

Using F-gases data for reporting for the Kigali Agreement to the Montreal Protocol

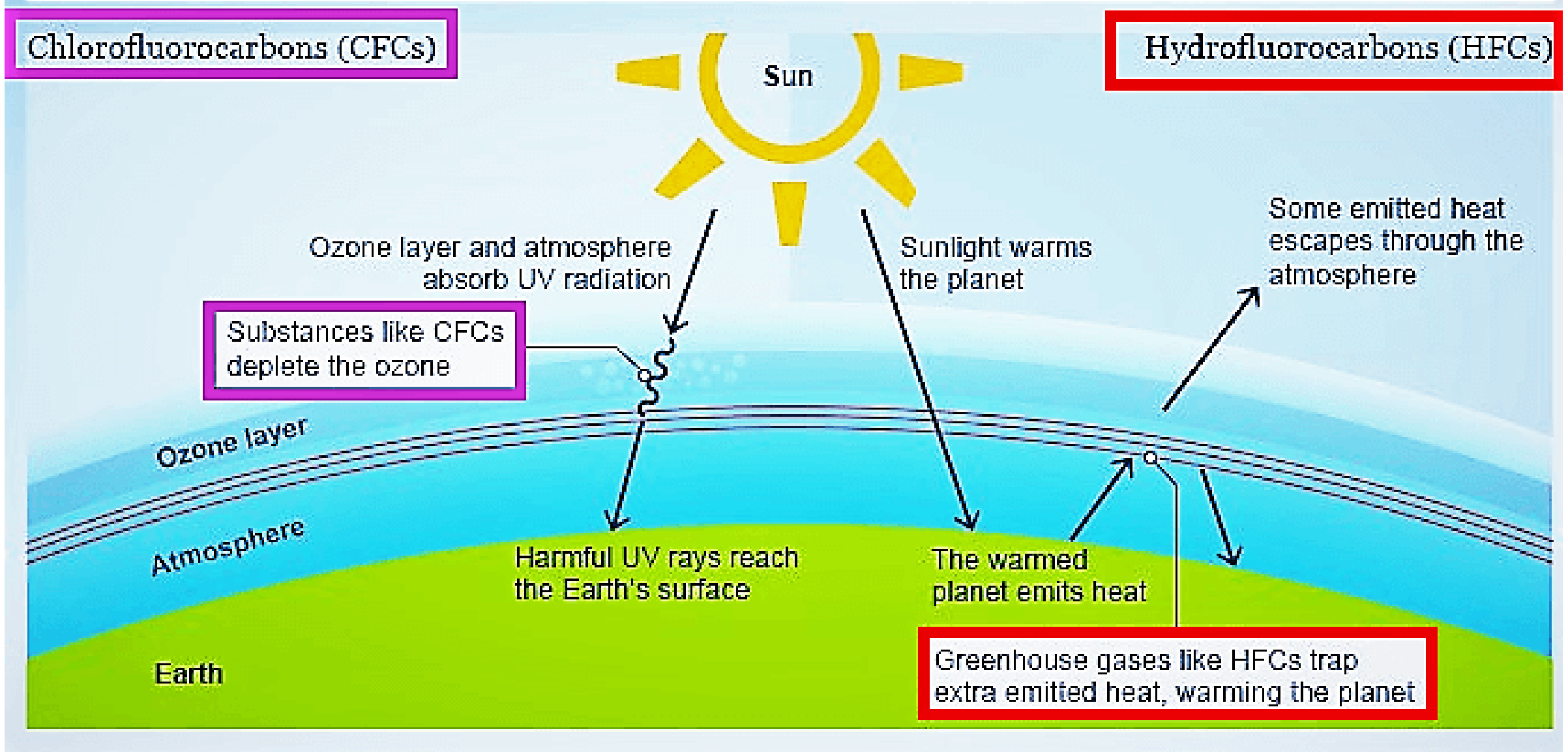
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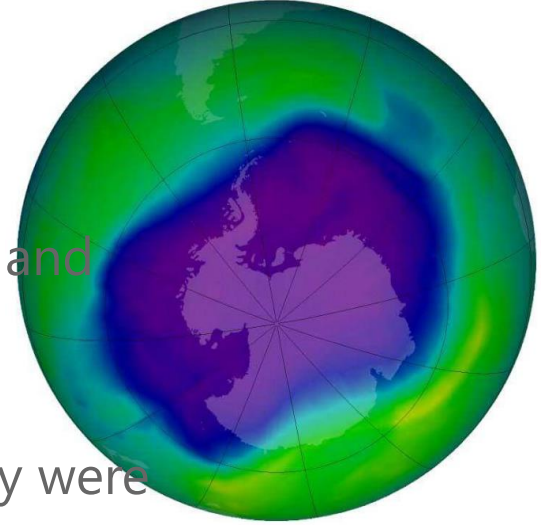


