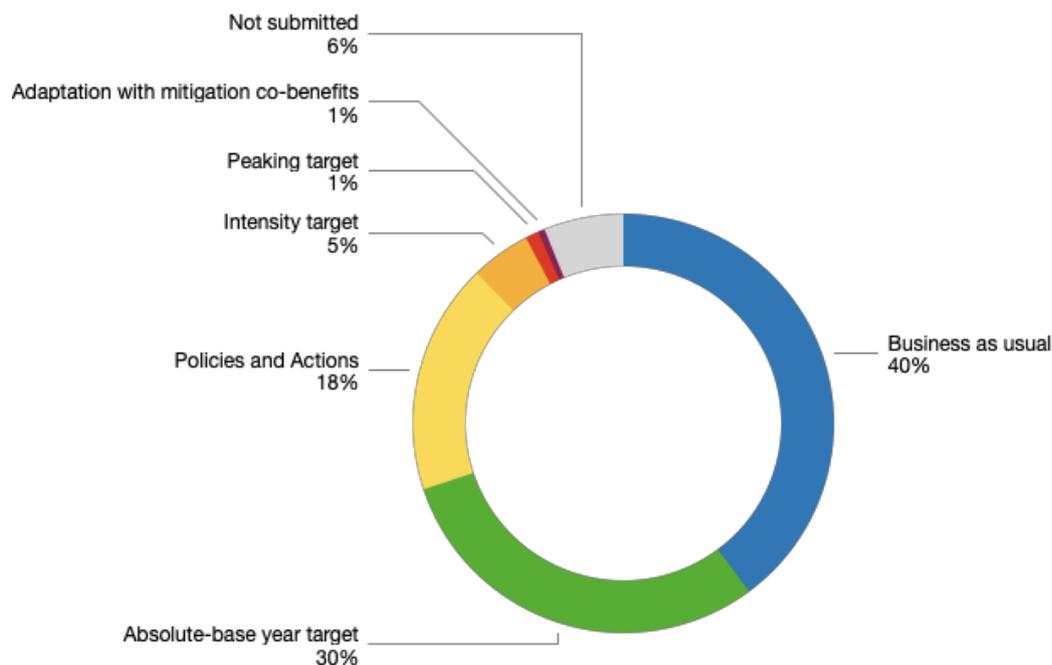
A description of the different NDC types submitted as of September 2020 retrieved and updated from "NDC Explorer" (GDI, 2016) is summarized below (Figure 2.1 and Figure 2.2). As it can be drawn from data, the most common NDC mitigation target is expressed as a GHG emissions reduction compared to a business-as-usual scenario (78 out of 196 Parties, or 40% of UNFCCC Parties), followed by absolute targets compared to a base year (59 Parties<sup>14</sup>, or 30%) and by policies and measures (35 Parties, or 18%). Other NDC types were chosen by a limited number of countries, although in some cases those are particularly relevant in terms of GHG emissions covered: for instance, China and India (which together account for roughly one-third of global emissions) have expressed their target as reduction of emission/carbon intensity of GDP.

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<sup>14</sup> Since the EU has only submitted one NDC covering all its member states, they were counted as 28 Parties.

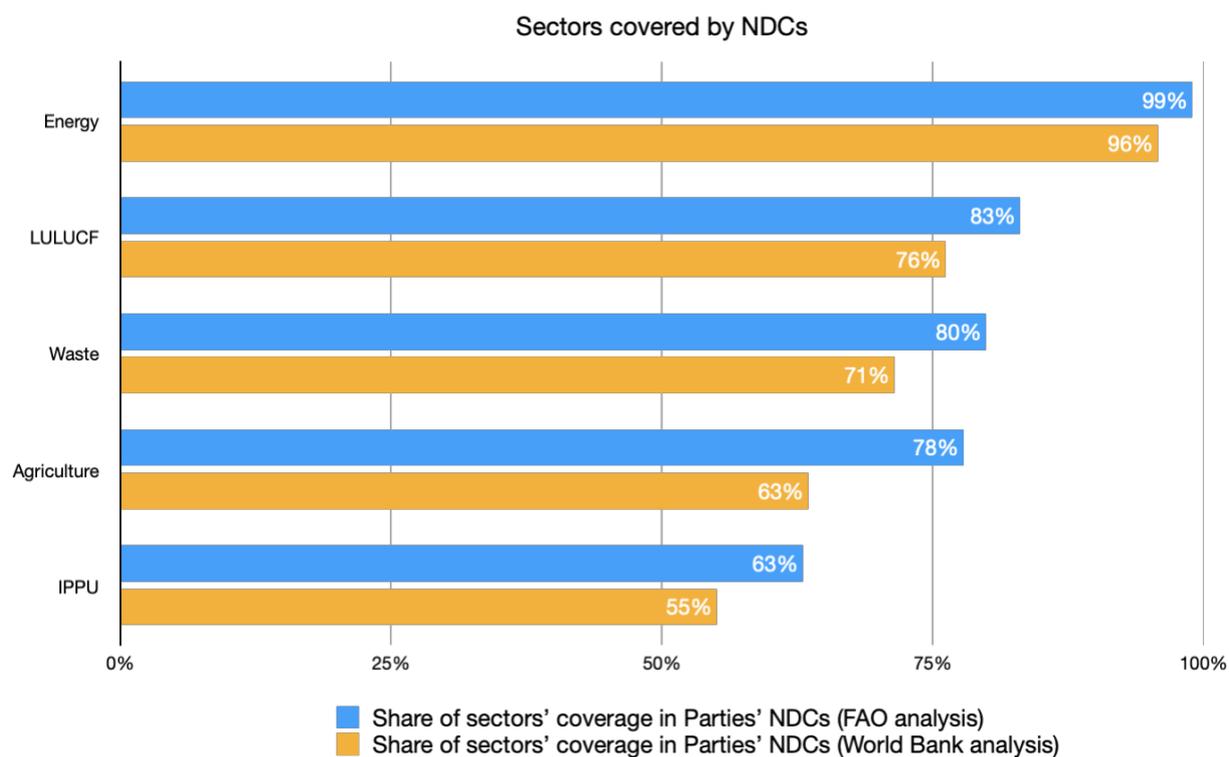


**Figure 2.1** - Overview of the different NDC types. Elaborated from analysis by NDC Explorer (GDI, 2016 - updated in 2020)

