



Utility Regulatory
Authority



Ministry of Climate Change,
Environment and Energy

Training on Energy Statistics and Energy Balance

30th January 2025

CBIT Maldives

Capacity Building for Improved Transparency of Climate
Change Mitigation and Adaptation Actions in the Maldives



Emissions

Introduction to The New
Requirements for
Reporting National GHG
Inventories And NDC
Tracking Under the ETF of
The Paris Agreement

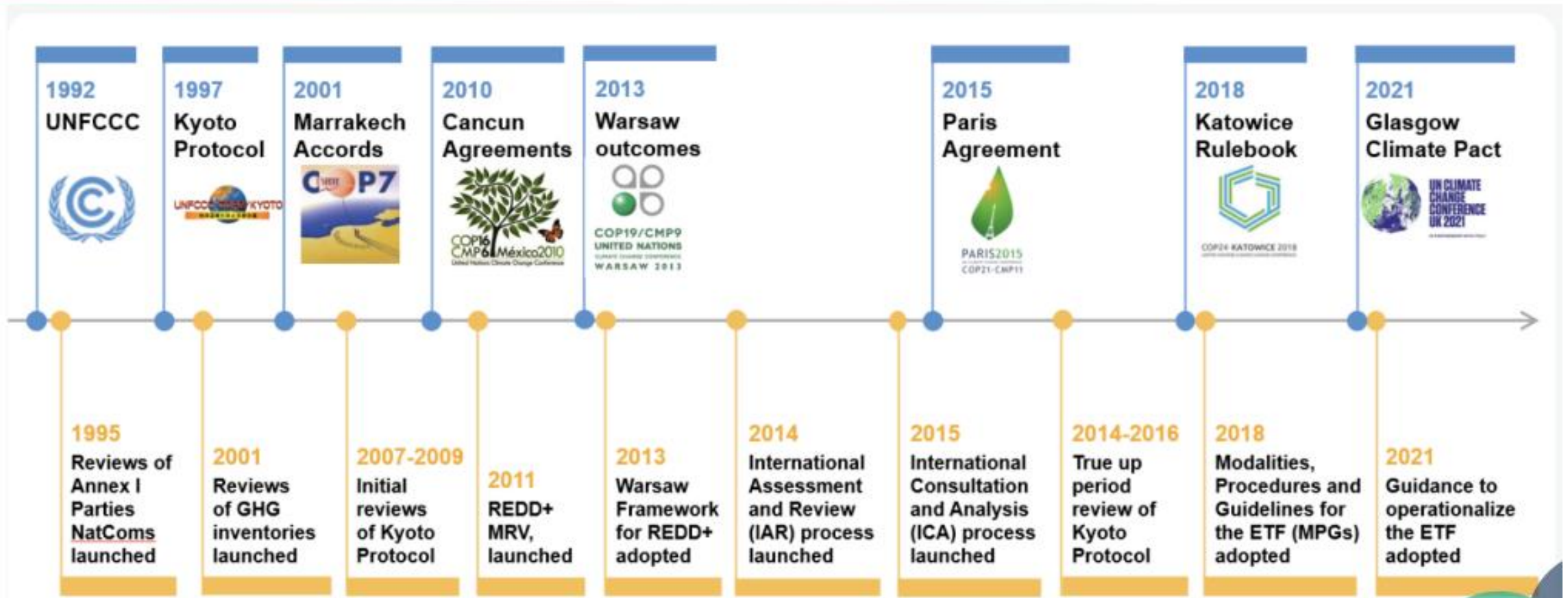
Nimashi Fernando



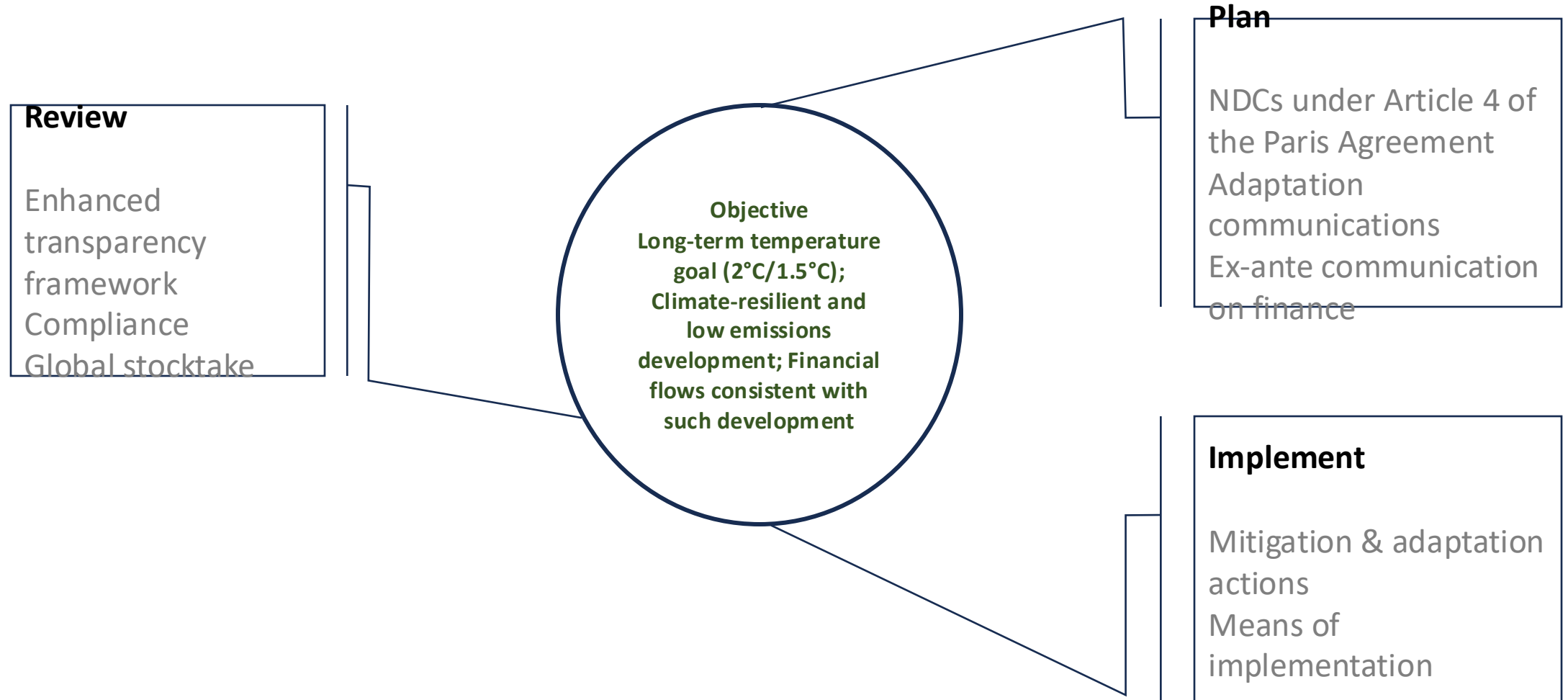
Introduction

- The energy system in Maldives is heavily dependent on fossil fuels.
 - In the past, it was diesel generators only
 - Now, integration of solar PV has introduced some complexity to emission calculations
- Combustion of fossil fuels emit carbon dioxide among other greenhouse gasses.
 - Apart from this, methane generated from decomposing waste and refrigerants used in HVAC systems contribute heavily to global warming
- Emission calculations are straightforward for the Maldives.
 - It is a complex affair for countries which host large number of generators in a connected national grid
 - Calculation of Grid Emission Factor (GEF) and Average Emission Factor (AEF) needs to be done annually
- The quantity of combusted fuel should be multiplied by the emission factor.
 - Maintaining good record of fuel use is a must