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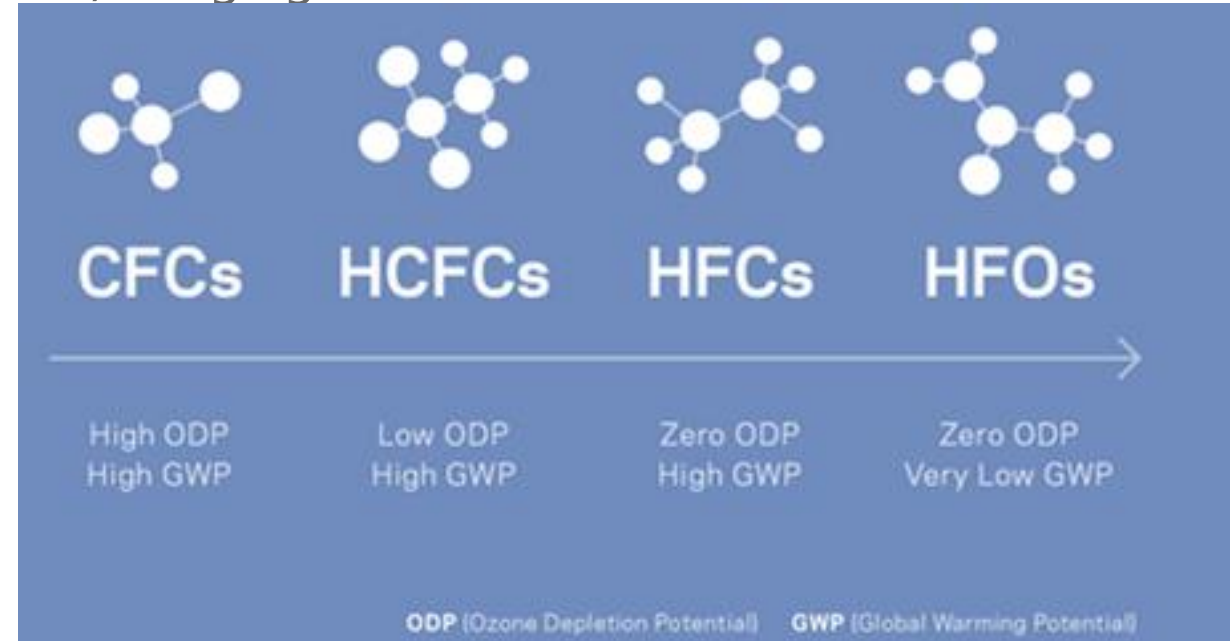
How Ozone-depleting substances affect the atmosphere



Which chemicals are added?



- Hydrofluorocarbons (HFCs) are organic compounds containing hydrogen, carbon, and fluorine.
- HFCs are commonly used as substitutes for Ozone-depleting substances like Chlorofluorocarbons (CFCs) and are used in refrigerators and air conditioners. They were introduced in the 1990s.
- While not ozone-depleting substances themselves, HFCs are greenhouse gases that can have high or very high global warming potentials (GWPs), ranging from about 12 to 14,800.
- HFCs are therefore reported in national GHG inventories, which is the main source for baseline and phase-down calculations under the Kigali amendment.
- **Next steps:** a new generation of low ODP and low GWP refrigerants, e.g., hydrofluoro olefin (HFO) that contain at least one double bond between the carbon atoms.



