ODS Alternatives Surveys:
Gaps, Challenges and Best practices

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Vienna, 13th June 2017

DATA

ANALYSIS

STRATEGY

ACTIONS

CONTENT

I. OUTCOMES FROM SURVEYS

II. PROJECTIONS, SCENARIOS AND EMISSIONS

III. UNIDO´S ANALYSIS AND BEST PRACTICES

Survey Scope & requirements

Before Kigali (75th ExCom)

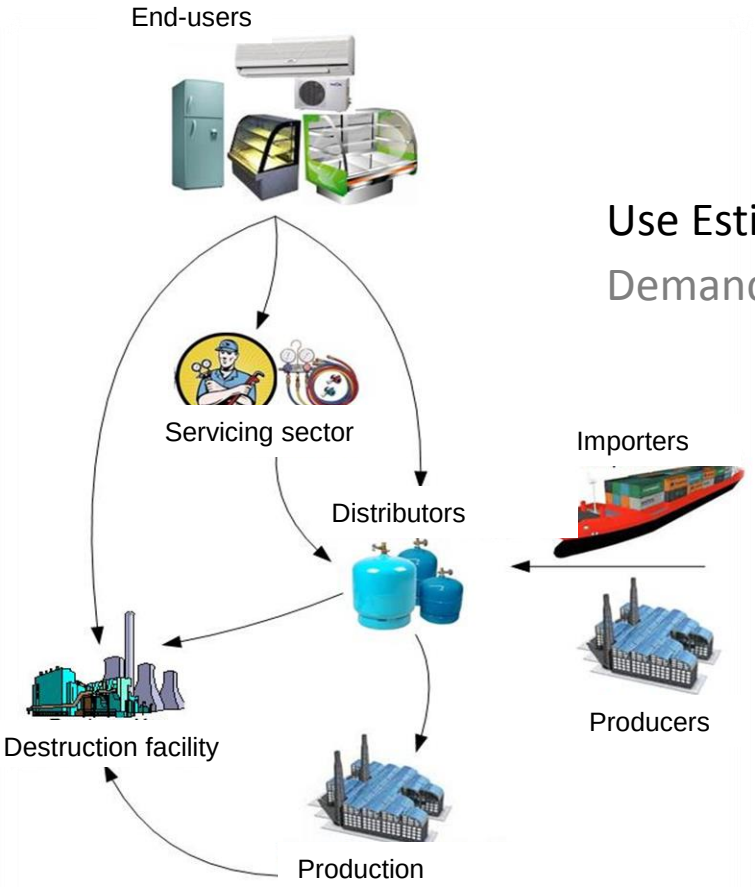
- **Format:** UNEP/OzL.Pro/ExCom/75/77/Rev.1
- **Guide for preparation of the surveys** (23rd August 2016)

After Kigali Amendment - Article 5 countries

- Historical and predicted consumption trends for **ODS alternatives**
- **Aggregate** production and consumption of HFCs in Article 5 countries