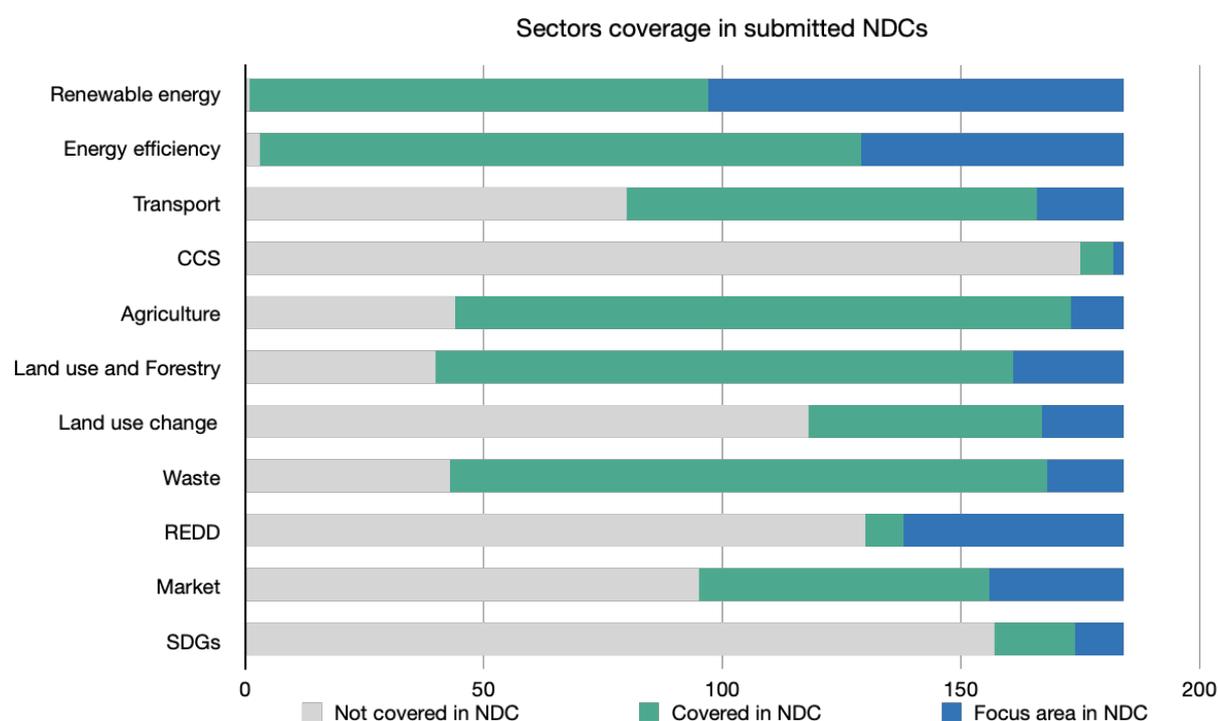


**Figure 2.2** - Shares of different NDC types. Elaborated from analysis by NDC Explorer (GDI, 2016 - updated in 2020)

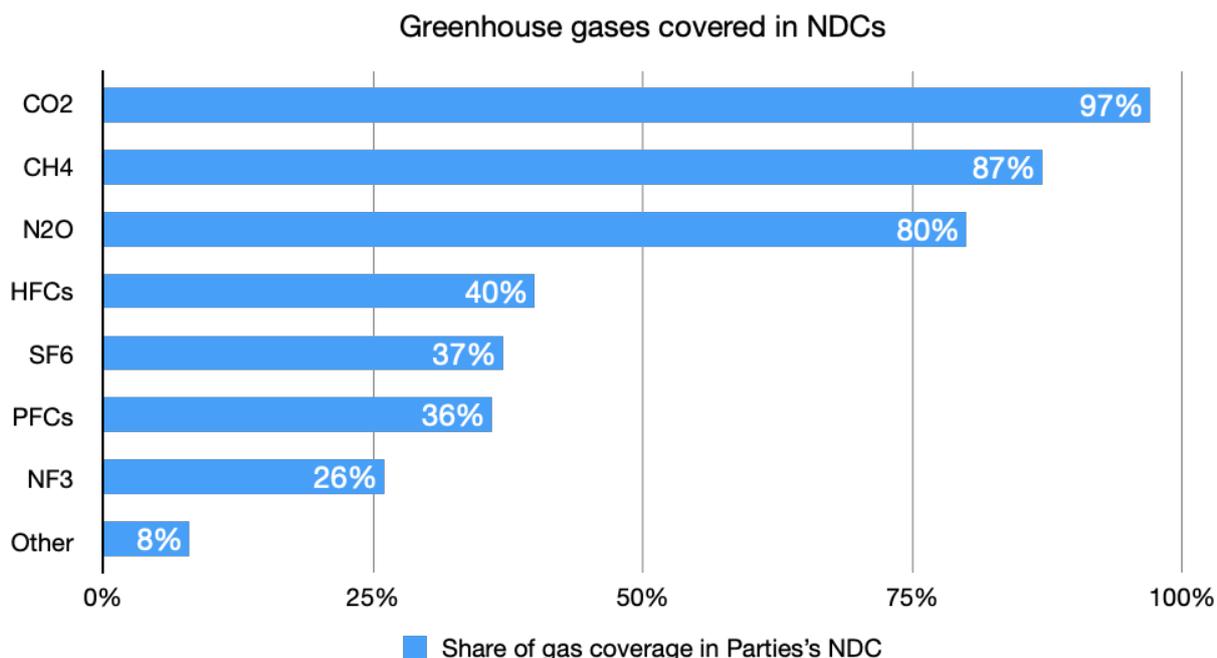
Analyses conducted by the United Nations Food and Agriculture Organization (FAO, 2016) and the World Bank (WB, 2016) on submitted NDCs found that Contributions not only differ for their GHG target type, but also for the sectors and/or greenhouse gases affected (Figure 2.3, Figure 2.4 and Figure 2.5). A further analysis (Öko Institute, 2018) found that 103 countries are covered by an NDC encompassing all five IPCC sectors (energy, IPPU, agriculture, LULUCF, waste), while 39 countries cover at least 3 to 4 sectors. The following figures summarize the percentage of countries covering specific sectors and GHGs in terms of mitigation targets/actions under their NDCs.



