

Session II: Fluorinated Gas Emissions from Non-Annex I Parties

The Kigali Amendment and the Status of Reporting of Fluorinated Gases under the UNFCCC: Emissions, Methods, and Gaps

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CFC and HCFC Consumption

Source: United Nations Environment Programme "UNEP/GEO Core Indicators"

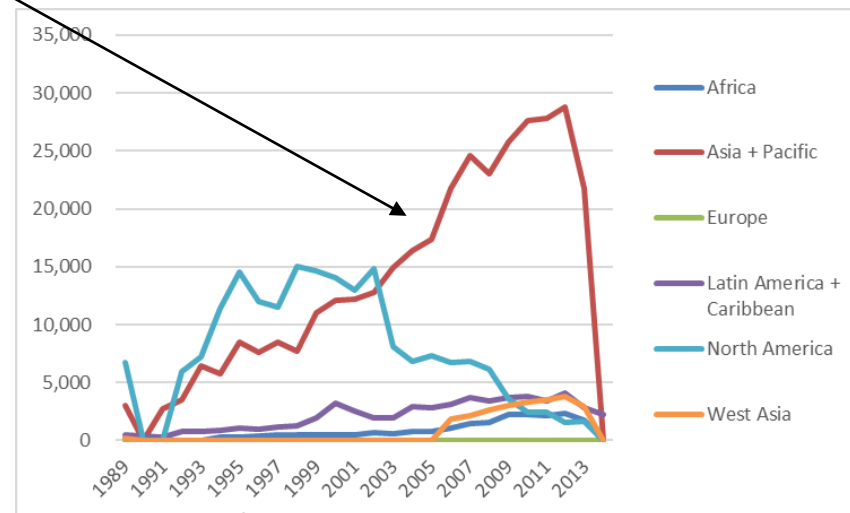
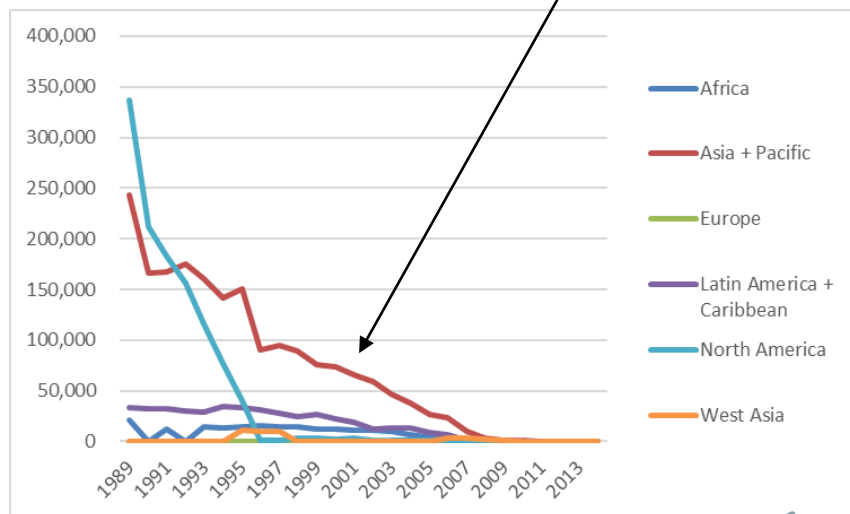
Asia + Pacific

HCFCs

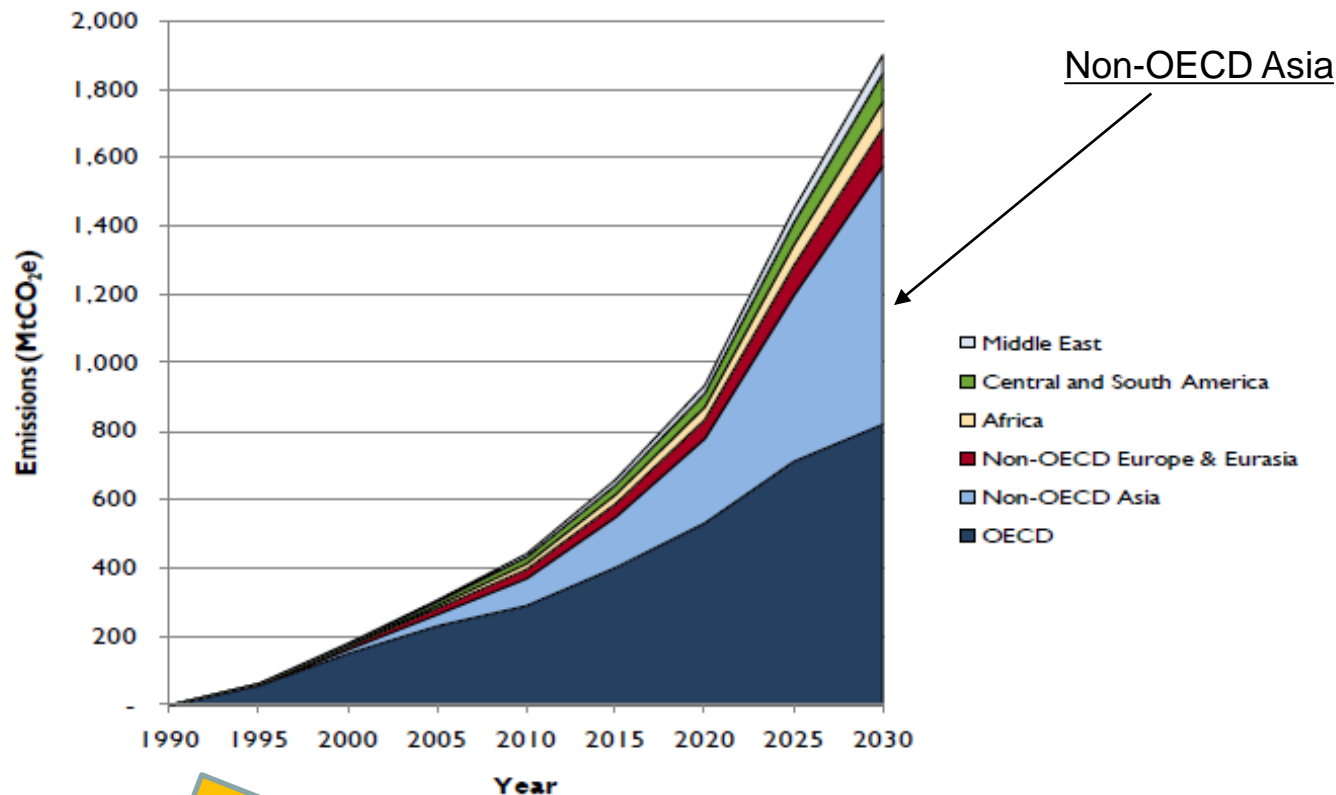
ODP-tonnes

CFCs

ODP-tonnes



HFC Emissions from ODS Substitutes



Source: US EPA "Global Anthropogenic Non-CO₂ Greenhouse Gas Emissions: 1990–2030 Revised December 2012"



The Kigali Amendment to the MP

- The inclusion of HFCs in the Montreal Protocol from the viewpoint of global warming countermeasures was under discussion since 2009. In October of 2016, at the 28th Meeting of the Parties (MOP 28) to the Montreal Protocol in Kigali, Rwanda, the amendment to newly include HFCs in the Protocol (the Kigali Amendment) was adopted.
- The agreed **phase-down** schedule is as shown in the table below.