The Kigali Amendment to the Montreal Protocol: HFC Phase-down



- The Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer reached an agreement at their 28th Meeting of the Parties on 15 October 2016 in Kigali, Rwanda to phase down hydrofluorocarbons (HFCs). The Amendment entered into force on 1 January 2019.
- It is a legally binding agreement between the signatory parties with non-compliance measures.
- The Agreement gives clear, concrete, and mandatory targets with fixed timelines to the signatory parties to achieve their targets.
- Globally, it would prevent the emission of HFCs equivalent to 70 billion tons of CO₂.
- Fiji ratified the Kigali amendment on 16 Jun 2020 and committed to phasing down hydrofluorocarbons (HFCs) by 80% by 2045. Fiji is in Group 1 under Article 5 Countries HFC phasedown (Developing Countries).

Baseline calculation – Kigali requirements

- The Kigali Amendment specifies how to calculate the baseline for HFC consumption and production and the timetable of HFC phase-down steps.
- The same baselines apply to consumption and production.
- All data is measured in tonnes CO₂e.
- The baseline is made up of two components:
 - the average annual HFC quantity consumed (or produced) during a 3-year baseline period
 - a proportion of the baseline for the control of HCFCs under the Montreal Protocol Two components are required because A5 countries are only in the early stages of HCFC phase-out.

Applying GWP for calculating the Kigali baseline

- Progress towards the HFC phase-down targets under the Kigali Amendment will be measured in tonnes of CO₂ equivalent.
- To calculate tonnes of CO₂ equivalent (CO₂e) it is necessary to know the GWP (global warming potential) of each relevant gas.
- Global warming potential (GWP) is a measure of the relative global warming effects of different gases. The GWP indicates the amount of heat trapped by 1 tonne of a gas relative to the amount of heat trapped by 1 tonne of CO₂ over a specific period.
- Under the Kigali Amendment, a standard set of GWP values has been agreed for reporting the consumption and production of HFCs.
- The GWPs of HCFCs and HFCs are listed in Annex C and Annex F of the Montreal Protocol and are based on the 100-year GWPs in the IPCC 4th Assessment Report.

GWP of a blend

- Some HCFCs and HFCs are used as pure fluids e.g. HFC-134a in various RAC applications.
- Many of the commonly used HFCs are blends of two or more individual HFC chemicals.
- If non-HFC components are included in the blend, they are removed for the Kigali calculation purposes
- The GWP of a blend is the weighted average of the GWPs of the blend components.
- **An example of calculation of GWP of a blend:**

A widely-used blend is R-404A. It consists of:

52% HFC-143a + 44% HFC-125 + 4% HFC-134a

GWPs: HFC-143a: 4470 HFC-125: 3500 HFC-134a: 1430

Blend GWP = 52% * 4470 + 44% * 3500 + 4% * 1430
= 3922

Group	Fluid	Montreal Protocol Standard GWP Value
HFCs	HFC-134a	1 430
	HFC-227ea	3 220
HFC blends	R-404A	3 922
	R-410A	2 088
HCFCs	HCFC-22	1 810
	HCFC-141b	725

- The GWPs of HCFCs are of importance because they form part of a country's baseline consumption

Calculating amounts of GHGs or blends in kt CO₂e

- Amount of CO₂e is the GWP-weighted quantity of a gas.
- Tonnes of CO₂ equivalent (t CO₂e) is a common metric used by the Montreal Protocol for reporting.
- Tonnes CO₂e is calculated by multiplying the mass of gas (in tonnes) by the GWP (global warming potential) of that gas. The GHG inventory (and often, the MP reports) uses 1000 tonnes (=kt) metric instead of tonnes for a better presentation.
- kt CO₂e is calculated by multiplying the mass of gas (in tonnes) by the GWP (global warming potential) of that gas and dividing the result by 1000. This calculation might be useful to compare and QC the phase-out interim results with the GHG inventory.