**Figure 2.3** - Sectors covered by NDCs across Parties to the UNFCCC. Elaborated from analyses by FAO (2016) and World Bank (2016).



**Figure 2.4** - Sectors and activities covered by submitted NDCs covering 184 Parties to the UNFCCC. Elaborated from analysis by NDC Explorer (GDI, 2016 - updated in 2020)



**Figure 2.5** - Greenhouse gases covered by NDCs across Parties to the UNFCCC. Elaborated from analysis by FAO (2016).

For the reasons just illustrated, as well as to reduce, to the extent possible, the risk of Parties being allowed to select and use tracking progress indicators that result poorly relevant to their own NDC, it will be essential that Parties clearly indicate their target type (as mandated by paragraph 64 of the MPGs) and identify a robust set of indicators relevant for each NDC-type and sectors covered. In fact, indicators are first and foremost needed at the domestic level to evaluate effectiveness of policies and measures put in place, before serving as the tool to report on progress at the international level.

### 2.3 Using indicators to track progress of NDCs

Chapter III of the MPGs provides for a detailed set of guidelines on the information necessary to track progress made in implementing and achieving NDCs; in particular, section C introduces prescriptions for the use of indicators. As overarching criteria, each Party will be required to identify and **select its indicator(s)** to track progress towards the **implementation and achievement of its NDC**. As anticipated, while the choice of indicators will be self-determined by the Party, indicators **shall be relevant** to a Party's NDC and may be either **qualitative or quantitative**. More specifically, **for each selected indicator**, Parties shall provide the following details:

- Description of methodologies and accounting approaches used;
- Description of how indicators selected are relevant to their respective NDCs;
- Information for the reference point(s), level(s), year(s), baseline(s), base year(s) or starting point(s);
- Information for each previous reporting year during the implementation period of the NDC;
- The most recent information available for such indicator.

Building on the information listed above, Parties will have to **track progress towards implementation and achievement of its NDC target(s)** in their BTRs by comparing the most recent information on selected indicators with their respective reference point(s), level(s), year(s), baseline(s), base year(s) or starting point(s). Moreover, in the first BTR containing information on the end year or period of the NDC, each Party shall include an **assessment of the achievement of its NDC** based on, among others, the most recent information for each selected indicator.

The MPGs furthermore provide for a sample list of possible indicators or type of indicators, which could be relevant for some Parties, as appropriate:

- **Net GHG emissions and removals;**
- **Percentages reduction of GHG intensity;**
- **Relevant qualitative indicators for a specific policy or measure;**
- **Mitigation co-benefits of adaptation actions and/or economic diversification plans;**

- **Others** (e.g. hectares of reforestation, percentage of renewable energy use or production, carbon neutrality, share of non-fossil fuel in primary energy consumption and non-GHG related indicators).

In the attempt to facilitate Parties' efforts in linking different NDC types with relevant indicators to track progress towards their achievement, the examples summarised in Table 2.2 below have also been suggested (UNFCCC, 2020).

**Table 2.2 - Common tabular formats (CTF) for developed country Parties under the Convention: CTF 4 – Reporting on progress**

<b>CTF TABLE 4 - REPORTING ON PROGRESS</b>	
<b>Type of NDC</b>	<b>Possible indicators</b>
<b>Absolute-base year target</b>	GHG emissions (t CO <sub>2</sub> -eq) in base year and current year with or without LULUCF, as appropriate; or emission reductions (t CO <sub>2</sub> -eq).
<b>Business as usual</b>	GHG emissions (t CO <sub>2</sub> -eq) in business as usual (if changes from the reference level) with or without LULUCF, as appropriate; or values for drivers of BAU (e.g. GDP, population, fuel demand); or current emission reductions below BAU.
<b>Intensity target</b>	Base year/current year GHG annual emissions, base year/current year driver (e.g. GDP, population, energy consumption).
<b>Peaking target</b>	GHG emissions (t CO <sub>2</sub> -eq) in all years leading to the current year, with or without LULUCF.
<b>Policies and actions</b>	Status of implementation of policies and measures (e.g. planned, adopted, implementing); or description of what would have happened in the country absent the policy; or emissions quantification of the policy impacts; or number of policies and measures implemented; or financial, technological and/or capacity-building support received for implementing policies and measures.
<b>Other (e.g. mitigation co-benefits of adaptation actions, or non-GHG targets)</b>	Description of current adaptation actions with mitigation co-benefits, quantification of mitigation co-benefits; or indicators under policies and actions (as above).

Parties' selected indicators may thus vary significantly in terms of nature (quantitative or qualitative), coverage (economy-wide vs sectorial) and scope (to track progress towards implementation, achievement or both). During the technical expert review process, the expert review team (ERT) will not be in a position to assess the adequacy or appropriateness of a selected indicator; however, the ERT will likely be able to ask questions and/or raise recommendations and encouragements related to completeness and transparency of information reported. For instance, if the ERT will not find - in a Party's BTR - sufficiently clear information on how a selected indicator is relevant to the Party's NDC, it may seek further explanations from the Party on how it considers such indicator to be, indeed, relevant to its NDC.

As anticipated, the provision of robust and transparent information on indicators used will thus be an essential component of Party's BTRs. Moreover, the usefulness of such information will not be limited to reporting purposes under Article 13 of the Paris Agreement. In fact, they will also contribute to define the overall status of implementation of the Paris Agreement through the global stocktake process under Article 14, which will encompass, among its sources of input, reports by Parties and synthesis reports prepared by the Secretariat on the aggregate effect of NDCs and collective progress towards their implementation ([Decision 19/CMA.1](#)).