	Developed countries	Developing countries Group 1	Developing countries Group 2
Baseline Years	2011 - 2013	2020 - 2022	2024 - 2026
Baseline Calculation (HFC+HCFC)	Average production /consumption of HFCs for baseline years + 15% of HCFC baseline production/consumption	Average production /consumption of HFCs for baseline years + 65% of HCFC baseline production/consumption	Average production /consumption of HFCs for baseline years + 65% of HCFC baseline production/consumption
Freeze year	-	2024	2028 *4
Reduction steps	2019: - 10% 2024: - 40% 2029: - 70% 2034: - 80% 2036: - 85%	2029: -10% 2035: - 30% 2040: - 50% 2045: - 80%	2032: - 10% 2037: - 20% 2042: - 30% 2047: - 85%

Note: For Belarus, the Russian Federation, Kazakhstan, Tajikistan and Uzbekistan, a 25% HCFC component of baseline and different initial two steps (1) 5% reduction in 2020 and (2) 35% reduction in 2025

Note: Developing countries Group 1: Developing countries other than Group 2

Note: Developing countries Group 2: India, Pakistan, Iran, Iraq, and Gulf countries

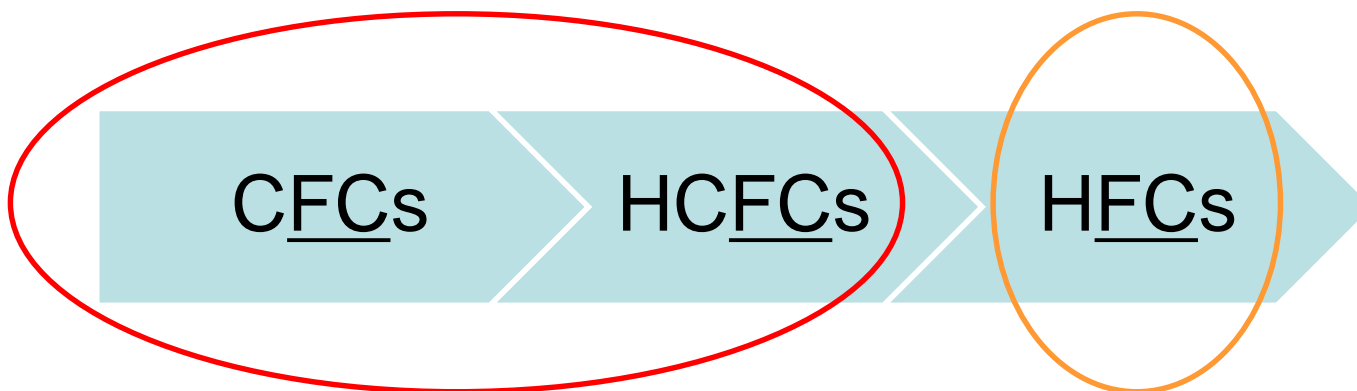
Note: 2028 Freeze year Developing countries Group 2: for Technology review four to five years before 2028 to consider the compliance deferral of two years from the freeze of 2028

Note: Reduction steps for all countries: for Technology review in 2022 and every five years

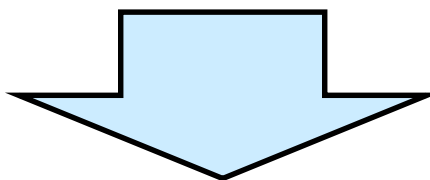
The Kigali Amendment to the Montreal Protocol