Objective and Methodology

Estimate current use of ODS alternatives by substance, sector/sub-sector



Use Estimated
Demand study

Consumption
MP equation

Methods applied

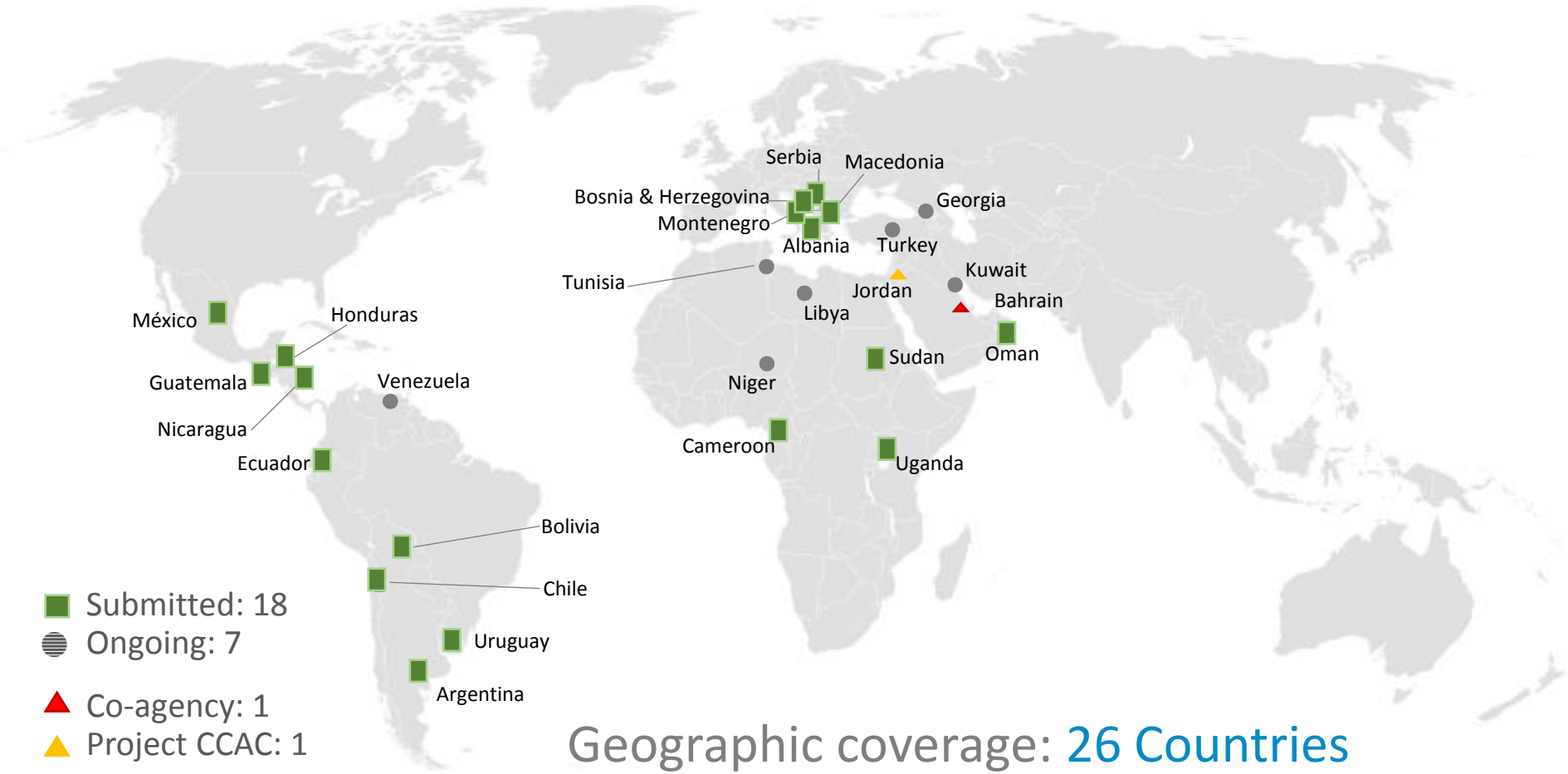
Bottom-up

Top-down

Combination

Bank and servicing demand

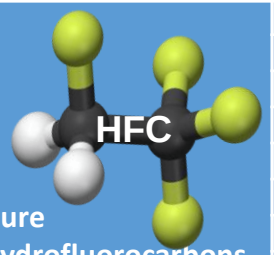
UNIDO's Survey Analysis



- Submitted: 18
- Ongoing: 7
- Co-agency: 1
- Project CCAC: 1

Geographic coverage: 26 Countries

ODS alternatives

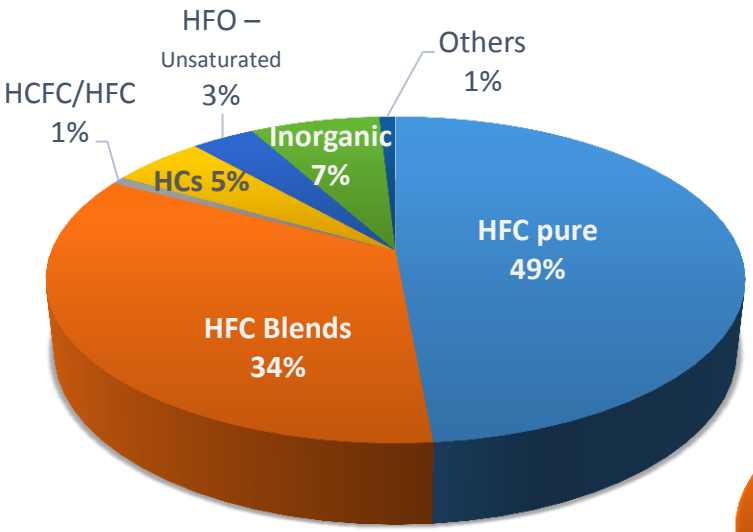
Group	Substance	GWP* 100-year	Sectors					
			RAC	Foam	Aerosols	Solvent	Fire Sup.	Other
 Pure hydrofluorocarbons	HFC-23	14,800	X				X	
	HFC-32	675	X					
	HFC-43-10mee	1,640						
	HFC-125	3,500	X				X	
	HFC-134	1,100		X (XPS)				
	HFC-134a	1,430	X	X	X		X	
	HFC-143a	4,470	X					
	HFC-152a	124	X	X	X			X
	HFC-227ea	3,220	X	X	X		X	
	HFC-236fa	9,810						
	HFC-245fa	1,030		X	X			
	HFC-365mfc	794		X	X	X		
HFC Blends (commonly used)	R-407C	1,774	X					
	R-407F	1,825	X					
	R-410A	2,088	X					
	R-404A	3,922	X					
	R-507A	3,985	X					
HC (Hydrocarbon)	Propane R290	5	X					
	Isobutane R-600a	5	X					
	Cyclopentane			X				
HCO (Oxygenated hydrocarbon)	Methyl formate	-		X				
	Methylal	-		X				
HFO (Hydrofluoroolefin)	HFO-1234yf	<1	X					
	HFO-1233zd	<1	X					
	HFO-1336mzzm	2		X				
Inorganic compounds	CO_2	1		X				
	R-744	1	X					
	R-717	-	X					

*GWP from Annex F of Kigali Amendment and AR5. HFC blends are not included, however once a component is listed, blend is controlled.

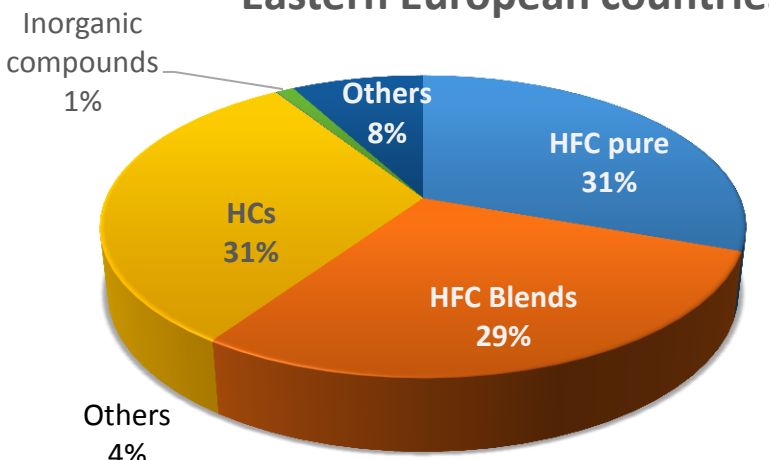
Distribution of ODS alternatives

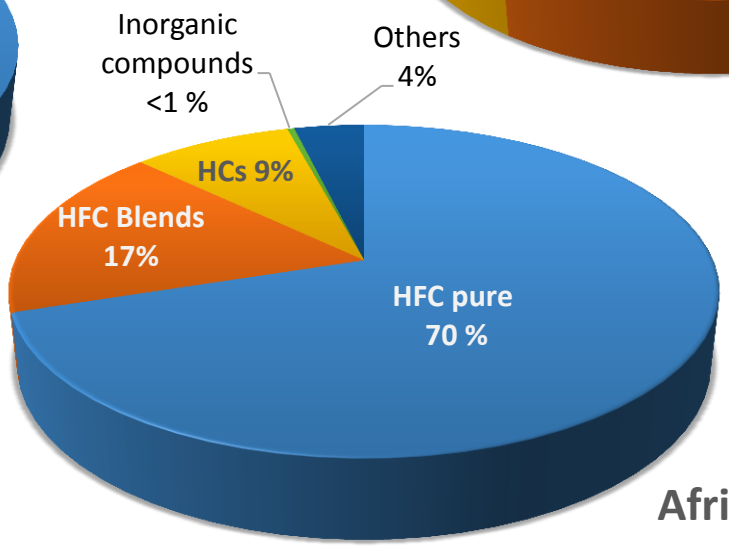
By Region for (2015)