To provide Parties with useful instruments to meet the extensive and detailed provisions of the MPGs, a list of relevant indicators is proposed in the next chapter.

### 3 PROPOSED INDICATORS FOR MONITORING CLIMATE ACTION

This chapter introduces relevant indicators for monitoring mitigation sectors and activities (paragraphs 3.1) as well as an overview of indicators that may be useful for tracking adaptation actions and targets (paragraph 3.2). To this purpose, two tabular lists of indicators have been built based on the authors' experience and expertise in monitoring domestic climate action, also in line with requirements arising from UNFCCC decisions and national or regional legislations. Accordingly, these indicators may serve the dual function of fulfilling domestic MRV activities (regardless of the information to be submitted within the UNFCCC) as well as of tracking progress towards implementation and achievement of NDCs, in line with the provisions set by the Enhanced Transparency Framework under the Paris Agreement.

While an attempt has been made to cover the majority of sectors and activities that may be helpful to monitor in the light of the various NDC types submitted by countries, the lists of indicators proposed in the paragraphs below are non-exhaustive and non-exclusive, and concern indicators mainly quantitative in nature. While both quantitative and qualitative indicators may be relevant for domestic monitoring purposes and, depending on the NDC target type, for tracking progress of NDCs, qualitative indicators are more challenging to be summarized as they are usually less standardized and vary significantly across countries even for similar purposes. Accordingly, it is essential that any country aiming to identify its indicators for monitoring climate action carefully evaluates the options available and further tailors its choices according to specific domestic objectives, purposes and national circumstances. Further, wider lists of indicators also exist in literature and may be helpful as a basis for the development of further specific, policy-driven indicators.

#### 3.1 Mitigation

The following list of proposed indicators for mitigation is categorized by macro indicators and those covering energy-related sectors (i.e. Energy, Industrial processes) and those addressing non-energy related sectors (i.e. Agriculture, LULUCF and Waste) and may be relevant, as appropriate, for both economy wide and non-economy wide NDC targets. For NDCs with an economy wide mitigation target, the indicators to be used in NDC tracking progress and implementation can be provided at sectoral level, mirroring the GHGI structure; however, it should be emphasized that this represents one out of some alternative options for clustering GHGI sectors, and it may vary according to national circumstances. For NDCs without an economy wide mitigation target, the indicators to be used in NDC tracking progress and implementation have to take into account the specific targets included under NDCs.

##### 3.1.1 Macro and energy-related indicators

**Table 3.1 - Proposed macro and energy-related indicators for mitigation activities and targets**

#	Group	Indicator	Description	Remarks
1	Macro	Total GHG emissions trend	Total annual CO <sub>2</sub> -eq emissions (Mt)	This is a relevant indicator to evaluate the impact of policies and measures on GHG emissions over time. It is particularly relevant for NDC targets expressed in the form of absolute-base year targets and peaking targets. It is also needed for tracking BAU targets.
2	Macro	Total carbon intensity of the economy	Total annual CO <sub>2</sub> -eq emissions (Mt) per GDP (bn Currency)	Total CO <sub>2</sub> -eq emissions (excluding LULUCF) and gross domestic product at constant prices are considered. This is indicator is particularly relevant for NDC intensity targets.
3	Macro	Per-capita carbon intensity of the economy	Total annual CO <sub>2</sub> -eq emissions (Mt) per inhabs	Total annual GHG emissions (with or without LULUCF) and the number of inhabitants are considered. This is indicator is particularly relevant for NDC intensity targets.
4	Services	Carbon intensity of the commercial and institutional sector	CO <sub>2</sub> -eq emissions from fossil fuel consumption in commercial and institutional sector (Mt) per gross value-added	CO <sub>2</sub> -eq emissions from fossil fuel combustion in commercial and institutional buildings in the public and private sectors are considered. Energy used for transport by services should not be included here but in the transport indicators. Gross value added is taken at constant prices in services (Relevant ISIC/NACE codes to

			services (bn Currency)	be specified).
5	Energy	Specific GHG emissions of public and autoproducer power plants	CO <sub>2</sub> -eq emissions from public and autoproducer thermal power stations (Mt) per output (all products) by public and autoproducer thermal power stations (PJ)	<p>This indicator considers CO<sub>2</sub>-eq emissions from all fossil fuel combustion for gross electricity and heat production, as well as gross electricity produced and any heat sold to third parties (combined heat and power plants – CHP), by public and autoproducer thermal power and combined heat and power plants. Emissions/outputs from heat-only plants are not included.</p> <p>Public thermal plants generate electricity (and heat) for sale to third parties, as their primary activity. They may be privately or publicly owned. Autoproducer thermal power stations generate electricity (and heat) entirely or partly for their use as an activity, which supports their primary activity. The gross electricity generation is measured at the outlet of the main transformers, i.e. the consumption of electricity in the plant auxiliaries and in transformers is included.</p>
6	Energy	Share of renewable energy production	Annual renewable energy production per total annual energy production (%)	This indicator can be used to track NDC progress, in terms of annual renewable energy production, and in terms of annual GHG emissions reduction.
7	Energy	Residential heating	CO <sub>2</sub> emissions (Mt) from residential heating out of the number of dwellings	This indicator can be used to track NDC progress, in terms of annual contribution of residential heating to the total GHG emissions.
8	Energy	Total energy consumption	Annual energy consumption (PJ)	This indicator can be used to track NDC progress, in terms of annual energy efficiency.
9	Energy	Total energy production out of energy input	Annual energy production (TJ) / energy input (TJ).	This indicator can be used to track NDC progress, in terms of annual energy efficiency, i.e electricity produced out of energy content of the fuel input.
10	Energy - Transport	Specific GHG emissions from transport sector	Annual CO <sub>2</sub> -eq emissions from transport sector (Mt) per final energy consumption (PJ)	This indicator takes into account annual GHG emissions deriving from transport sector (considered as a whole or differentiated by subsector: domestic aviation, road transportation, railways, domestic navigation, other transportation) and respective final energy consumption (from all energy sources, including biomass and electricity consumption), allowing tracking changes of transport performances about greenhouse gas emissions per final energy consumption over the years.
11	Energy - Transport	Specific GHG emissions of passenger cars respect to mileage travelled	Annual CO <sub>2</sub> -eq emissions from road passenger cars (kt) per mileage travelled (Mkm)	This indicator takes into account annual GHG emissions deriving from passenger cars category, considered as a whole or differentiated by fuel, and the respective number of vehicle kilometres travelled (source: transport statistics), considering that activity data should be consistent with the emission data, allowing tracking changes of the performances of the passenger cars in relation to greenhouse gas emissions per vehicle-km over the years.
12	Energy - Transport	Specific road transport fuel consumptions	Annual fuel consumptions of road transport vehicles (MJ) per distance travelled (km)	This indicator takes into account annual consumptions (MJ) of the different road transport vehicle categories (passenger cars, light duty trucks, heavy duty trucks, buses, two-wheeled vehicles) and the respective distance travelled (source: transport statistics), allowing tracking changes of the efficiency of the vehicles over the years.
13	Energy - Transport	Road transport vehicle fleet complying with highest emission	Share of vehicles complying with highest emission standards compared to the total road transport circulating fleet	This indicator takes into account the number of vehicles complying with highest emission standards (according to the vehicle fleet classification adopted in the Country), distinctly for road transport vehicle category (passenger cars, light duty trucks, heavy duty trucks, buses, two-wheeled vehicles), and the respective total