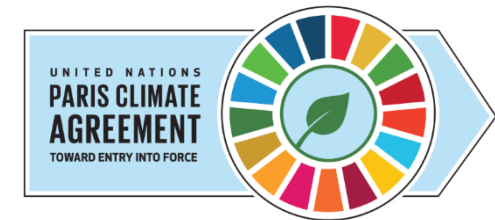
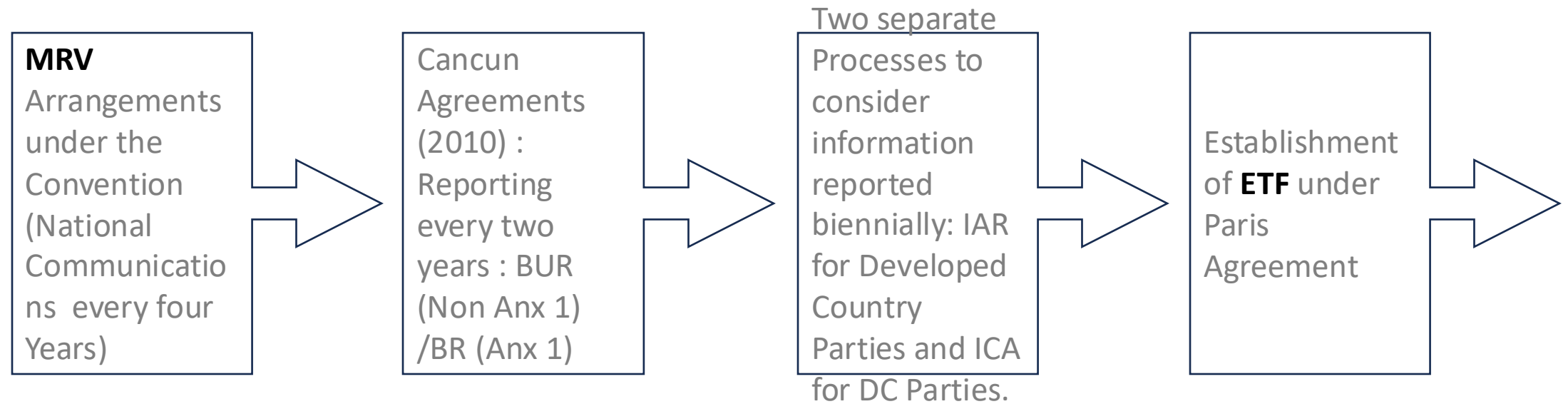
Transparency negotiations



Paris Agreement – Going beyond ambitions



From MRV to ETF



IAR Process: International Assessment and Review
ICA Process: International Consultation and Analysis