Latin American countries



Eastern European countries





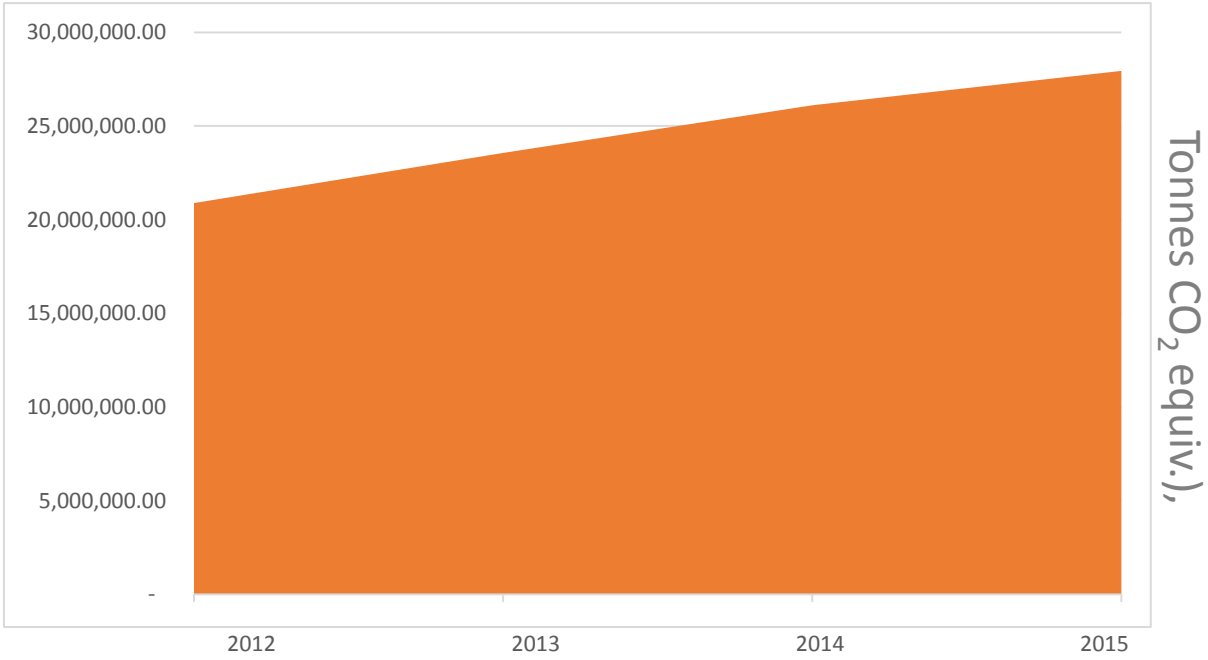
African countries

Other alternatives reported

- PFCs: 1 country
- Methyl Chloride: 1 country
- Methyl-formate: 3 countries

HFC Production and Consumption

HFCs consumption for countries evaluated, period 2012 - 2015

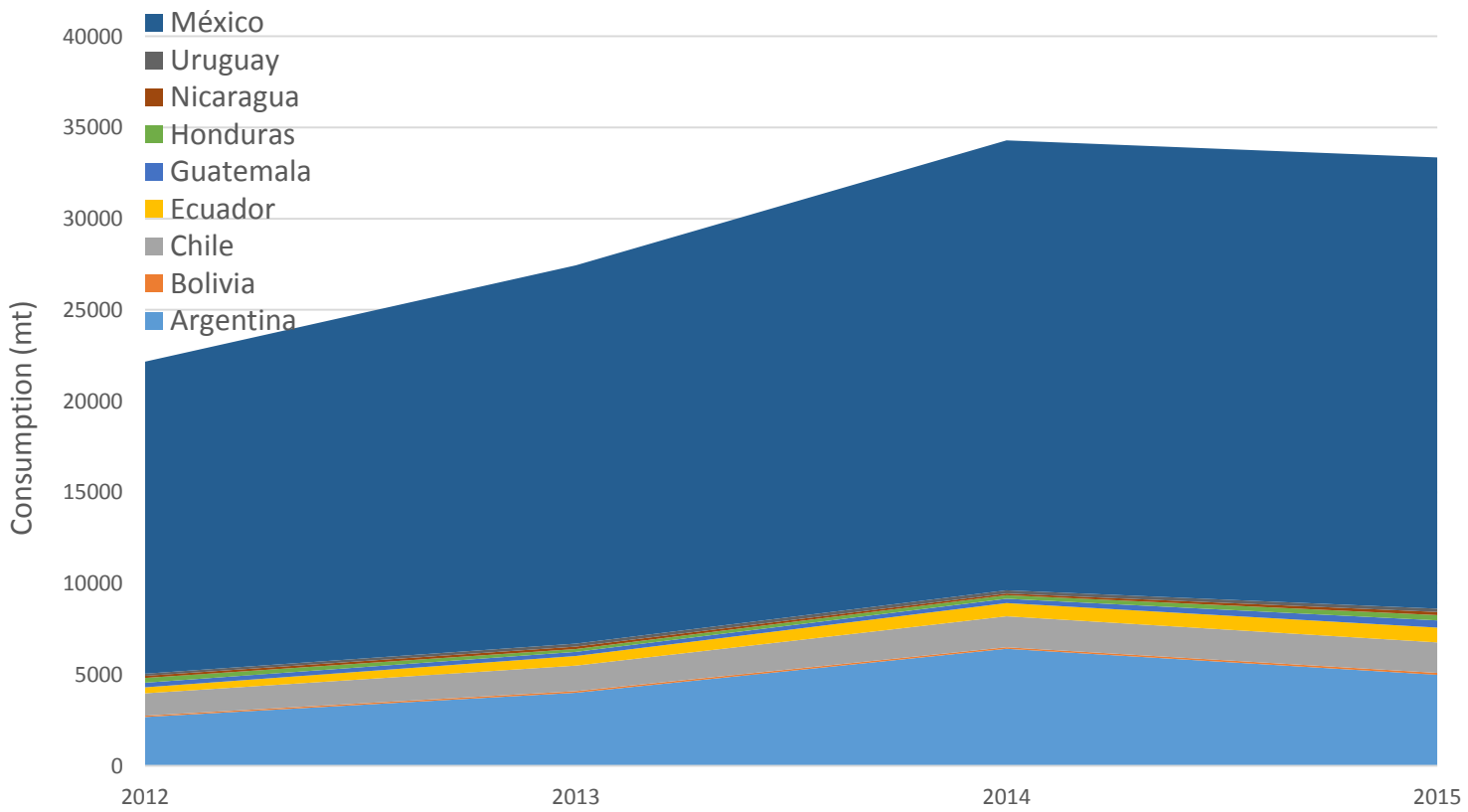


TEAP (2015):

- Global production of HFCs (2015) 314,515 mt or 1220 Mt CO_2-eq
- HCFC baseline for production in Article 5 countries amounted to 501,266 mt
- Consumption for Art-5: 284,326 mt and 1,265 Megaton CO_2 equiv. in 2015

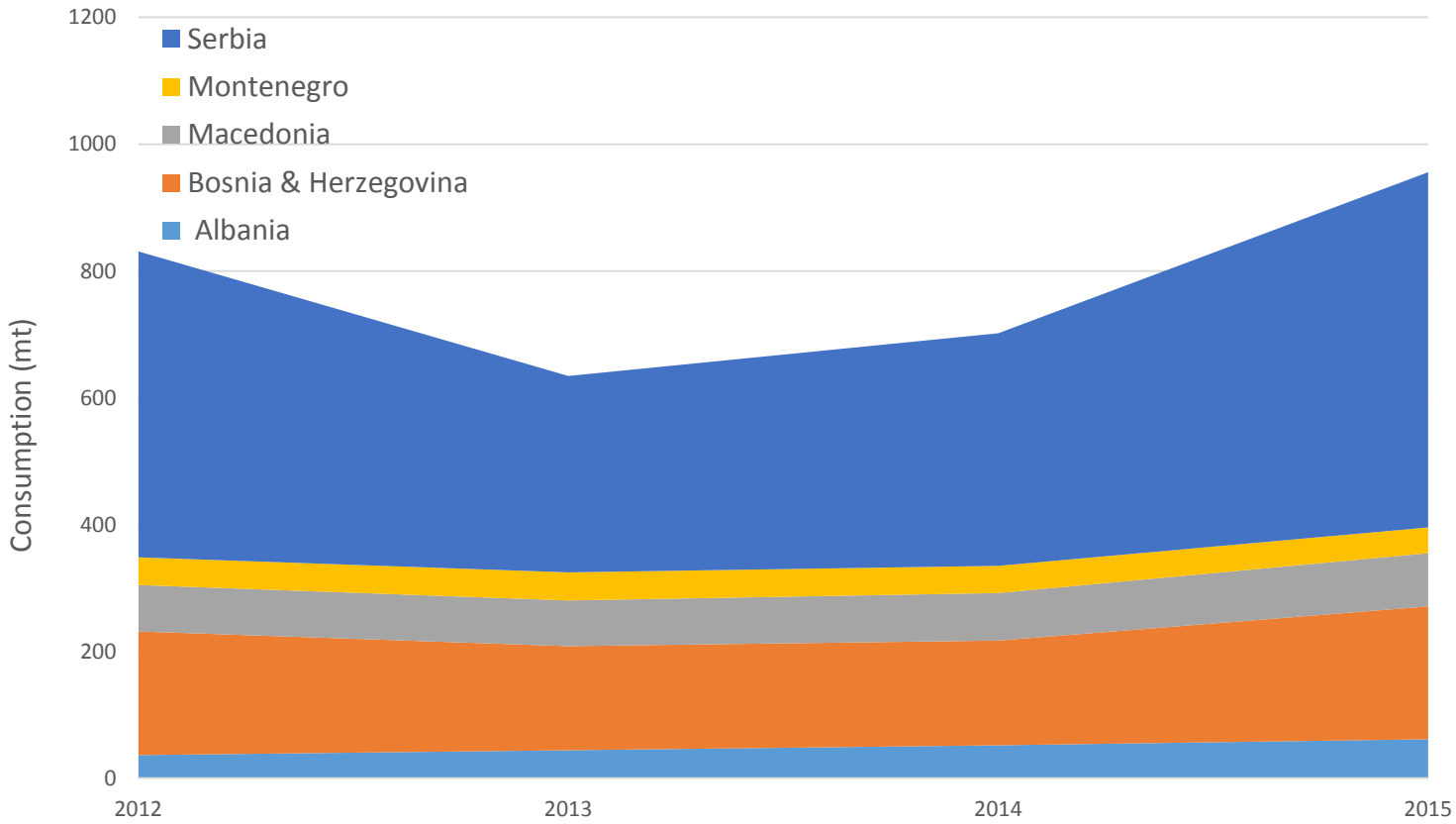
HFC estimated use by Region

Latin American Countries (2012 - 2015)