		standards	(%)	number of circulating vehicles (source: transport statistics), allowing tracking changes of the penetration of more modern vehicles in national road transport fleets.
14	Energy - Transport	Use of alternative fuels in transport	Share of alternative fuels consumption compared to the total energy consumption in transport sector (%)	This indicator takes into account the amount of alternative fuels consumption (including natural gas, LPG, biomass and electricity consumption) and the total final energy consumption (from all energy sources) in transport sector (including domestic aviation, road transportation, railways, domestic navigation, other transportation) allowing tracking changes of the penetration of fuels with a lower environmental impact.
15	Energy - Transport	Electrification of the railway network	Share of the electrified railway network compared to the total network (%)	This indicator takes into account the length data (km) of the total railway network and of the electrified portion (transport statistics) allowing to represent the electrified share of the railway infrastructure of a territory.
16	Industry	GHG emissions from the industry sector	Total CO <sub>2</sub> -eq emissions from the sector (Mt)	This indicator considers emissions from combustion of fossil fuels in manufacturing industries, construction and mining and quarrying (except coal mines and oil and gas extraction) including combustion for the generation of electricity and heat. Energy used for transport by industry should not be included here but in the transport indicators. Emissions arising from off-road and other mobile machinery in industry should be included in this sector.
17	Industry	Final energy consumption from the industry sector	Total final energy consumption from the sector (PJ)	This indicator takes into account total final energy consumption of industry from all energy sources (including biomass and electricity consumption).
18	Industry	Clinker substitution	Amount of secondary raw materials, i.e. waste input (t) per amount of natural raw materials (t)	The amount of waste replacing natural raw material fed into the kiln is considered.

### 3.1.2 Non-energy-related indicators

**Table 3.2 - Proposed non-energy related indicators for mitigation activities and targets**

#	Group	Indicator	Description	Remarks
19	Agriculture	CH <sub>4</sub> emissions	CH <sub>4</sub> emissions by emission category (enteric fermentation, manure management, rice cultivation, field burning of agricultural residues)	The indicator tracks changes of the CH <sub>4</sub> emissions reduction/increase due to livestock and soil management.
20	Agriculture	N <sub>2</sub> O emissions	N <sub>2</sub> O emissions by emission category (manure management, agricultural soils, field burning of agricultural residues)	The indicator tracks changes of the N <sub>2</sub> O emissions reduction/increase due to livestock and soil management.
21	Agriculture	Synthetic nitrogen fertilizers applied	Change in the applied amount of synthetic nitrogen fertilizers (%)	The indicator tracks changes of the N <sub>2</sub> O emissions reduction/increase due to synthetic nitrogen fertilizers use.
22	Agriculture	Livestock numbers	Change in livestock numbers, e.g. cattle, swine, poultry (%)	The indicator helps tracking changes in the share of emission from livestock and soil management.
23	Agriculture	Rice cultivated area	Area (ha) by several conditions, e.g. ecosystem rice/water regime/type of seeding, changes of surface (%)	The area subject to each management practice is needed, since each management practice is linked to specific set of parameters indicated in the IPCC guidelines (e.g.