Montreal Protocol

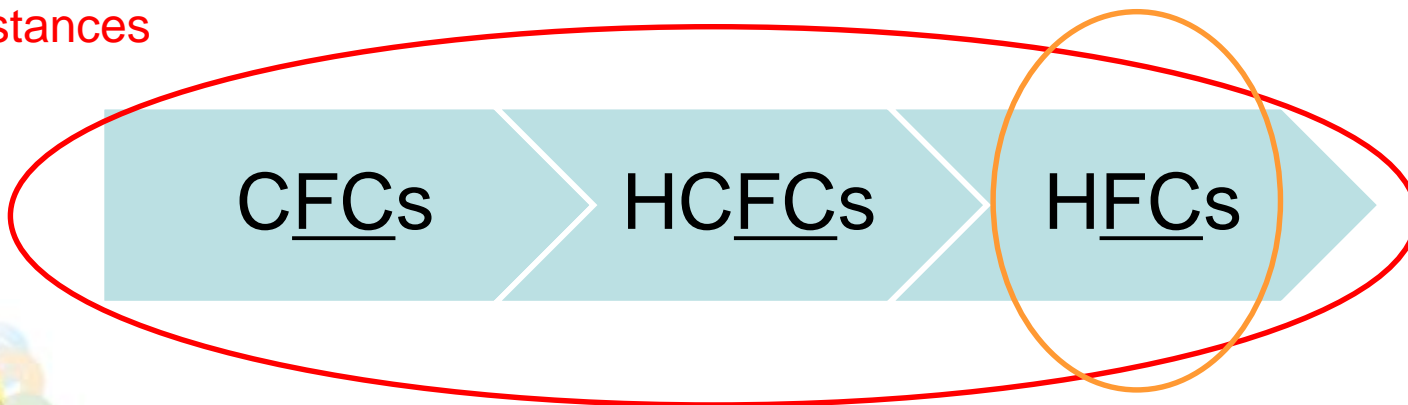
UNFCCC



production and consumption
of global warming
and ozone depleting
substances



emissions of global
warming substances



Gas coverage in UNFCCC

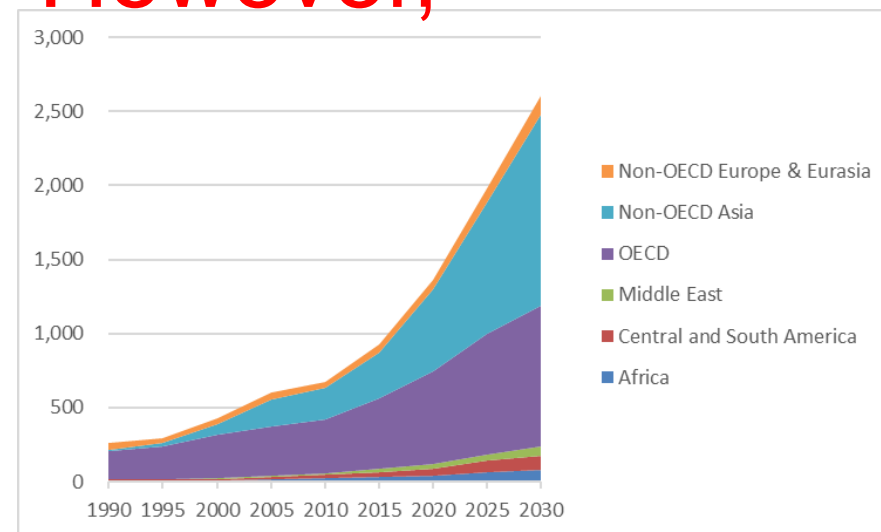
HFCs,
PFCs,
SF₆

CO₂,
CH₄,
N₂O

Letters in bold: Mandatory
Letters in black: Encouraged
(17/CP.8)

However,

F-gas Totals



Source: US EPA "Global Anthropogenic Non-CO₂ Greenhouse Gas Emissions: 1990–2030 Revised December 2012"



HFC reporting status for WGIA countries + Others

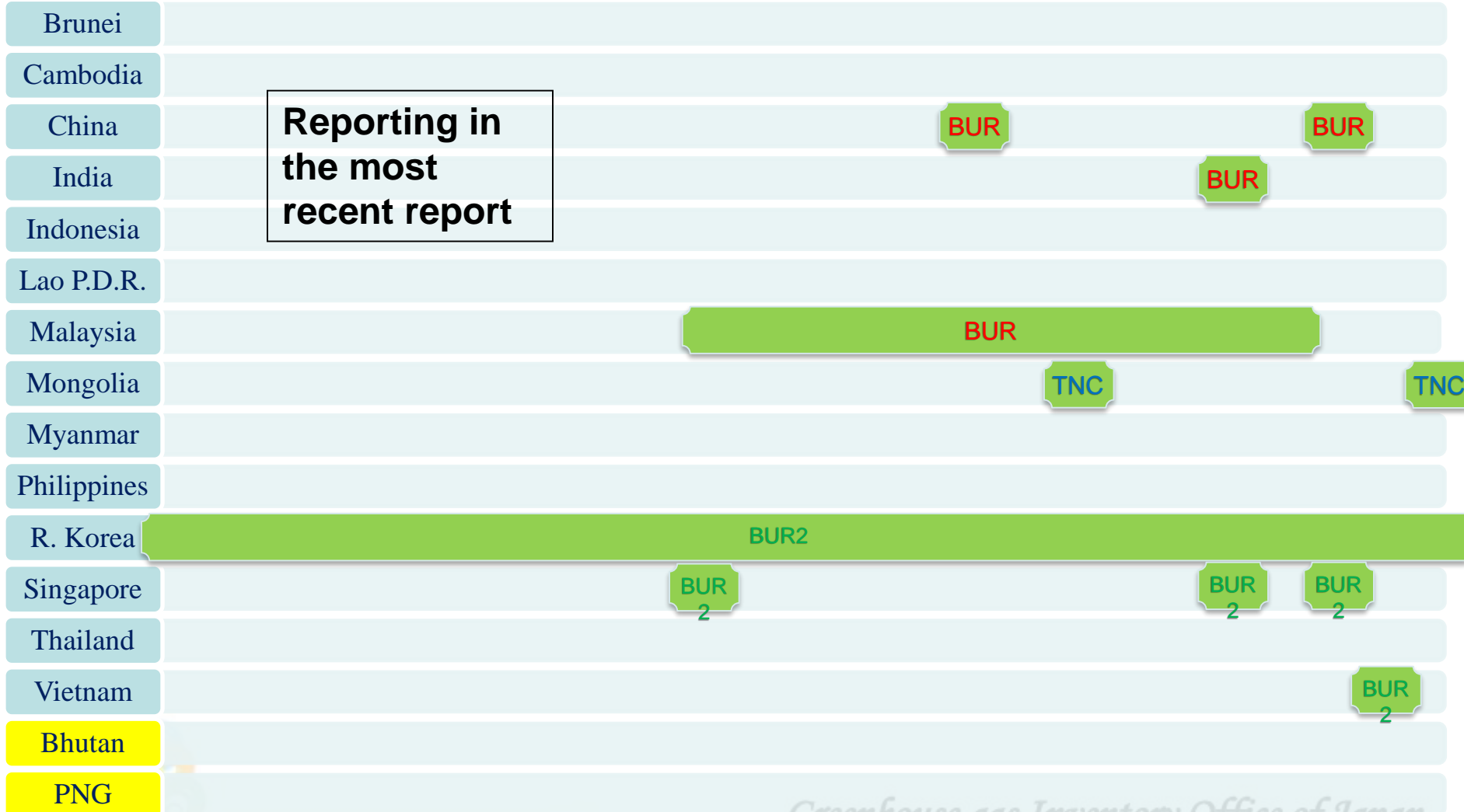
Based on information from UNFCCC web site



Inventory year

90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14

Reporting in the most recent report



Sources of HFCs

Fluorochemical Production

- By-product Emissions (e.g. HFC-23 from HCFC-22 production)
- Fugitive Emissions (e.g. Leaks from producing HFC-134a)

Metal Industry

- Magnesium Production

Electronics Industry (during manufacturing)

- Integrated Circuit/Semiconductor
- TFT Flat Panel Display
- Photovoltaics

Product Uses as Substitutes for Ozone Depleting Substances (from manufacturing, stocks, and disposal)

- Refrigeration and Air Conditioning
- Foam Blowing Agents
- Fire Protection
- Aerosols
- Solvents