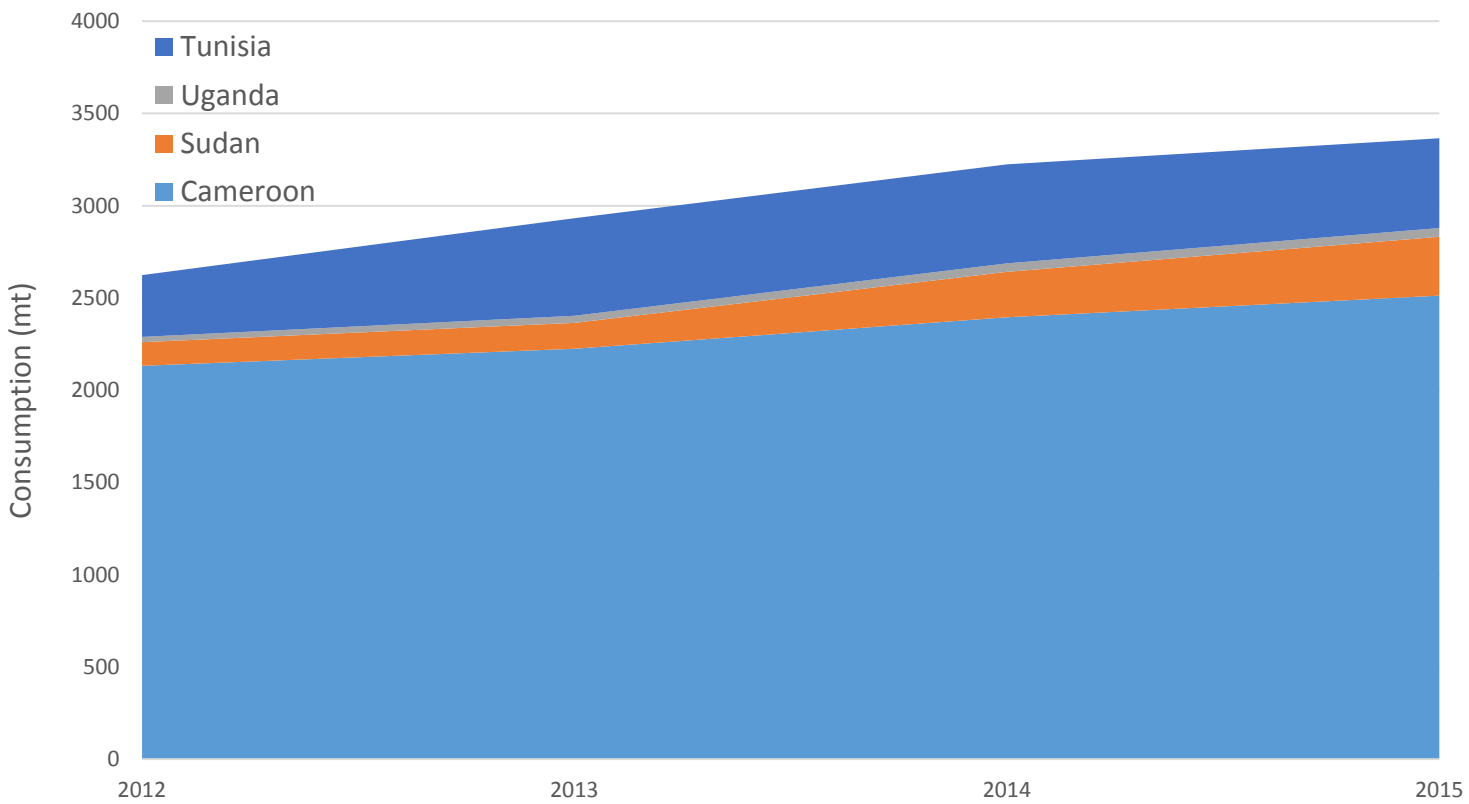
HFC estimated use by Region

Eastern European Countries (2012 - 2015)

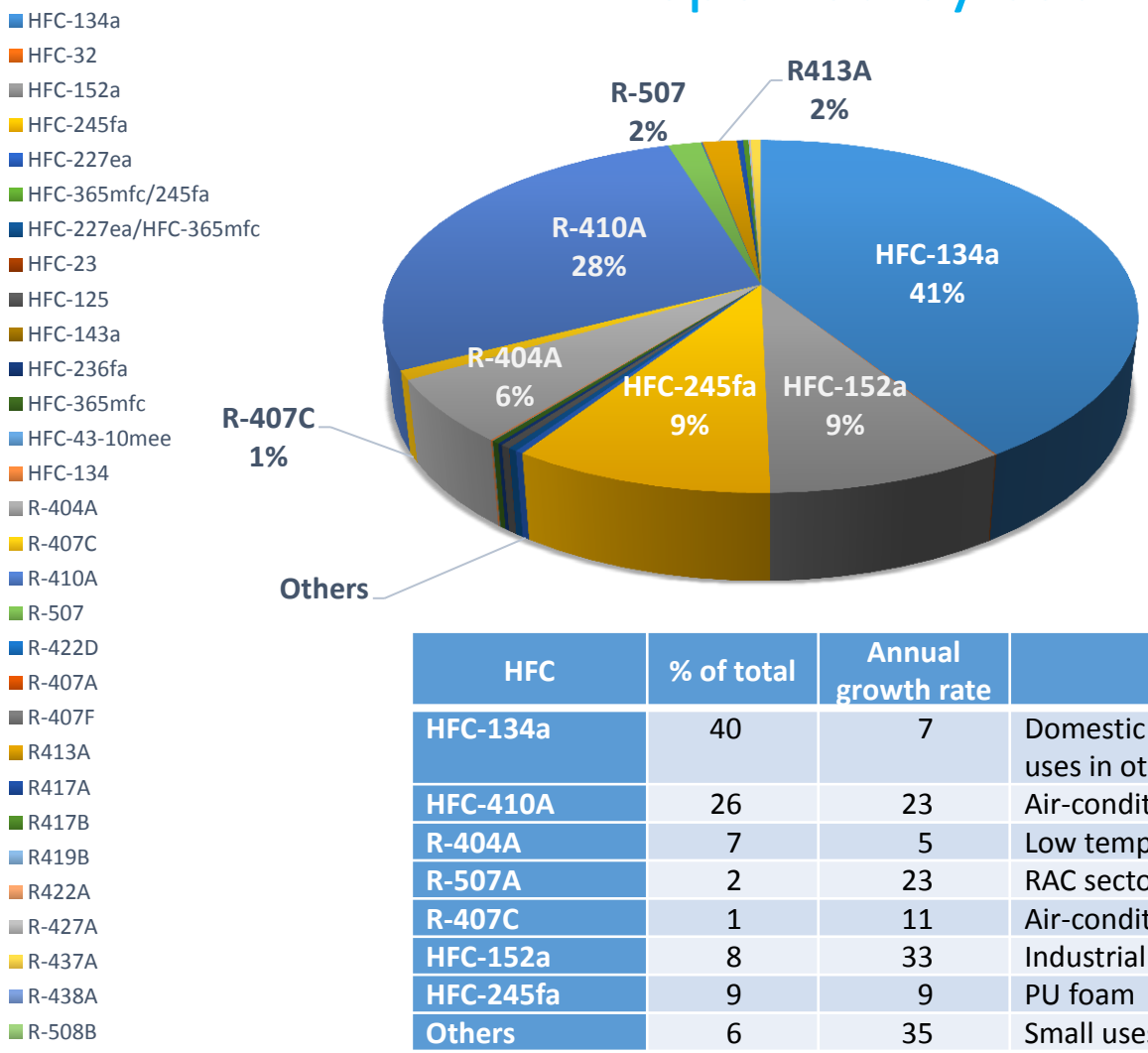


HFC estimated use by Region

African Countries (2012 - 2015)