			with respect to a base year/base period/baseline (*)	ecosystem rice/water regime/type of seeding, etc.), and therefore driving the estimation process.  The indicator allows the estimate CH <sub>4</sub> emissions from rice cultivation. The indicator helps tracking changes of the CH <sub>4</sub> emissions reduction due to the use of cultivation/irrigation techniques other than the conventional continuously flooded rice practice.
24	Agriculture	Annual milk production	Annual amount of milk produced (t or lt), or changes (%) compared to the base year	The amount of milk together with the number of heads allows for calculation of yield. This information may be related to changes in diets.
25	Agriculture	Manure storage in closed structures	Annual amount (t)	The indicator allows the calculation of NH <sub>3</sub> emissions from manure management, which lead the indirect N <sub>2</sub> O emissions.
26	Agriculture	Manure distribution on agricultural soils	Annual amount per manure spreading technique (t)	The indicator allows the calculation of NH <sub>3</sub> emissions from agricultural soils (NH <sub>3</sub> emissions are important as they affect indirect N <sub>2</sub> O ones); management practice is also correlated to potential increase of soil organic content.
27	Agriculture	Anaerobic digesters	Number and installed power generation capacity of digesters fed with animal manure (MW)	The indicator is correlated to the reduction of CH <sub>4</sub> emissions from manure management.
28	Agriculture	Animal manure sent to anaerobic digesters	Annual amount of manure (t)	The indicator is correlated to the reduction of CH <sub>4</sub> emissions from manure management.
29	Agriculture/ Energy	Annual energy or biogas produced by anaerobic digestion of animal manure	Energy (MWh) or biogas (Sm <sup>3</sup> ) produced on a calendar year or changes in these numbers (%) with respect to the base year/ base period/ baseline	The indicator is correlated to the reduction of annual GHG emissions from manure management and can be used to track NDC progress and achievement.
30	Waste	Specific waste production	Waste production (t) per Population (inhab).	The indicator is key in the tracking changes in emissions from waste.
31	Waste	Waste management	Total amount (t) or share (%) of waste sent to landfill	The indicator is key in the tracking changes in emissions from waste.
32	Waste/ Energy	Annual energy or biogas produced by anaerobic digestion of waste	Energy (MWh) or biogas (Sm <sup>3</sup> ) produced on a calendar year or changes in these numbers (%) with respect to the base year/ base period/ baseline	The indicator is correlated to the reduction of annual GHG emissions from waste management.
33	Waste	CH <sub>4</sub> emissions	CH <sub>4</sub> emissions time series from solid waste disposal sites	The indicator tracks changes of the CH <sub>4</sub> emissions reduction/increase due to waste disposed of in landfills.
34	Waste	Landfill gas recovered in managed landfills	Biogas (Sm <sup>3</sup> ) recovered through a gas collection system	The indicator makes it possible to evaluate the reduction of methane emissions from SWDS (Solid Waste Disposal Sites).
35	LULUCF - Cropland	Burial of crop residues	Annual area of cropland subject to the activity, for types of crop (ha) (*)	Management practice correlated with the potential increase of soil organic carbon and nitrogen content. Effects depending on temperature and humidity.
36	LULUCF - Cropland	Cover crop	Annual area of cropland with cover crop (ha) (*)	Management practice correlated with the potential increase of soil organic carbon or to increase carbon and nitrogen content and soil erosion.
37	LULUCF - Cropland	Zero/minimum tillage	Annual area of cropland subject to the management practice (ha) (*)	Management practice correlated with the potential increase of soil organic carbon; the indicator can be used in the estimation of C removals from cropland soils.

38	LULUCF - Forestry	Land covered by forests	Area (ha), number of trees or changes of surface (%) with respect to a base year/ base period/baseline (*)	The indicator is key in estimating CO <sub>2</sub> -eq removals and can be used to track NDC progress and achievement (e.g. millions of trees, hectares of forest area). The activity is also linked to the REDD+ activities.
39	LULUCF - Forestry	Afforestation/Reforestation, Land converted to forest land	Annual afforested/reforested land area (ha), changes of surface (%) with respect to a base year / base period / baseline, or number of planted trees (*)	The indicator is key in estimating CO <sub>2</sub> -eq removals and can be used to track NDC progress and achievement (e.g. millions of trees, hectares of forest area). The activity is also linked to the REDD+ activities.
40	LULUCF - Forestry	Deforestation, Forest converted to other land uses	Annual deforested area (ha), changes of surface (%) with respect to a base year/base period/baseline, or number of harvested trees (*)	The indicator is key in estimating CO <sub>2</sub> -eq emissions. The activity is also linked to the REDD+ activities.
41	LULUCF - Forestry	Enhancement/conservation of forests carbon stocks	Annual change in biomass carbon stock (tC/ha), or another equivalent unit	The indicator is key in estimating CO <sub>2</sub> -eq removals. The activity is also linked to the REDD+ activities.
42	LULUCF - Forestry	Sustainable management of forests	Area (ha), changes of annual surface (%) (*)	The indicator is key in estimating CO <sub>2</sub> -eq removals. The activity is also linked to the REDD+ activities.
43	LULUCF - Forestry	Burned area (wildfires, controlled burning)	Annual area (ha)	The indicator is key in estimating CO <sub>2</sub> -eq emissions from wildfires occurring on forest area.
44	LULUCF - Forestry	Harvested biomass	Annual volume (m <sup>3</sup> ) or annual biomass (t)	The indicator is key in estimating CO <sub>2</sub> -eq emissions and removals.
45	LULUCF - Forestry	Biomass	Aboveground biomass (AGB) carbon stock (t C/ha)	The indicator is key in estimating GHG sinks; it is also linked to the REDD+ activities.

Nota (\*): for management practice, its implementation in the reporting years is an important factor (% of area subject to the practice on the total cultivated area), being a driver of emissions variation compared to a baseline/base year/period.

## 3.2 Adaptation

Action on adaptation is gaining momentum in the international negotiations and results essential for most vulnerable countries to cope with the present and future impacts of climate change (see for example: [Cancun Adaptation Framework](#) and [Nairobi Work Programme on impacts, vulnerability and adaptation to climate change - IPCC](#)). Efficient indicators to monitor resilience and adaptation to climate change and extreme weather events, as well as progress on the implementation of adaptation actions and fulfilment of specific targets, are therefore extremely important.

Despite the fact that monitoring and evaluation of adaptation is an emerging subject, yet there is no analytical framework or unified indicators in the field, unlike mitigation, for which the indicator of the number of tons of CO<sub>2</sub> avoided is a consensus; however, a certain amount of research and experimentation is underway (Leiter et al., 2019).

Countries may use adaptation indicators for a number of purposes; for instance, the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (AR5) mentions three uses of adaptation metrics: to identify adaptation needs (usually by assessing climate vulnerability or risk), to track the implementation of adaptation, and to assess its effectiveness (IPCC, 2014). This multiplicity of uses has led to the development of different types of indicators, which are summarised in Table 3.3 (Mäkinen et al., 2018).