For example, the tonnes CO₂ equivalent of 100 kg of HFC 404A is calculated as follows:

CO₂ equivalent = mass (in tonnes) x GWP

Mass = 100/1 000 = 0.1 tonnes

GWP of R-404A = 3 922

Hence 100 kg R-404A is 0.1 x 3 922 tonnes CO₂e
= 392.2 tonnes CO₂e

Specific Kigali requirements to A5 Group 1

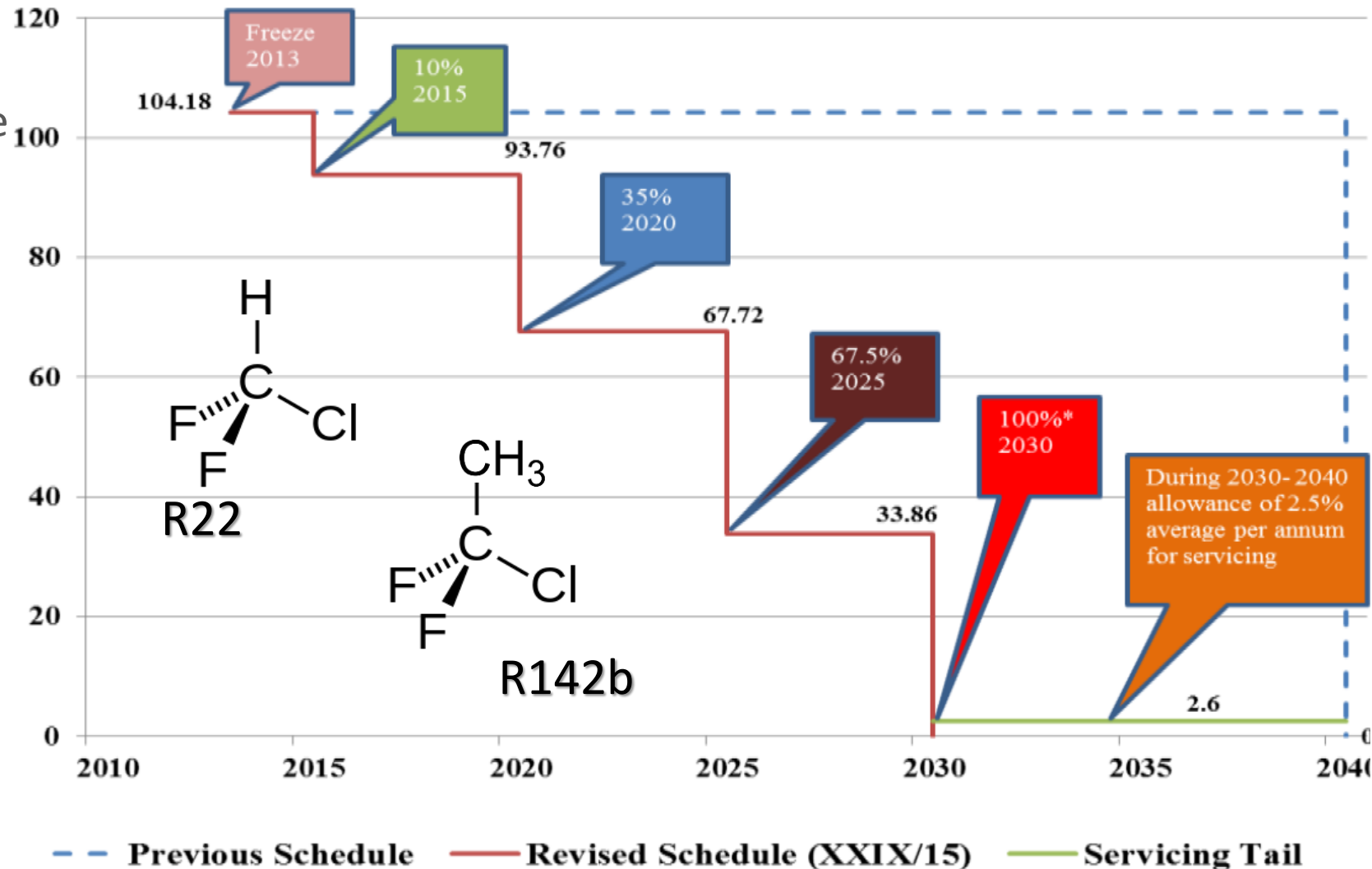
- Each Party operating under paragraph 1 of Article 5 will be obliged to calculate its consumption baseline through an average of its calculated levels of consumption of Annex F controlled substances (HFCs) for the years 2020-2022, plus 65% of its baseline consumption of Annex C (CFCs, and HCFCs, and bromodichloromethane), Group I, controlled substances