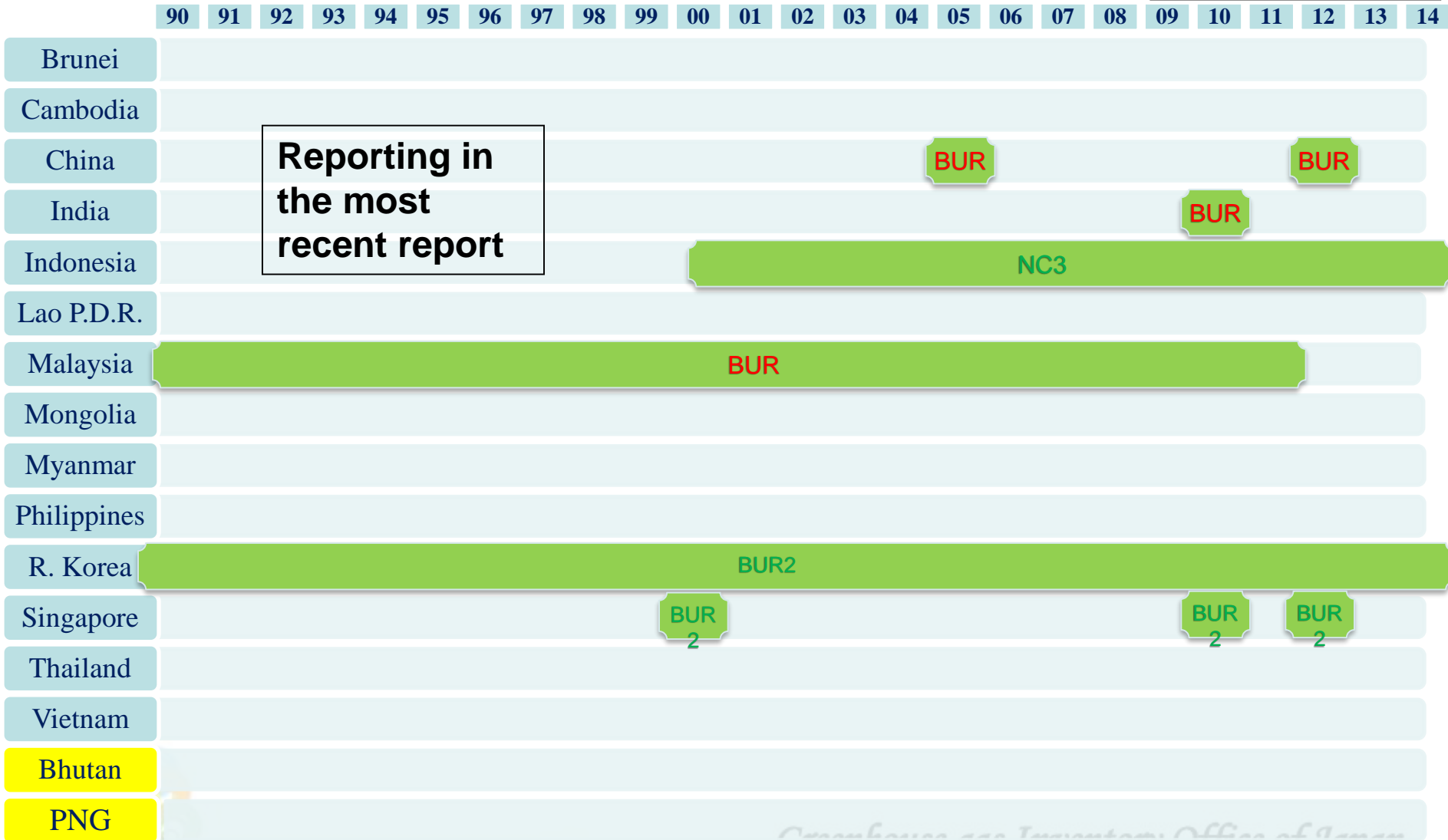
Typical delayed emissions

PFC reporting status for WGIA countries + Others

Based on information from UNFCCC web site



Inventory year



Reporting in the most recent report

Sources of PFCs

Fluorochemical Production

- By-product Emissions
- Fugitive Emissions (e.g. Leaks from producing PFCs)

Metal Industry

- Aluminium Production
- Magnesium Production

Electronics Industry (during manufacturing)

- Integrated Circuit/Semiconductor
- TFT Flat Panel Display
- Photovoltaics

Product Uses as Substitutes for Ozone Depleting Substances (from manufacturing, stocks, and disposal)

- Refrigeration and Air Conditioning
- Fire Protection
- Aerosols
- Solvents

Other Product Manufacture and Use

- Electrical Equipment



Typical prompt emissions



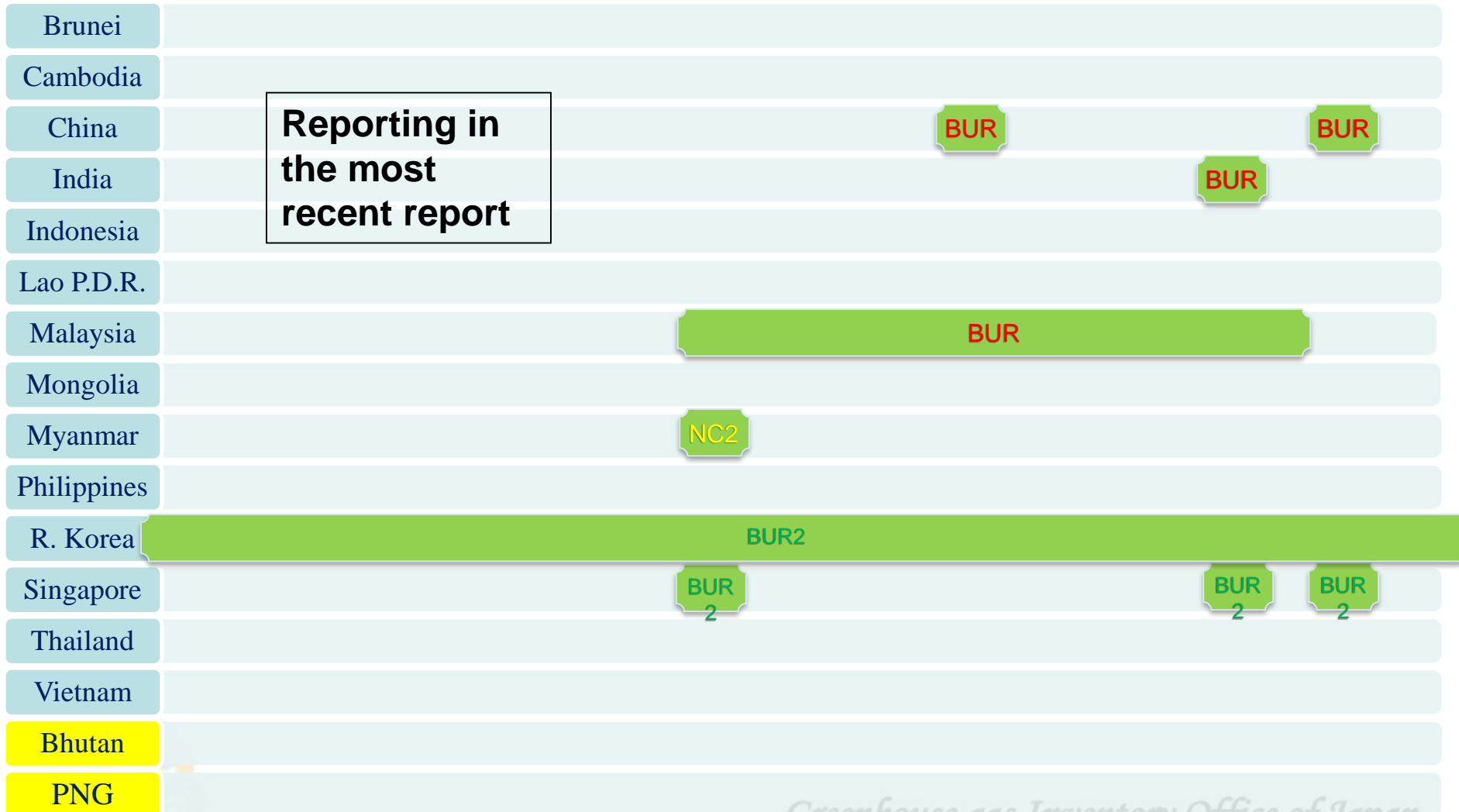
SF₆ reporting status for WGIA countries + Others