HFC Reported by countries

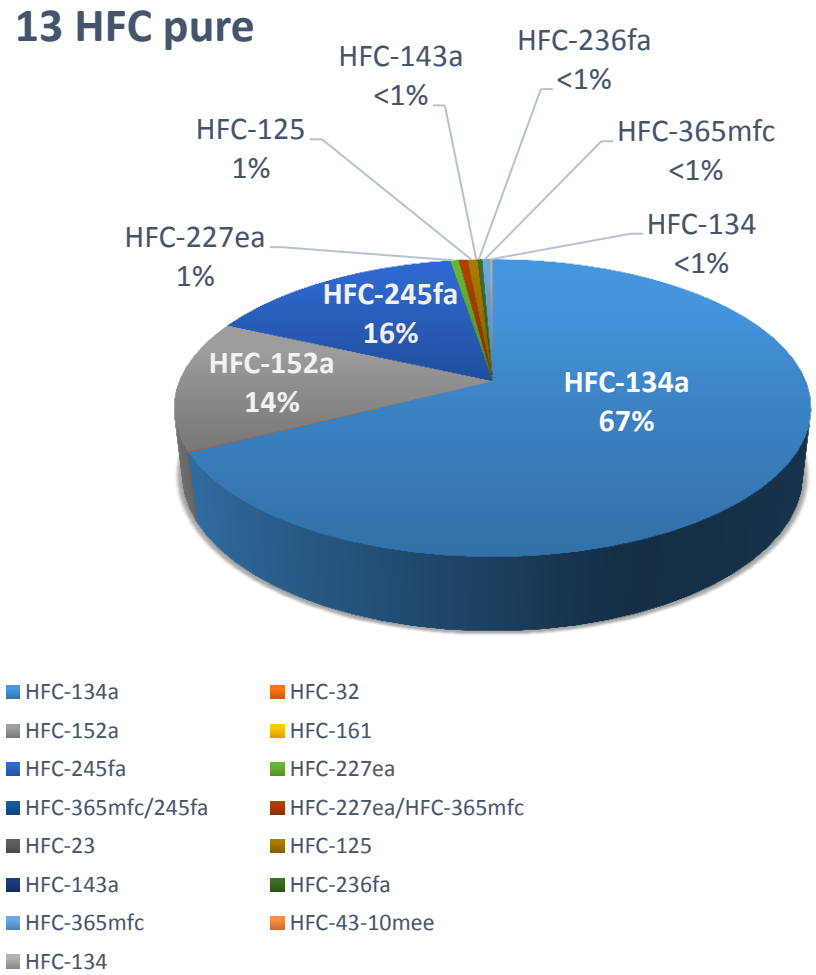


- HFC-134a, R-404A, R-410A, R407C were reported by all countries
- HFC/HCFC blends reported by 4 countries

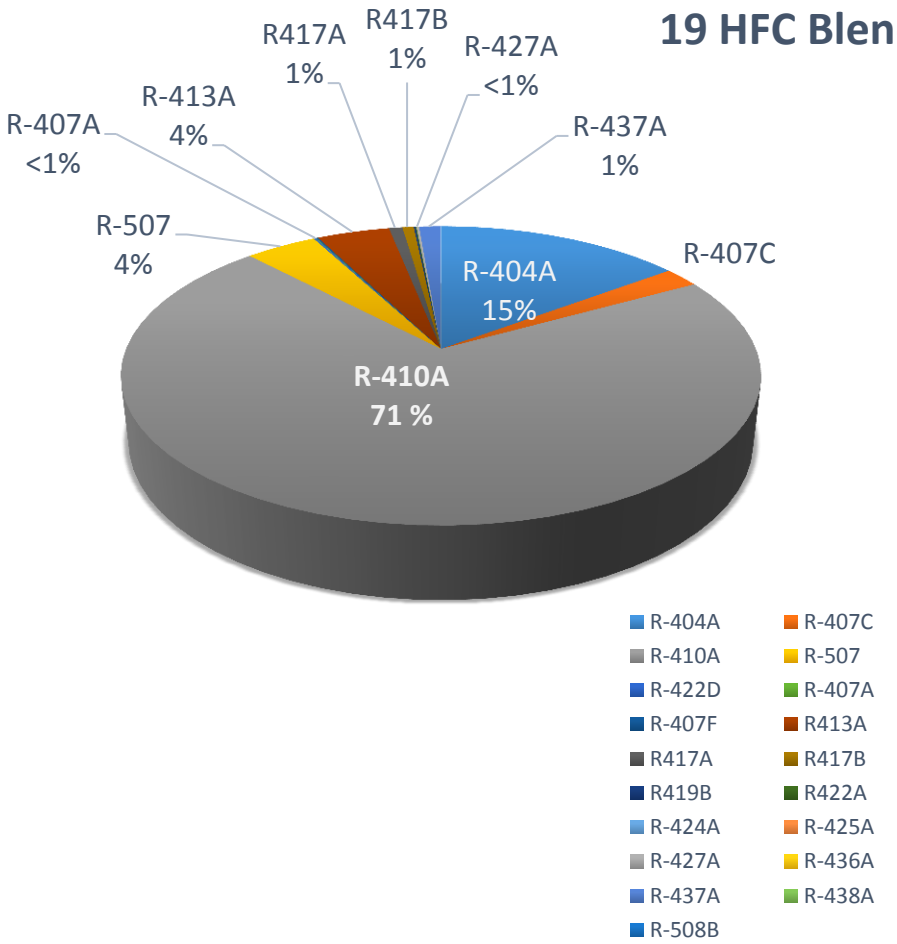
HFC	% of total	Annual growth rate	Uses
HFC-134a	40	7	Domestic and commercial refrigeration and MAC; with small uses in other RAC applications, foam and MDIs
HFC-410A	26	23	Air-conditioning applications
R-404A	7	5	Low temperature refrigeration applications
R-507A	2	23	RAC sector
R-407C	1	11	Air-conditioning applications
HFC-152a	8	33	Industrial aerosol sector and extruded polystyrene foam
HFC-245fa	9	9	PU foam
Others	6	35	Small uses in all applications