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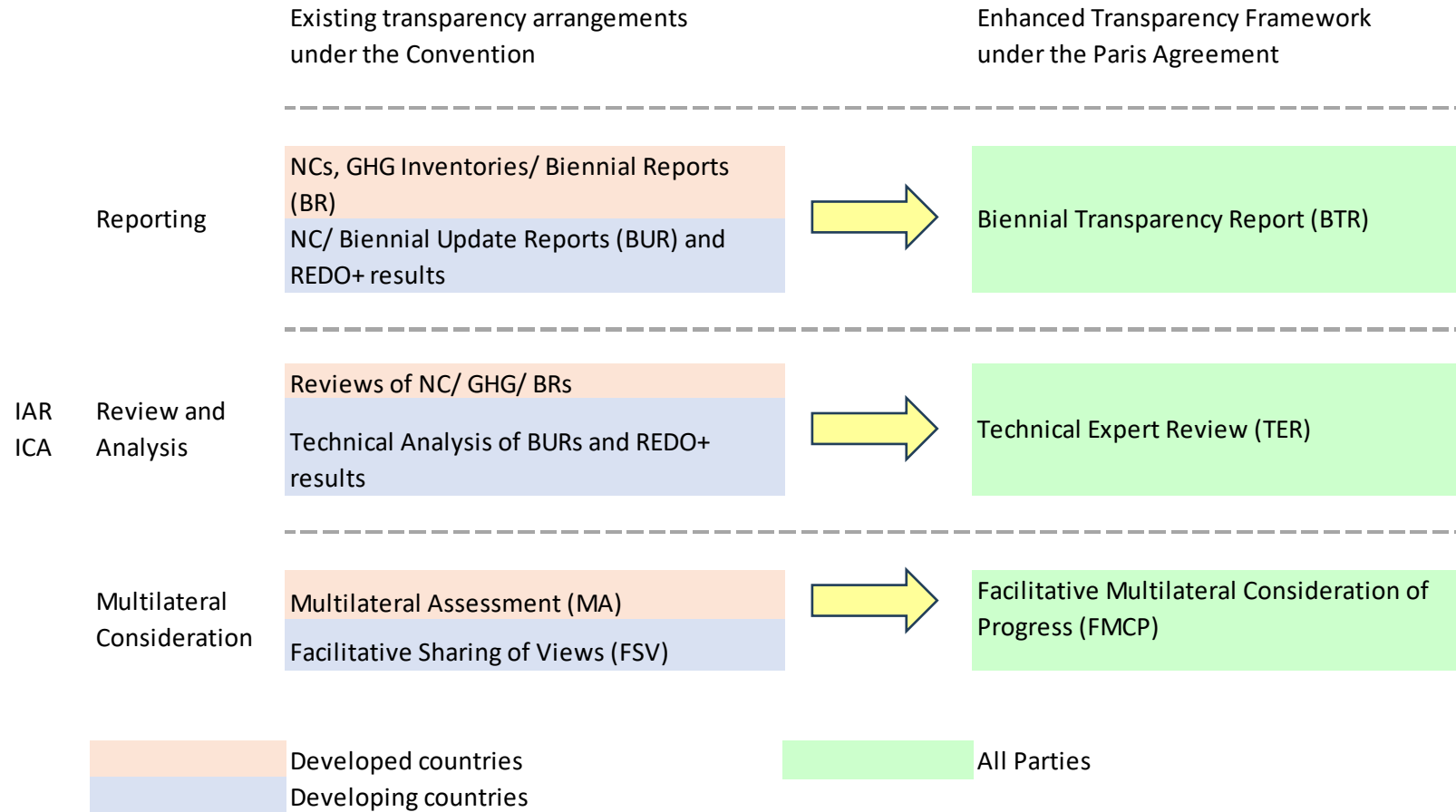
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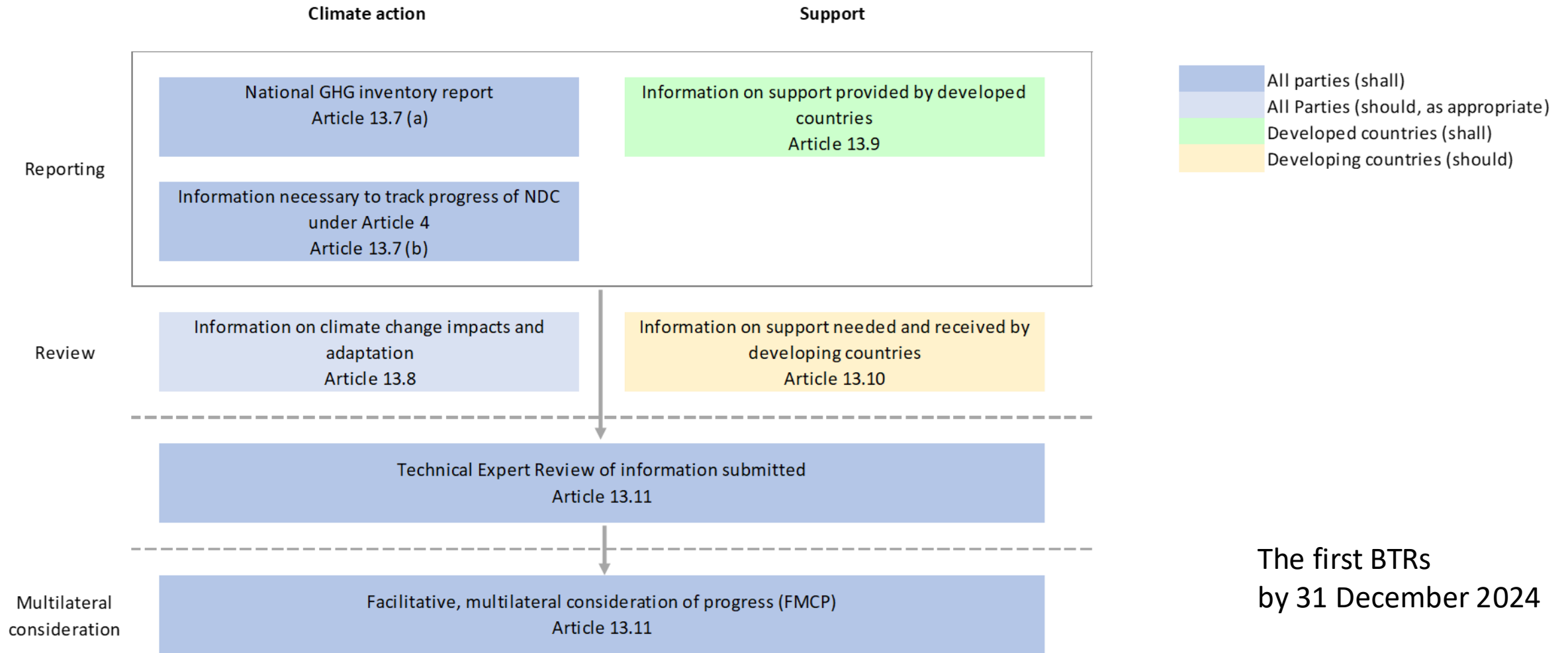
The Paris Agreement and the ETF