Based on information from UNFCCC web site

Inventory year

90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14

Reporting in the most recent report



Sources of SF₆

Fluorochemical Production

- By-product Emissions
- Fugitive Emissions (e.g. Leaks from producing SF₆)

Metal Industry

- Magnesium Production

Electronics Industry (during manufacturing)

- Integrated Circuit/Semiconductor
- TFT Flat Panel Display
- Photovoltaics

Other Product Manufacture and Use

- Electrical Equipment
- SF₆ and PFCs from Other Product Uses (e.g. Accelerators)



Estimation Methodology

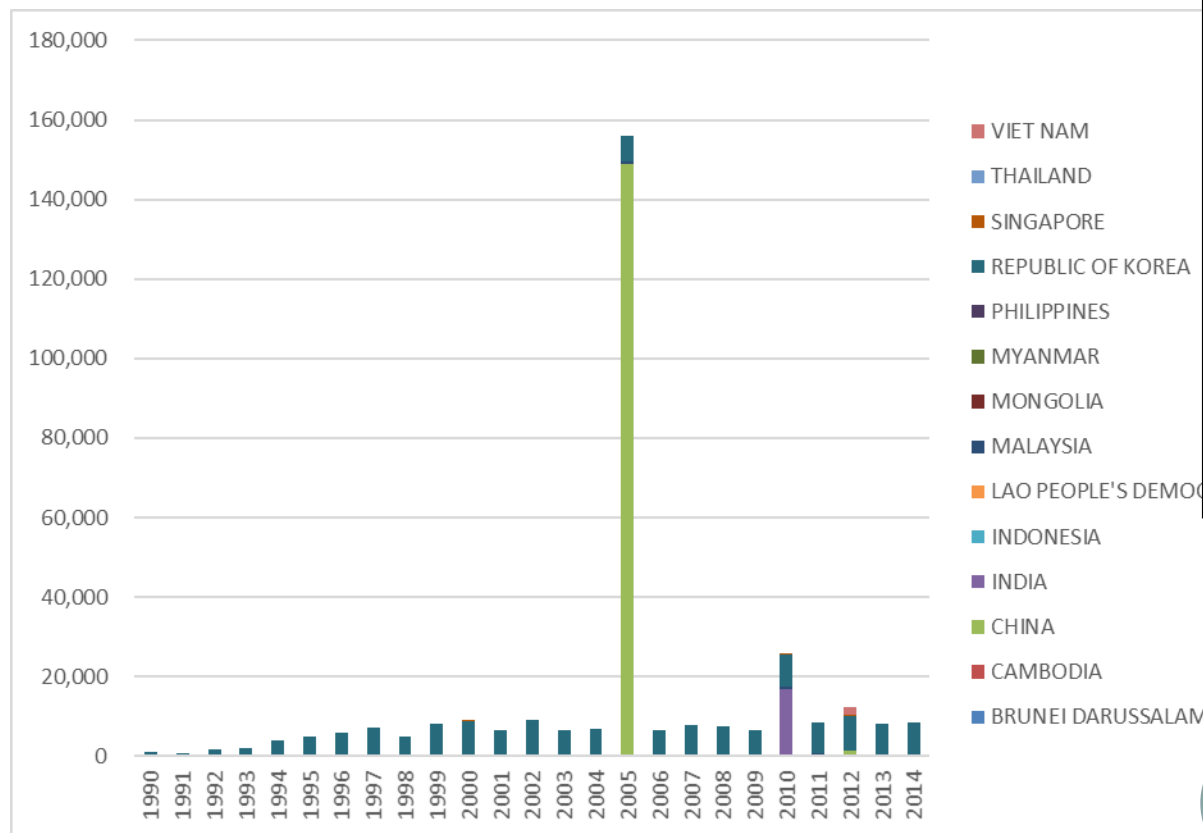
	HFCs	PFCs	SF ₆
Brunei	---	---	---
Cambodia	---	---	---
China	1996/GPG Tier 1	1996/GPG Tier 1	1996/GPG Tier 1
India	NO	NO	NO
Indonesia	---	2006 Tier 2	---
Lao P.D.R.	---	---	---
Malaysia	1996 Tier 1, Tier 2	1996 Tier 1	1996 Tier 1
Mongolia	2006 Tier 1	---	---
Myanmar	---	---	---
Philippines	---	---	---
R. Korea	NO	NO	NO
Singapore	2006 Tier 2	2006 Tier 2	2006 Tier 2
Thailand	---	---	---
Vietnam	NO	---	---
Bhutan	---	---	---
PNG	---	---	---

NO:
no specific
reference to what
GL/which Tier was
used for F-gas
source



HFC Emissions in WGIA countries

(as reported)



Note: It is difficult to grasp the general picture of F-gas emissions because it is often unclear:

- 1) whether it is a true NO or whether it is just a NE,
- 2) whether it is an intentional NE, or
- 3) whether the reported data are true

might be contingent on time/ resources that can be spent on the specific source

Gg-CO₂ eq



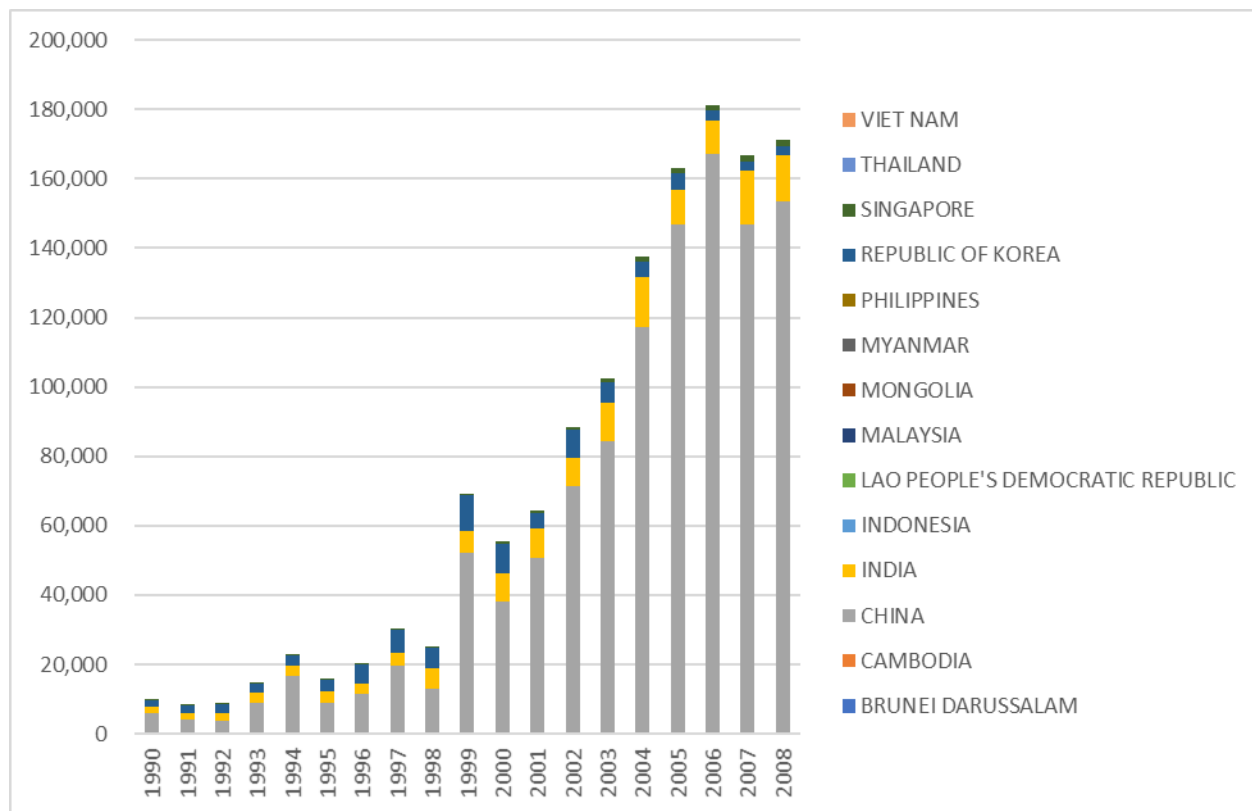
Data based on the most recent report (as at June 27, 2018), and compiled by E.Hatanaka

HFC Emissions in WGIA countries

(For reference: Global Emissions EDGAR v4.2)



Gg-CO₂ eq



European Commission, Joint Research Centre (JRC)/Netherlands

Environmental Assessment Agency (PBL), Global Emissions EDGAR v4.2

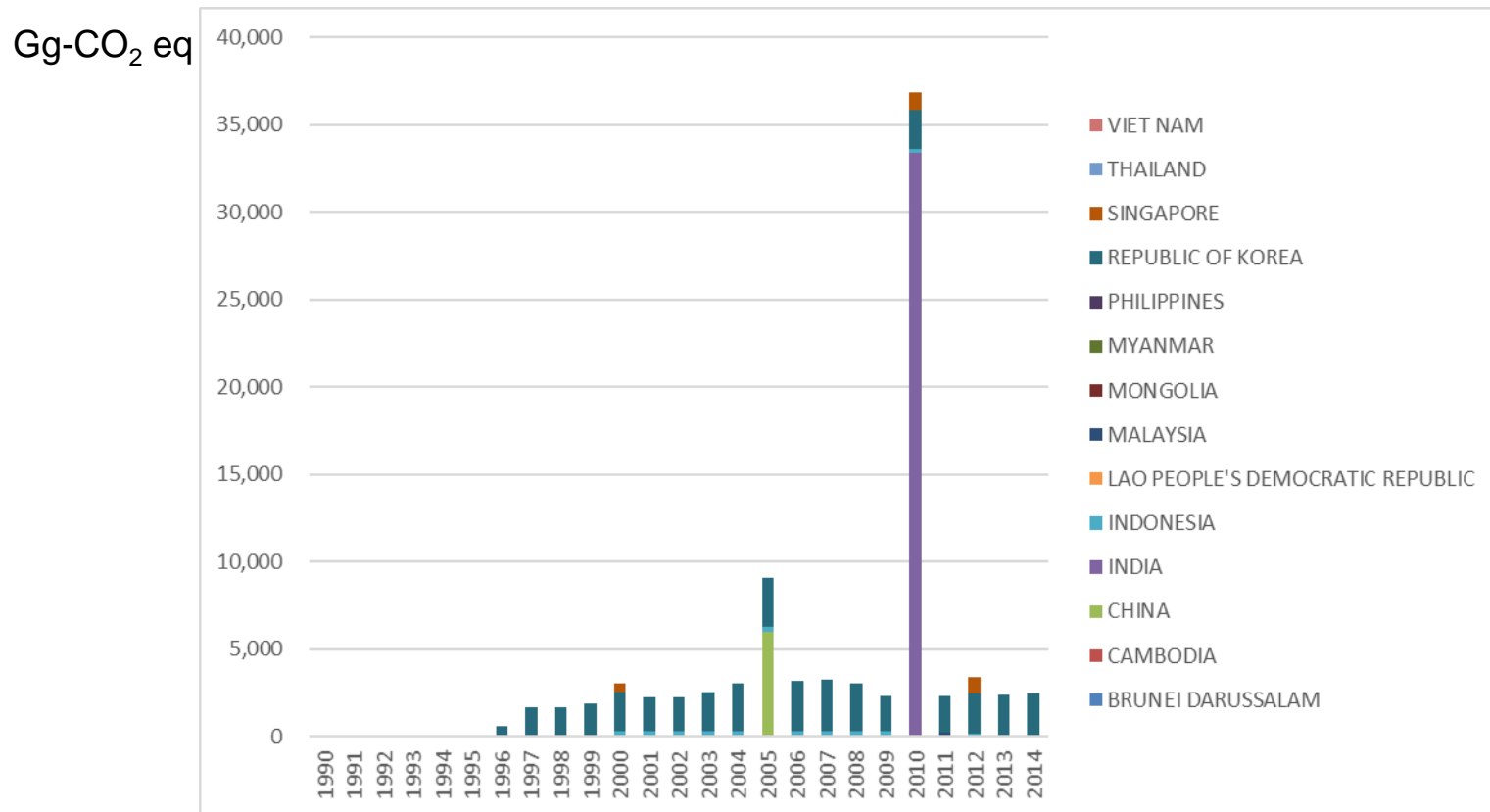
(November 2011) Timeseries 1970-2008, converted into CO₂ eq using IPCC