HFC Reported by countries for 2015

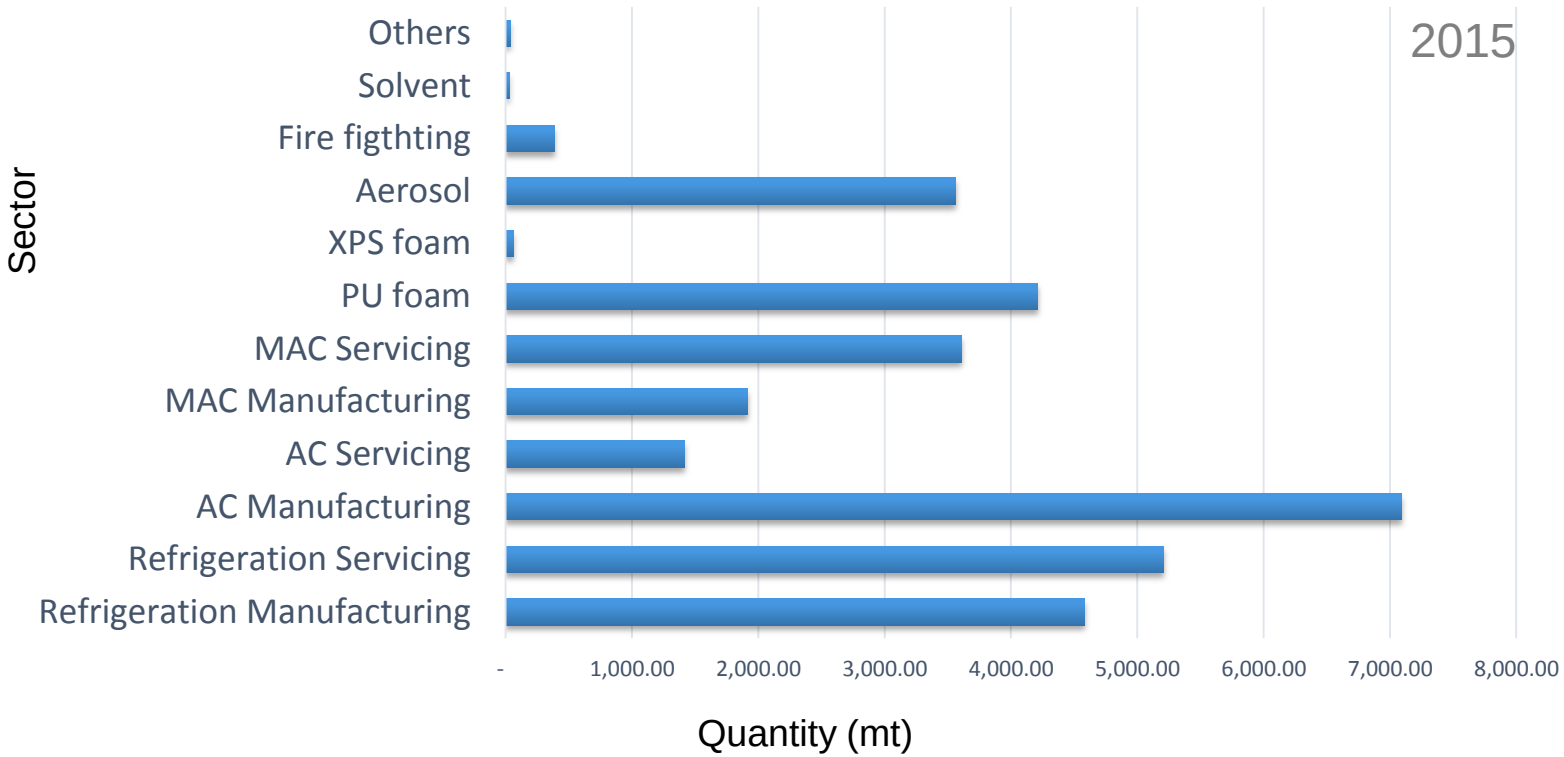
13 HFC pure



19 HFC Blends



HFC distribution by sector/subsector



TEAP:

- R/AC sector: total demand **473.4 kilotonnes** (calculated for 2015) (**Article 5 Parties 272.9 kt**)

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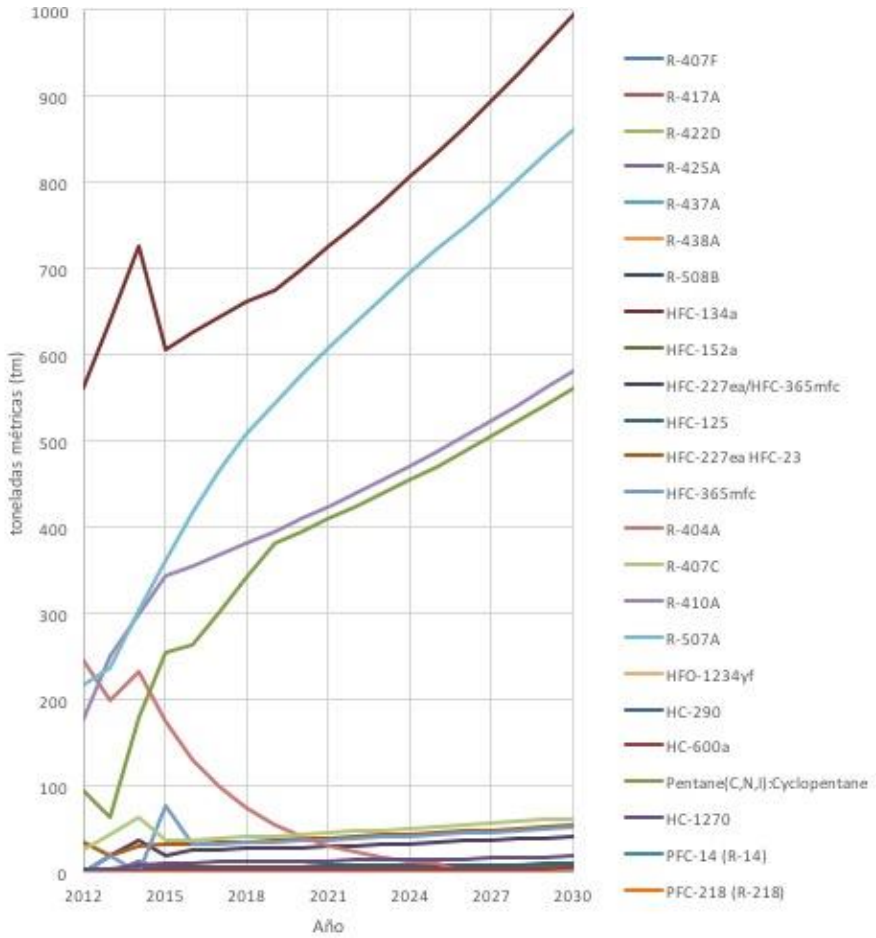
Projections of future use (2016-2030)

Grow rate applied for forecasting estimation



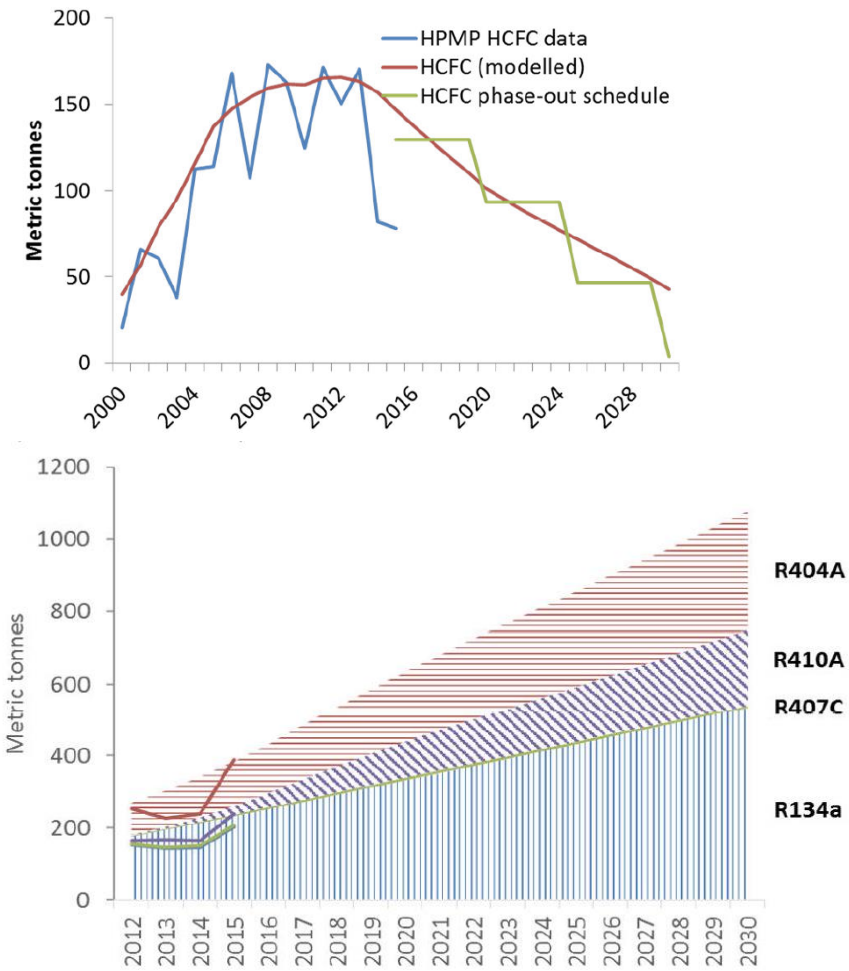


Figure 8: Detailed Comparison between top-down HFC consumption data (in metric tonnes) and the HFC consumption modelled in this study for R134a, R404a, R410A and R407C.