- Article 13 decision 18/CMA.1, Paris Agreement adopts the enhanced transparency framework (ETF) for action and support.
- The ETF is a common framework applicable to all Parties, with specific flexibility provisions provided to DC Parties that need it in the light of their capacities in its implementation.
- Article 13 of the Paris Agreement goes on to outline the core elements of the ETF, which include reporting, the TER and the FMCP.

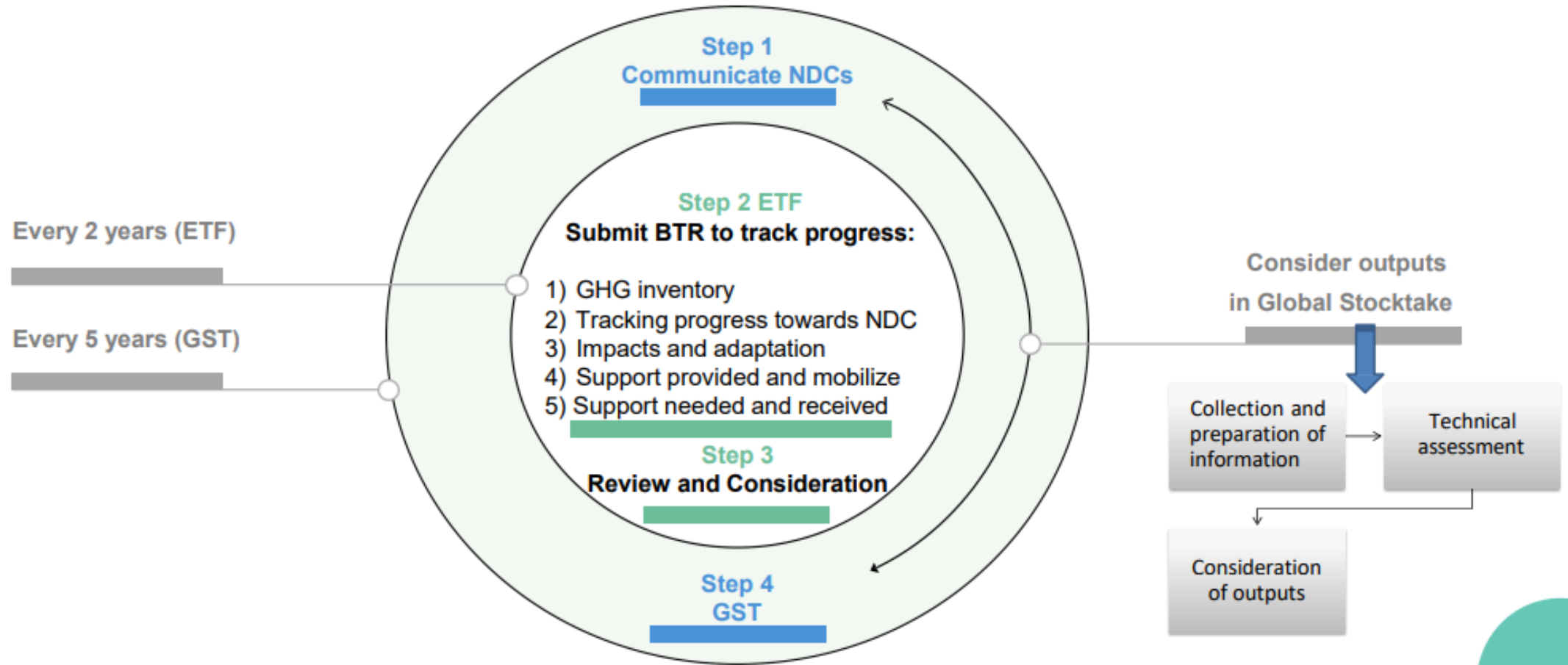
Difference between MRV and ETF



Outline Of the Core Elements of the ETF Under the PA



Paris Agreement – Linking NDCs, ETF and GST



Relevance for GHG inventories and NDC Tracking

- GHG Inventories form the basis for accountability framework: principles and methodologies used, shared taxonomy, nomenclatures etc.
- GHG inventories cover all anthropogenic (man made) emission sources and probable carbon storage (sinks)
- Establishing and maintaining a good GHG inventory which gives out regular / accurate estimates is an essential prerequisite for NDC tracking.
- Climate policy development is often misdirected without a proper GHG inventory in operation (for a longer period)
- Essentially a time series of climate data that presents the historical trends, which can be used to generate future pathways and trends.
- Strongly interlinked to the energy data repository of a country
 - if energy data is intact, climate data can be easily derived

Main Components of a GHG Inventory

- Emissions are accounted for at the source where they are emitted or sequestered (sinks) under the IPCC guidelines and the UNFCCC.
- The emission sources fall into five main sectors:
 - Energy (combustion of fuels in energy supply and use, transport and fugitives, excluding non-energy uses)
 - Industrial Processes and Product-use – IPPU (process and product emissions occurring in the industry from chemical and physical transformation)
 - Agriculture (food crops, livestock and agricultural soils)
 - Land Use, Land-use Change and Forestry LULUCF (changes in the carbon stock due to deforestation – or reforestation – and land use changes)
 - Waste (solid and liquid waste treatment plants)

Tracking Ndc's Using GHG Inventories

- Energy balance and energy data arranged in a time series can be used to generate emission data from the energy sector operations
- Historical data will provide the baseline energy data from which the historical emission data too can be derived, which can be used for baseline estimates
- Once the baseline estimates are made, various Policies and Measures (PaMs) can be proposed for emission reductions
- Implementation of any PaM coupled with the relevant MRV system will generate a reduced emission profile compared to the Business as Usual (BaU) or Without Measures (WoM) scenario