SAR GWP

Greenhouse Gas Inventory Office of Japan



PFC Emissions in WGIA countries (as reported)



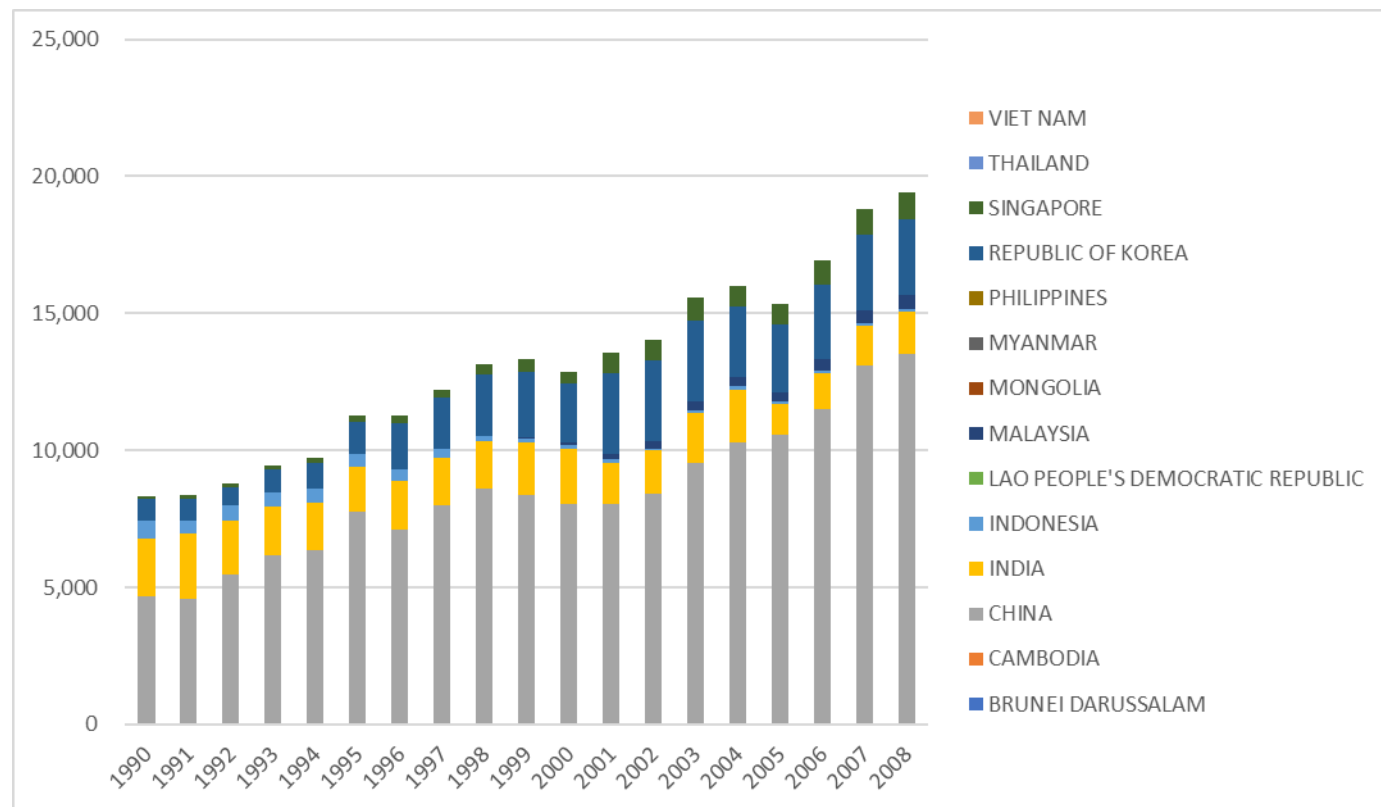
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PFC Emissions in WGIA countries

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Gg-CO₂ eq



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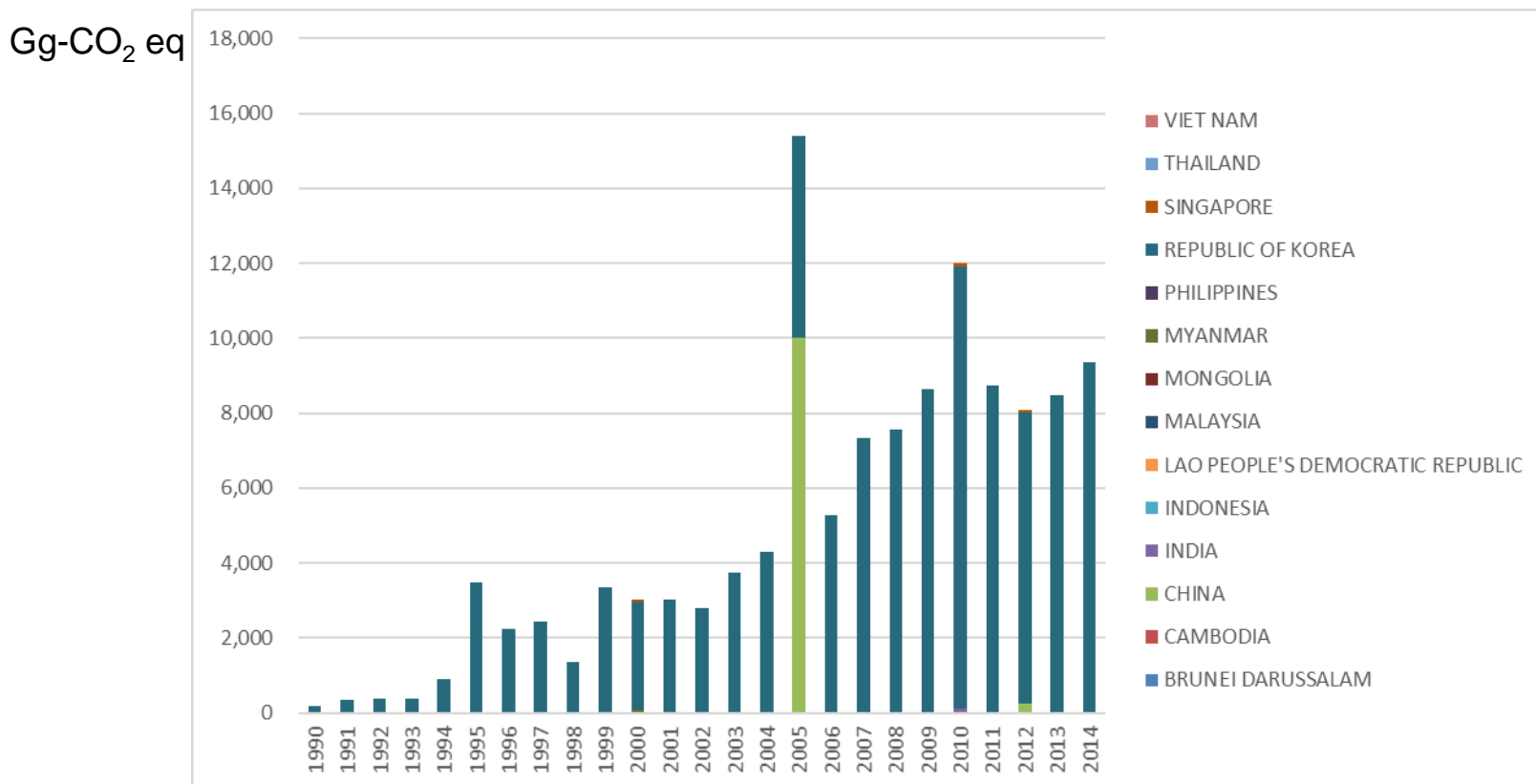
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SAR GWP