Bank and Demand Estimation

Assumptions and factors

Number of vans on road in 2015	**9.634**
Charged with HFC-134a (in %) (cabin air-conditioning)	60%
Vans with refrigeration (in % from the vans with AC)	17%
Average charge per vehicle (in kg)	2
Charged with HFC-134a (in %) (refrigeration)	90%
Charged with R-404A (in %) (refrigeration)	10%
Leakage rate (in %) (refrigeration)	20%
Lifespan of vehicles (in years)	15-20

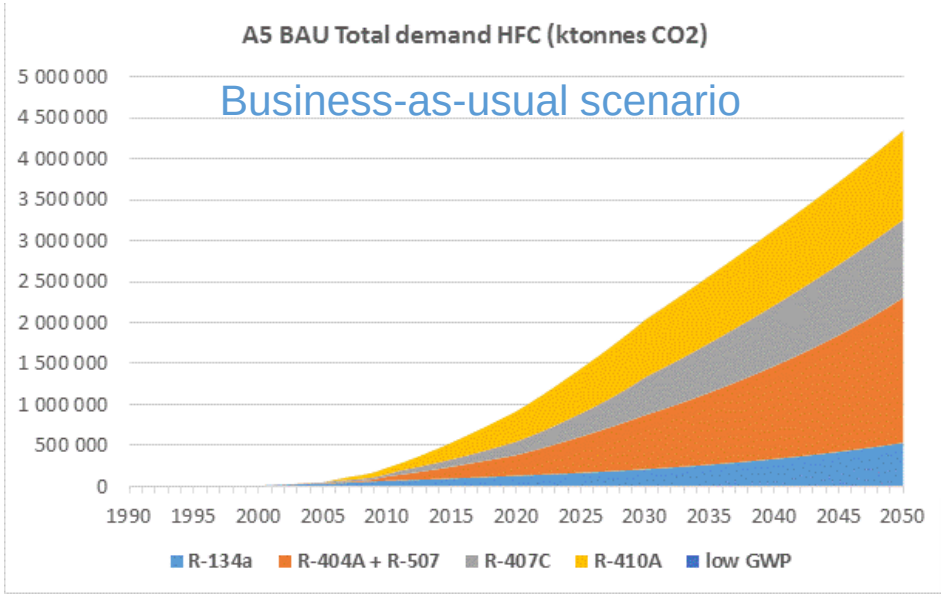
Demand (consumption):

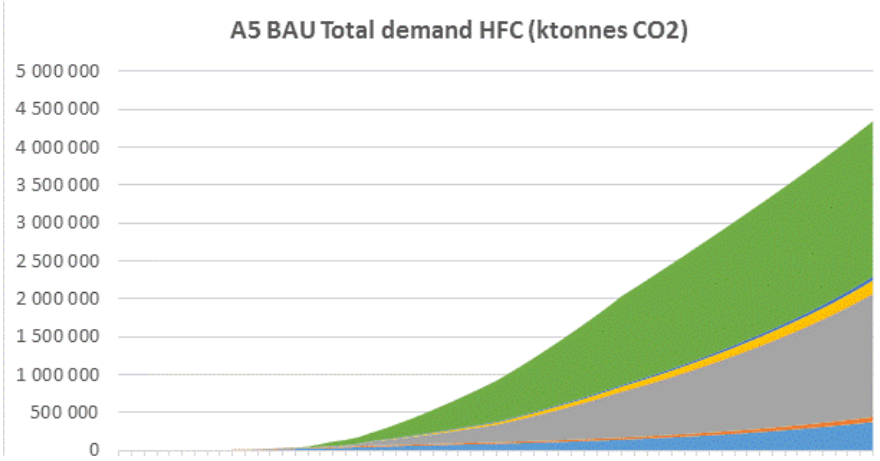
1.Supplied to existing bank
2.Added to the bank
3. Less recovered/reused

Bank and services needs

Year	HFC-134a		HFC-404A		Total	
	Bank (mt)	Servicing needs (mt)	Bank (mt)	Servicing needs (mt)	Bank (mt)	Servicing needs (mt)
2015	1,77	0,35	0,20	0,04	1,97	0,39
2020	2,24	0,45	0,40	0,08	2,64	0,53
2025	2,70	0,54	0,60	0,12	3,30	0,66
2030	3,22	0,64	0,82	0,16	4,04	0,81

BAU and mitigation Scenarios

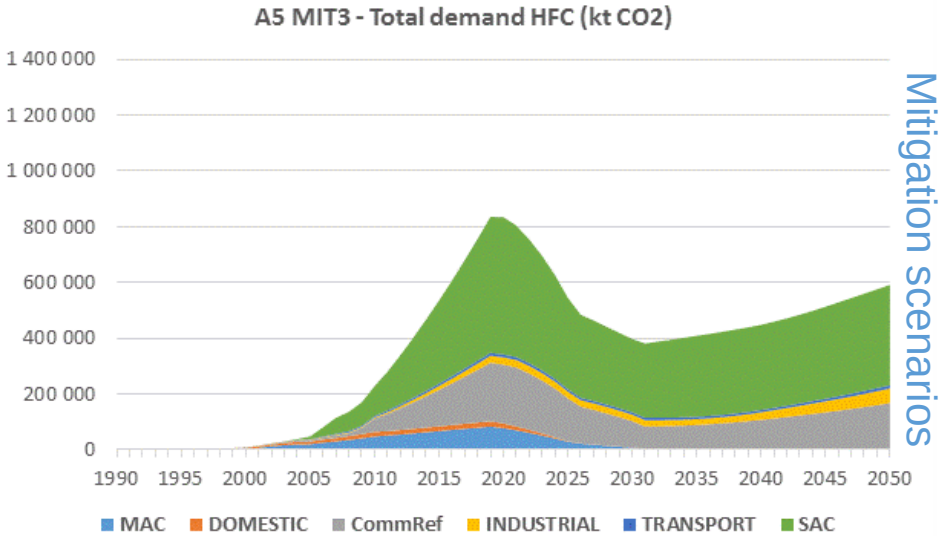




TEAP: Consumption of HFC in Art-5 will reach 1,021,216 mt in 2030 under a BAU (without Kigali amendment)

Transition to low-GWP scenarios

Conversion period is a key element in MIT scenarios estimation.



Mitigation scenarios

Potential Emissions and Emissions

- Total climate impact related to refrigerants consists of direct and indirect contributions.
- Data obtained from survey was a relevant contribution for the calculation of F-gas emissions, National communication of climate change (UNFCCC).
- The banks allow to calculate emissions using agreed emission parameters (IPCC).
- Amount of emissions (dependent on leakage assumptions).
- Potential emissions reduction due the impact of mitigation scenarios.