**Table 3.3 - Types of adaptation indicators. Source: Mäkinen et al., 2018**

Indicator function
<ul style="list-style-type: none"> <li>• <b>Input indicator</b> – an indicator that provides a measure of resources, both human and financial, devoted to a particular adaptation activity, programme or intervention.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Process indicator</b> – an indicator that tracks progress in adaptation policy processes and actions.</li> </ul>

<ul style="list-style-type: none"> <li>• <b>Output indicator</b> – an indicator that relates to the direct results of an adaptation policy or action, without assessing if these results actually lead to better adaptation outcomes.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Outcome indicator</b> – an indicator that seeks to define an explicit outcome or result of an adaptation action. Outcome indicators may also assess the level of success of specific adaptation measures, indicating e.g. a reduction in vulnerability or improved adaptive capacity.</li> </ul>
<b>Indicator content</b>
<ul style="list-style-type: none"> <li>• <b>Exposure indicator</b> – an indicator of the exposure of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Adaptive capacity indicator</b> – an indicator of the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities or to respond to consequences.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Sensitivity indicator</b> – an indication of the degree to which a system or species is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Composite vulnerability indicator</b> – an indicator that provides a metric characterizing the vulnerability of a system by combining, with or without weighting, several indicators assumed to represent vulnerability. This includes indicators, which combine two or more indicators of exposure, sensitivity and/or adaptive capacity.</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Hazard indicator</b> – an indicator of the potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources.</li> </ul>

As emphasized by Leiter et al. (2019), it is recommended that the choice of adaptation metrics is based on the aimed purpose and on the careful consideration of what is intended to be measured or achieved, the types of decisions the metric will be used for (e.g. planning, allocation of funding, learning, etc.), its meaningfulness to its audience, and the scale at which it will be communicated. It is important to emphasize that adaptation to climate change requires the understanding of processes operating on decadal time. Among socio-economic processes, food chains are crucial; while from the agro-ecological point of view, it is also very important to preserve germplasm suitable to local climates<sup>15</sup>. Given the wide spectrum of sectors and actions with an influence on adaptation, several indicators may be identified building on countries' specific national circumstances and plans. These may include indicators to address meteorological parameters that may drive climate change (e.g. number of extreme events with respect to reference annual/seasonal value); indicators to address potential occurrence of natural or human-induced physical events or trends, or their physical impact (hazard); indicators to address potential exposure to natural or human-induced physical events; indicators specifically relevant to the agriculture sector (e.g. related to its productivity, management and/or impacts faced, development of short supply chains); indicators relevant for other sectors and activities (e.g. waste management, forestry); indicators representing stages of implementation processes of plans, strategies and actions. A selection of indicators is thus proposed in Table 3.4 below, mainly referring to hazard and exposure type of content.

**Table 3.4 - Proposed indicators for adaptation activities and targets**

#	Group	Indicator	Description	Remarks
46	Planning	Implementation of national plans, strategies or actions	It provides an indication of the extent/degree of achievement of adaptation targets.	For instance, this may involve NAP or NDC processes. Source: Leiter et al., 2019.
47	Planning	Number of new or improved adaptation frameworks	It provides an overview of policy frameworks, institutional arrangements or processes developed for climate change adaptation	This indicator may concern the establishment of domestic institutional arrangements for data collection and sharing, MRV purposes, evaluation and/or decision-making bodies, or institutional processes to deal with climate change impacts.
48	Planning	Number of early	Operational early warning systems introduced and	Information may be detailed to the type of support, and may also include geographical coverage, and

<sup>15</sup> According to Plant Genetic Resources for Food and Agriculture Treaty and Nagoya Protocol

		warning systems	supported.	number of municipalities included. Source: Leiter et al., 2019
49	Funding	Ratio of public / private finance mobilized over needed for climate adaptation	It provides an assessment of financial resources available to implement adaptation plans, strategies and actions compared to resources needed	This indicator implies a prior mapping of adaptation financial needs.
50	Meteorological parameters	Number of heat/cold waves events	With respect to reference annual/seasonal value	Definition of extreme required. This indicator requires a data series across decades to be able to associate any observed trends in climate variables
51	Meteorological parameters	Consecutive dry days	With respect to reference annual/seasonal value	High values corresponding to long periods of low precipitation and potentially drought-favouring conditions.  An increase of this index with time means that the chance of drought conditions will increase.
52	Meteorological parameters	Consecutive wet days	With respect to reference annual/seasonal value	An increase of this index with time means that the chance of flood conditions will increase.
53	Meteorological parameters	Change in average annual precipitation	With respect to reference annual value	This indicator requires a data series across decades to be able to associate any observed trends in climate variables to climate change.
54	Physical events	Change in river flooding	Historical seasonal series	This indicator can drive flood management shift from pure protection against floods to the integrated management of flood risks.
55	Physical events	Change in coastal flooding occurrence	Historical seasonal series	This indicator can to show establishing new flood hazard regimes communicating urgency for sea-level rise planning and adaptation.
56	Physical events	Number of inhabitants living in flood-prone areas	Inhabitants per square kilometre in flood-prone area.	It shows the size of the population involved in the adaptation processes. Historical comparisons at local level are adequate.
57	Physical events	Percentage of population in flood-prone areas	Percentage of country population exposed to flood events	It shows the size of the population involved in the adaptation processes. Historical comparisons at local level are adequate.
58	Physical events	Number of inhabitants living in drought-prone areas	Inhabitants per square kilometre in drought-prone area.	It shows the size of the population involved in the adaptation processes. Historical comparisons at local level are adequate.
59	Physical events	Percentage of population in drought-prone areas	Percentage of country population exposed to drought risks	It shows the size of the population involved in the adaptation processes. Historical comparisons at local level are adequate.
60	Physical events	Number of facilities located in areas at flood/coastal erosion risk	Number of public and private facilities located in areas at flood/coastal erosion risk (n/km <sup>2</sup> )	Facilities may include households, hospitals, business and educational facilities.
61	Physical events	Increase in frequency and impact of forest/land fires	Absolute or proportional change of annual fires events, of annual burned area and fires intensity or damage	The indicator is linked to soil degradation, erosion, vulnerability to extreme events and consequent reduction in the possibility to adapt.
62	Water	Declining quality or quantity of water resources due to extreme events (wet or dry)	Surface (km <sup>2</sup> ) and volume (m <sup>3</sup> ) of water resources with declining water quality or quantity caused by extreme events (wet or dry)	Local historical comparisons may be appropriate.