Greenhouse Gas Inventory Office of Japan



SF₆ Emissions in WGIA countries (as reported)



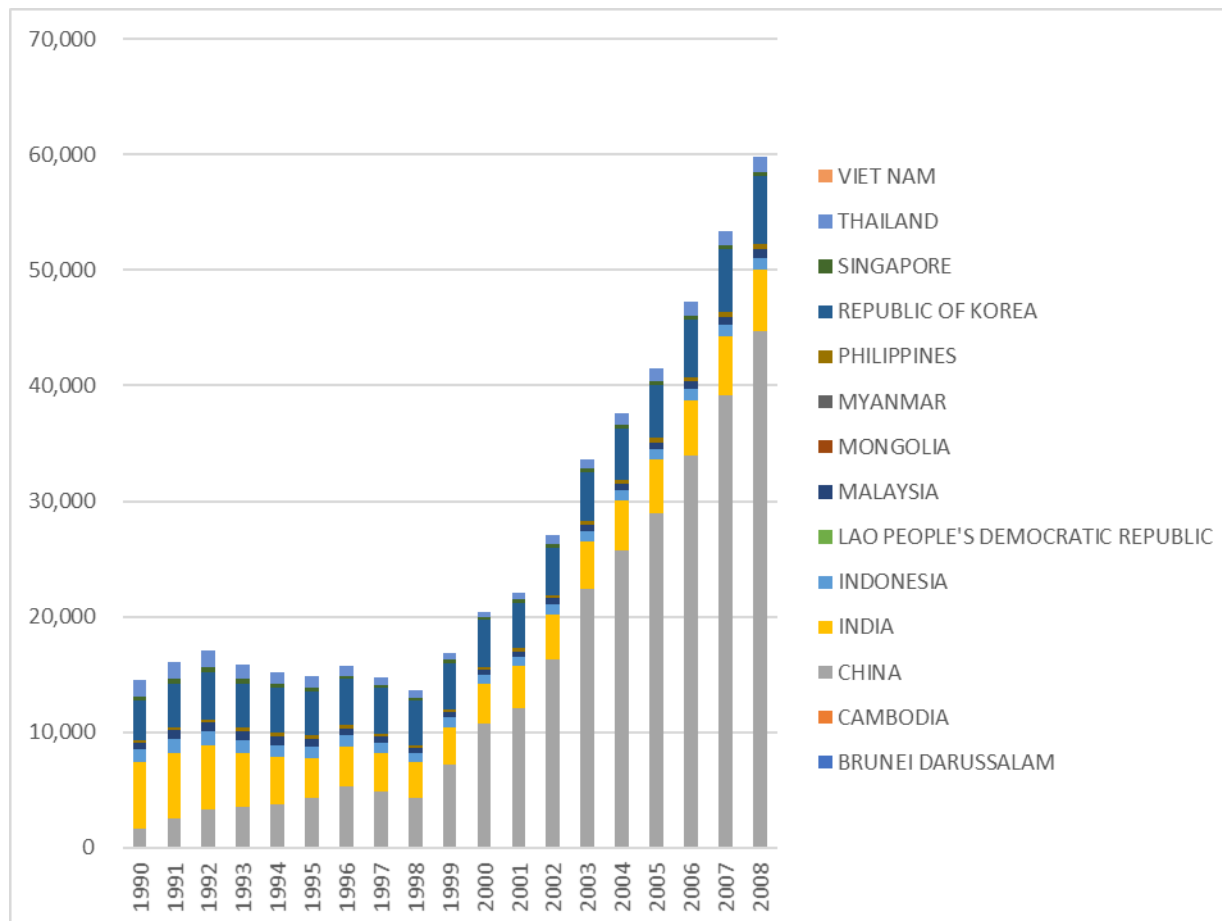
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SF₆ Emissions of WGIA countries

(For reference: Global Emissions EDGAR v4.2)



Gg-CO₂ eq



European Commission, Joint Research Centre (JRC)/Netherlands

Environmental Assessment Agency (PBL), Global Emissions EDGAR v4.2

(November 2011) Timeseries 1970-2008, converted into CO₂ eq using IPCC

SAR GWP

Greenhouse gas Inventory Office of Japan



Observations

- Isolated peaks in emissions occur for certain years when reporting took place
- Size of emissions are quite different between the gases: HFCs >>>> PFCs > SF₆
- Difficult to evaluate consistency across years within one country's reporting when there is no time-series data
- However, comparison between HFC/PFC/SF₆ emissions within one country, during one reporting might be useful
- Comparison across countries for the same inventory year might be also useful
- Comparison with other estimates might also be useful, bearing in mind that various assumptions are made to prepare the estimates



Summary

- The Kigali Amendment to the Montreal Protocol will be controlling HFCs as well, however, its mission is to phase down production and consumption, and therefore reducing emissions during the use of HFC devices, etc will still be the job of UNFCCC
- With this overlap, it may be efficient to plan to deal with MP and UNFCCC together, where appropriate
- It is important to further develop each country's F-gas inventory under UNFCCC (including PFCs and SF₆, etc), while keeping in mind that CFCs and HCFCs are still also potent global warming substances