	Non-A5, earlier start	Non-A5, later start	A5 Group 1	A5 Group 2
HFC component Average HFCs in period	2011 to 2013		2020 to 2022	2024 to 2026
HCFC component % of HCFC baseline	15%	25%	65%	

Fiji's obligation

HCFC baseline in Fiji

- Fiji's Baseline Survey for HCFC was done in 2009-2010. The Original Fiji's baseline for HCFCs was established at 152.83 t HCFCs
- This was later revised through Decision XXIX/15 in 2015 with the revised amount of 104.18MT (5.73 ODP tonnes).
- The baseline was reduced from 152.83t to 104.18t with the removal of 48.65t for the ODS supply of Foreign Flagged Fishing Vessels (FFFV)
- According to the government of Fiji, the two ODS subject to the HCFC baseline are **HCFC-22 (R22)** and **HCFC-142b** (Freon-142b or R142b)



Calculating HFC phase-down under the Kigali – starting point

- The baseline, or starting point, for the amount of HFCs a country can consume (consumption being import minus export), is calculated for each country using the following formula:

*Average HFC consumption for the period 2020–22 plus 65%
of the hydrochlorofluorocarbon (HCFC) baseline*

- The HCFC component bolsters a country's HFC baseline to allow for growth. It does not change any obligations countries have regarding HCFCs.
- Under the Kigali Amendment, Fiji will start the phase-down in 2024 and by 2029, will achieve the first step of a reduction of 10% from their calculated baseline.

Example of calculating the Kigali baseline

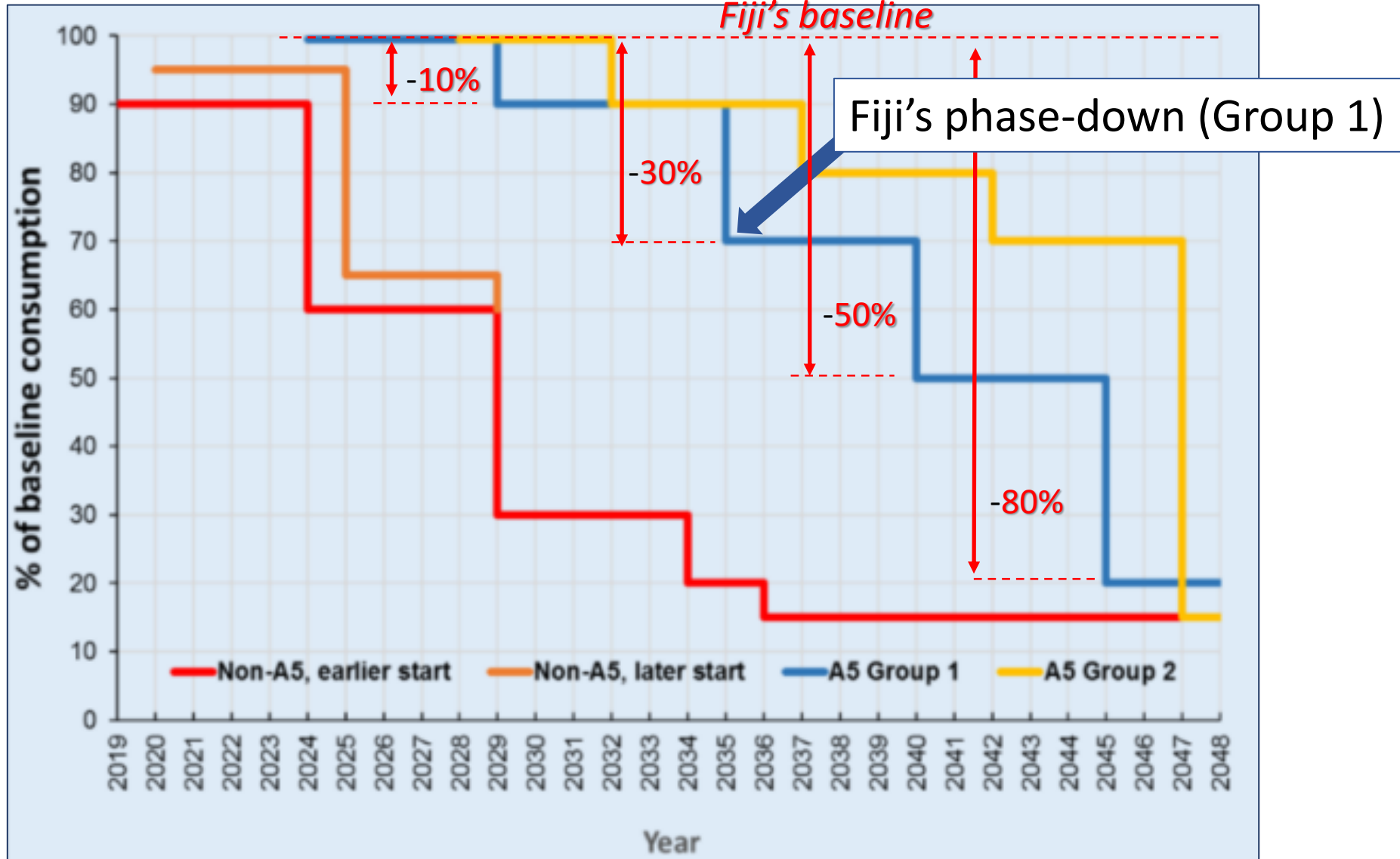
Example Baseline Calculation for a fictional Country in A5 Group 1