- Designing indicators specific to the target for a given PaM is an absolute necessity in evaluating its progress.
- Tracking NDCs is essential, not only to gauge the success of a given PaM, but also to update and derive new PaMs for NDC 3.0 and beyond.

BTR – the reporting vehicle for the ETF

1/ National Inventory Report of GHG Emissions

All Parties
Mandatory

2/ Progress made in implementing and achieving the NDC

All Parties
Mandatory

3/ Climate change impacts and adaptation

All Parties
Optional

4/ Financial, technology transfer and capacity-building support provided

Developed country Parties
Mandatory
Other Parties that provide support
Optional

5/ Financial, technology transfer and capacity-building support needed and received

Developing country Parties
Optional

Information necessary to track progress made in achieving NDC

- A. National circumstances and institutional arrangements Should be used to show a comprehensive image of the country's particular context that might impact their progress towards NDCs, including institutional, legal, procedural arrangements for implementation.
- B. Description of a Party's NDC under Article 4 of the Paris Agreement, including updates Detailed description of the NDC, including all its parameters and any updates since the last report. The purpose is to ensure a clear understanding of the country's climate commitments and any changes therein.
- C. Information necessary to track progress The goal of this section is to outline how a country tracks its progress towards meeting its NDCs. It involves detailing the specific indicators used and sharing the most recent data related to these indicators.

Information necessary to track progress made in achieving NDC

- D. Mitigation Policies, Actions, and Plans Section that presents policies, actions and plans in place to mitigate climate change. The goal is to highlight the measures being taken to reduce GHG emissions and the effectiveness of these measures. (Flexibility)
- E. Summary of GHG Emissions and Removals Provide a succinct summary of a country's GHG emissions and removals. This information is especially important for countries submitting a standalone national inventory report.
- F. Projections of GHG Emissions and Removals Projection of future GHG emissions and removals, based on current mitigation policies and measures. This helps to identify the potential future trajectory of a country's GHG emissions. (Flexibility)
- G. Other Information Any additional information that helps understand the progress in implementing and achieving their NDCs. This could include any unique initiatives, challenges, or plans that are relevant to the NDC progress.