63	Water	Water loss (leakages in the distribution network)	Share of water loss (%)	Historical comparisons over water distribution at local level may be appropriate.
64	Forestry	Forest browning	Surface (hectares), changes (%)	The indicator is related to decrease CO <sub>2</sub> absorption and sink.
65	Agriculture	Development of short supply chains	Tonnes of products, number of people, change (%)	The indicator is correlated to the reduction of CO <sub>2</sub> emissions from transport of food
66	Agriculture	Agricultural productivity	Productivity per Unit Area (g/m <sup>2</sup> /yr or ton/hectare/yr)	The indicator is related to transformation of GHGs in food resources
67	Agriculture	Water consumption in agriculture	Amount of water (lt or m <sup>3</sup> ) for hectares	The indicator is related to climate adaptation
68	Agriculture	Impact of increased temperatures on manure management	Effect of rising temperatures on GHG emissions caused by amount of manure application (t/ha yr), its management and composition	Linked to GHG sequestration or production, also with respect to the influence on agricultural soils
69	Agriculture	Impact of increased temperatures on milk production	Effects of rising temperatures on milk production amount (e.g. l/heads, total t/yr or l/yr production by single species)	The indicators can be applied to homogeneous portions of the territory on a regional scale in relation to environmental conditions and milk production methods.
70	Agriculture	Maintenance of local genetic diversity related to food and agriculture resources	Land area (ha) cultivated with local cultivar and a wide spectrum of genetic resources.	The indicator is related to climate adaptation; it is correlated with the reduction of CO <sub>2</sub> emissions from transport. It is connected with the development of short supply chains. The activity is linked to Treaty on Plant Genetic Resources for Food and Agriculture <sup>16</sup> and Nagoya Protocol <sup>17</sup>
71	Waste	Solid waste production	Pro capita production of solid waste over time (e.g. kg/inhabs)	The waste management practices and procedures contribute to GHG emissions and these include waste transportation, open dumping of waste and indiscriminate burning. In addition, any potential GHG emission from reuse and recycling activities should also be assessed.
72	Waste	Change in treated wastewater	The most used indicators are BOD <sub>5</sub> , COD and TOC. The characteristic units of measurement for chemical monitoring parameters are generally mg/l or g/m <sup>3</sup> .	Increase in treated wastewater is a good indicator to identify efficiency of mitigation and adaptation plans taken by local administration. The indicator has to take in consideration which type of water is treated (e.g. industrial, etc.) and the level of water contamination.

Across the Nationally Determined Contributions submitted to date, several countries have already used quantified indicators in order to define the intended targets of adaptation actions included in these documents. For example, an analysis of the first INDCs submitted showed that 38 developing countries included quantitative adaptation targets in their Contributions, mostly in forestry (17 INDCs) and water (16 INDCs), thus contributing to the identification of quantitative indicators. Such efforts may also contribute to inform the development of adaptation metrics under the UNFCCC (Pauw et al., 2018).

<sup>16</sup> Treaty on Plant Genetic Resources for Food and Agriculture.

<sup>17</sup> Nagoya Protocol on Access to Genetic Resources and the fair and equitable sharing of benefits arising from their utilization to the Convention on Biological Diversity.

**Table 3.5** - *Examples of quantified adaptation targets used by Parties in their NDC. Source: authors' elaboration on submitted NDCs.*

<b>Country</b>	<b>Source</b>	<b>Indicator</b>	<b>Indicator type (function)</b>	<b>Indicator type (content)</b>
<b>Afghanistan</b>	First NDC (2015)	Increasing irrigated agricultural land to 3.14 Mha, through restoration and development of Afghanistan's irrigation systems.	Outcome	Adaptive capacity
<b>Chile</b>	Updated NDC (2020)	Delivery of Regional Climate Change Action Plans by administrative regions: 10 by 2025, 16 by 2030.	Process	Adaptive capacity
<b>Comoros</b>	First NDC (2020)	100% of the population located in vulnerable areas are displaced or benefit from facilities protecting them from climatic hazards and more particularly from submersion risk	Output	Exposure
<b>Costa Rica</b>	Updated NDC (2020)	By 2026, 100% of the management plans for Wild Protected Areas, Marine Protected Areas, as well as Marine Areas for Responsible Fishing, include climate risk analysis and climate adaptation criteria.	Process	Vulnerability
<b>India</b>	First NDC (2016)	Enhance water use efficiency by 20% by 2030.	Output	Adaptive capacity
<b>Morocco</b>	First NDC (2016)	Protecting 1,500,000 hectares of forests against erosion, which will include the prioritization of 22 basins.	Outcome	Sensitivity

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## **LIST OF ACRONYMS**

- APM – Actions, Policies and Measures
- BAU – Business-as-usual
- BR – Biennial Report
- BTR – Biennial Transparency Report
- BUR – Biennial Update Report
- COP – Conference of Parties
- CRF – Common Reporting Format
- CRT – Common Reporting Table
- CTF – Common Tabular Format
- ERT – Expert Review Team
- ETF – Enhanced Transparency Framework
- FMCP – Facilitative Multilateral Consideration of Progress
- FSV – Facilitative Sharing of Views
- GHG – Greenhouse Gas
- GHGI – Greenhouse Gas Inventory
- IPCC – Intergovernmental Panel on Climate Change
- IPPU – Industrial Processes and Product Use
- LDC – Least Developed Country
- LULUCF – Land Use, Land Use Change and Forestry
- MA – Multilateral Assessment of Progress
- MPG – Modalities, Procedures and Guidelines
- MRV – Monitoring, Reporting and Verification
- NatCom – National Communication
- NDC – Nationally Determined Contribution
- NID – National Inventory Document
- NIR – National Inventory Report
- PA – Paris Agreement
- PaMs – Policies and Measures
- SBSTA – Subsidiary Body for Scientific and Technological Advice

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SIDS – Small Islands Developing State

TA – Technical Analysis

TACCC – Transparency, Accuracy, Completeness, Consistency and Comparability

TER – Technical Expert Review

TR – Technical Review of Information

UNFCCC – United Nations Framework Convention on Climate Change

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