Fluid	Average annual tonnes	GWP	Tonnes CO ₂ e (000s)
	2020 to 2022		
HFC-134a	5 000	1 430	7 150
R-404A	2 500	3 922	9 805
R-410A	3 300	2 088	6 890
	2009 to 2010		
HCFC-22	8 000	1 810	14 480
HCFC-141b	1 000	725	725
Total Baseline, thousand tonnes CO₂e HFC component + 65% HCFC component			33 730

Phase down schedule for Fiji

Article 5 Parties: Group 1	
Baseline Years	2020, 2021 & 2022
Baseline Calculation	Average production/ consumption of HFCs in 2020, 2021, and 2022 Plus 65% of HCFC baseline production/ consumption
Reduction Steps Freeze	2024
Step 1	2029 10%
Step 2	2035 30%
Step 3	2040 50%
Step 4	2045 80%

Phase-down Commitments: HFCs Phasedown Schedule



Example of calculation of the first reduction under the Kigali

Fluid	Average annual tonnes	GWP	Tonnes CO ₂ e (000s)
	2020 to 2022		
HFC-134a	5 000	1 430	7 150
R-404A	2 500	3 922	9 805
R-410A	3 300	2 088	6 890
	2009 to 2010		
HCFC-22	8 000	1 810	14 480
HCFC-141b	1 000	725	725
Total Baseline, thousand tonnes CO₂e HFC component + 65% HCFC component			33 730



Step 1	10% reduction by 2029
Baseline (kt CO ₂ e)	33,729
1st reduction step	10%
Amount of HFCs reduced	3,373
Amount of HFCs after the reduction	30,356

Data needed for baseline and further reporting

- For HFCs – the data from the GHG inventory, specifically:
 - Consumption of HFC blends or/and individual chemicals used in Fiji in 2020-22 – from Fiji Revenue & Customs Services – for the baseline calculations
 - Actual or modeled data for HFC consumption (as individual chemicals or blends) for the entire time series
 - Data on the composition of blends imported in Fiji (per blend) – default values (2006 IPCC GLs)
- Baseline value of HCFCs in Fiji (updated - 104.18 tonnes, but this needs to be converted to CO₂e by gas)

HFC consumption modeling data:

- The economic growth rate;
- Annual Population growth
- Cooling demand, which could be a function of per capita ownership of refrigerators and air conditioners, and other equipment containing/using HFCs in that country; and
- Policies and measures adopted in the HPMP that may create a replacement demand for non-HCFC-based systems and/or may affect the HFC import figures.

Thank you!
Questions?