Use of Energy Statistics for Emission Reporting

Harsha Wickramasinghe



Estimation of Emissions Generated in the Energy Sector

- Use of petroleum for electricity generation and as transport and cooking fuels results in emission of green house gases including CO₂, CH₄, and N₂O.
- However, among the emissions, carbon dioxide (CO₂) is the most prominent.
- From the national energy balance, CO₂ emissions from all energy consuming sectors are calculated
- IPCC Guidelines for National Greenhouse Gas Inventories–2006 is used for the calculation
- Tier 1 approach described in the guideline can be adopted owing to the paucity of detailed data
- Following primary relationship between emissions and fuel consumption is used to calculate CO₂ emissions;

$$\text{CO}_2 \text{ Emissions} = \text{Fuel consumption} * \text{Emission factor}$$

Relevant Chapters of IPCC Guideline Used in Emission Calculations

- Chapter 3 – Mobile Combustion of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories was referred for;
 - Transport – diesel, petrol and Jet A1 consumption
 - Agriculture – diesel consumption in fishing boats
- Chapter 2 – Stationary Combustion of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories was referred for;
 - Industry – electricity
 - Resorts – electricity and LP gas
 - Household, commercial and other – electricity and LP gas

Emission Factors

Type of fuel	Density	Energy content		Emission factor
	g/cm ³	GJ/tonne	toe/tonne	tCO ₂ /toe
Diesel	0.84	43.33	1.04	3.06
Petrol	0.75	44.80	1.07	2.84
Jet A1	0.80	44.59	1.07	2.92
LP gas	0.54	47.31	1.13	2.57

Emissions from an Electrical System – Sample Calculation



- A remote outpost of a Government agency
- A simple diesel generator
 - Use 35 litres of diesel / day
 - Gives out 108kWh per day

Emission Factor of Off-Grid Generator

- Amount of fuel used = 35 litres / day
- Density of diesel = 0.859473 kg/m³
- Weight of diesel = 35x0.859473 = 30.08
- Amount of CO₂ emitted = 30.08x2.74 = 88.51 kgCO₂/day
- Emission factor = CO₂ emitted / kWh generated
= 88.51/108
= 0.81949 kgCO₂/kWh
 - Annual emission = 88.51x365 = 32.306 tCO₂

Possible Improvements

- Generation system upgrade
 - Replace air filter, repair engine, clean injector nozzles etc.
- Now only 28 litres (24.07kg) of fuel is needed per day
 - To generate same 108 kWh

Amount of CO₂ emitted = $24.07 \times 2.94 = 70.77 \text{ kgCO}_2/\text{day}$

• Emission factor = CO₂ emitted / kWh generated
= $70.77/108$
= $0.65523 \text{ kgCO}_2/\text{kWh}$

• Annual emission = $65.94 \times 365 = 25.831 \text{ tCO}_2$

Energy Efficiency

- Reduce demand for electricity by changing all lamps to LED light sources
 - Now Maha Eliya need only 87kWh/day

$$\begin{aligned}\text{Amount of CO}_2 \text{ emitted} &= \text{emission factor} \times \text{generation} \\ &= 0.65523 \text{ kgCO}_2/\text{kWh} \times 87\text{kWh/day} \\ &= 57.01 \text{ kgCO}_2/\text{day}\end{aligned}$$

$$\bullet \text{ Annual emission} = 57.01 \times 365 = 20.806 \text{ tCO}_2$$

Renewable Energy

- Develop a rooftop solar system to reduce diesel generation
 - Roof space available can only house 13.5kW_p capacity
 - Solar generation 13.5x4 = 54 kWh (assumption)
 - Now the office need only (87-54) 33kWh/day of diesel power

Amount of CO₂ emitted = emission factor x generation
= 0.65523 kgCO₂/kWh x 33kWh/day
= 21.62 kgCO₂/day

- Emission factor = CO₂ emitted / kWh generated
= 21.62/87
= 0.24854 kgCO₂/kWh

- Annual emission = 21.62x365 = 7,891 tCO₂

Thank you!