Impact of mitigation scenarios compared to BAU for a sector in Article 5 parties: it should show the <u>incremental climate savings achieved</u> for Mitigation scenarios proposed against the BAU baseline.

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Issues in the Surveys

- **Top-down** was the preferred option to estimate use of ODS alternatives (problems related to availability and updating of data in official sources)
- **Tendency** of ODS alternatives consumption in some countries was not clearly established (limited points to forecasting – early period of estimation)
- **More Blends** are becoming increasingly available commercially, some without clear composition information.
- **Servicing sector** demand estimation one of the biggest challenges

Findings, Gaps and requirements (I)

Legal and Regulatory Issues

- **Customs records:** data access, pre-charged was not consistently reported.
- **Tariff codes:** same code for alternatives (pure substances, blends)

Suggested Actions

Improve and strengthen HFCs and ODS alternatives control:

- ✓ Harmonized tariff codes according to HFCs commitments
- ✓ Regulations related to the use of HFCs and other ODS alternatives
- ✓ License system including HFCs (Article 4B) and other alternatives
- ✓ Training for customs officers in import trade control

- **Specific standards** for flammable/toxic low-GWP alternatives are urgent

Findings, Gaps and requirements (II)

Main substances available, key sectors and barriers were identified

Linkage between HCFC and HFC:

- Direct transition towards natural refrigerants preferable in some countries (Flexible implementation).

Energy Efficiency Information

- Detailed information was not available in the majority of the countries.

Data Reporting

- Improvement of current country data reporting (CP) on ODS to report HFC consumption (Decision 76/7d)

Findings, Gaps and requirements (III)

Manufacturing sector

- Technical assistance, research, safe introduction of flammable/toxic alternatives: conversions

ODS Production sector

- HFC-23 (cost-effective options for destruction).

Service sector

- Refrigeration technicians lack awareness, proper knowledge or skills.
- Certification programme, training & servicing tool
- Increase rate of recovery and reuse of HFCs, in particular in end-sectors.

End-user

- Consumption information
- Technical assistance, safe introduction of flammable/toxic alternatives.

Opportunities and Challenges

Estimation and relevant information

- Methodologies available - need of their transfer to the NOUs

Availability of ODS alternatives in local market

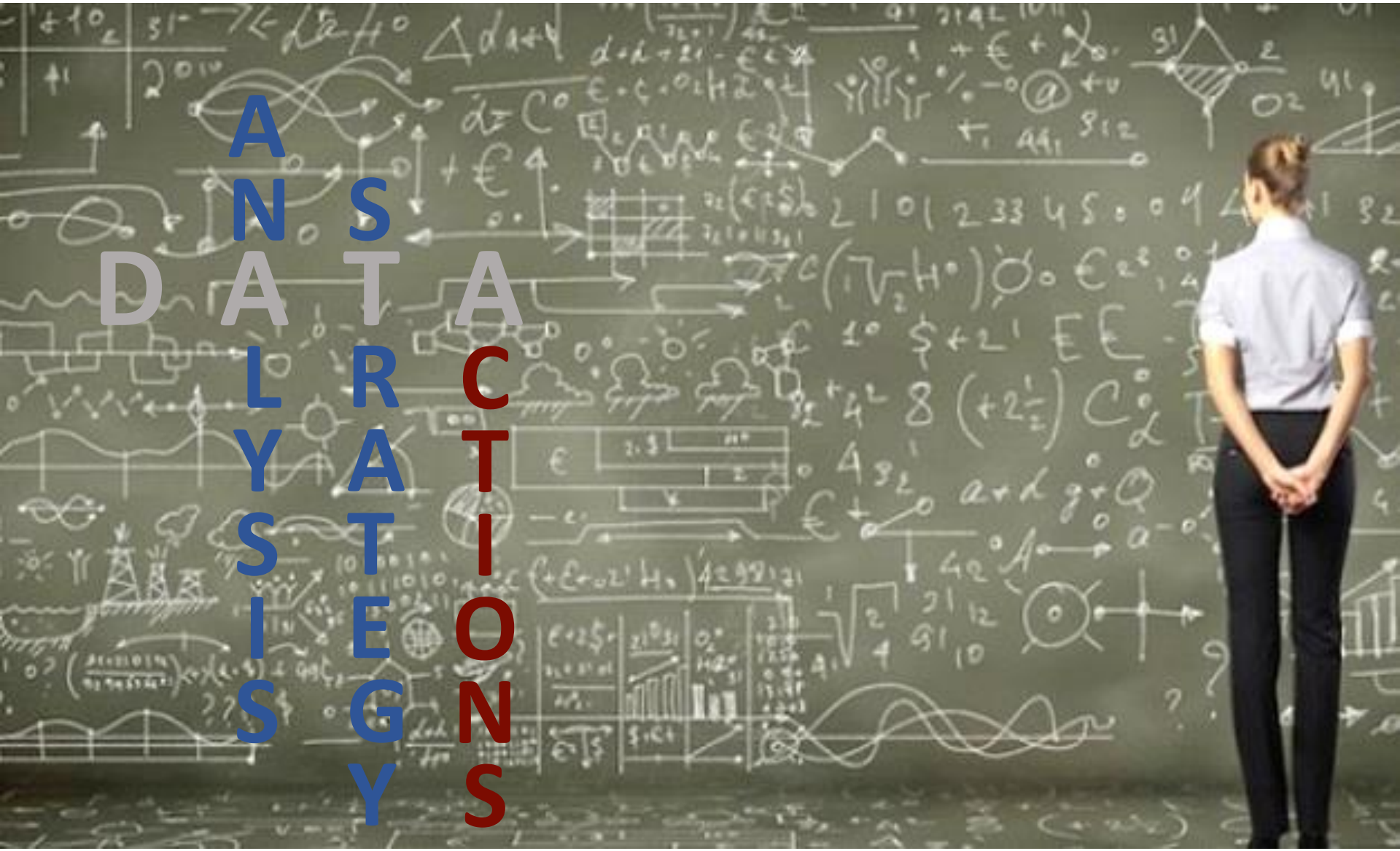
- Adopting lower GWP options, which may not always be feasible in some markets or for some products.
- HFC phase-down: review of alternatives to HFCs (existing technologies and not-in-kind)
- Effective replacement in RAC sector, if significant EE improvement possible

Stockpile management and destruction facilities (HFC-23 by-product).

- Cost-effective solution for all substances

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

SUSTAINABLE DEVELOPMENT GOAL 9
INDUSTRY, INNOVATION AND INFRASTRUCTURE



INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT

WWW.UNIDO.ORG

Experience 1. Cameroon: Survey Outputs

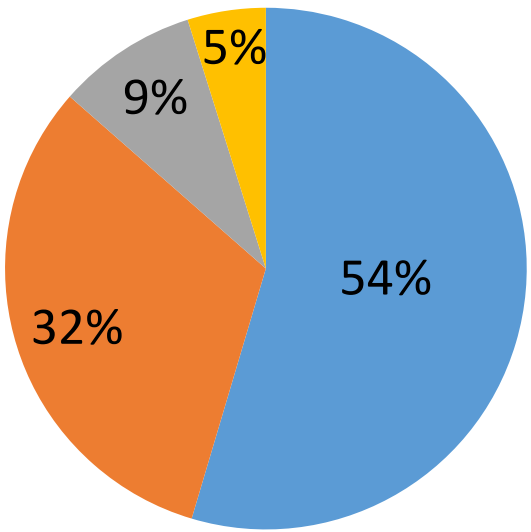
Experience 2. Chile: Tariff Codes for appliances and control of HFC

Experience 3. Bosnia & Herzegovina: Bank and demand estimation

Experience 4. México: Potential emission reductions for HFC by sector

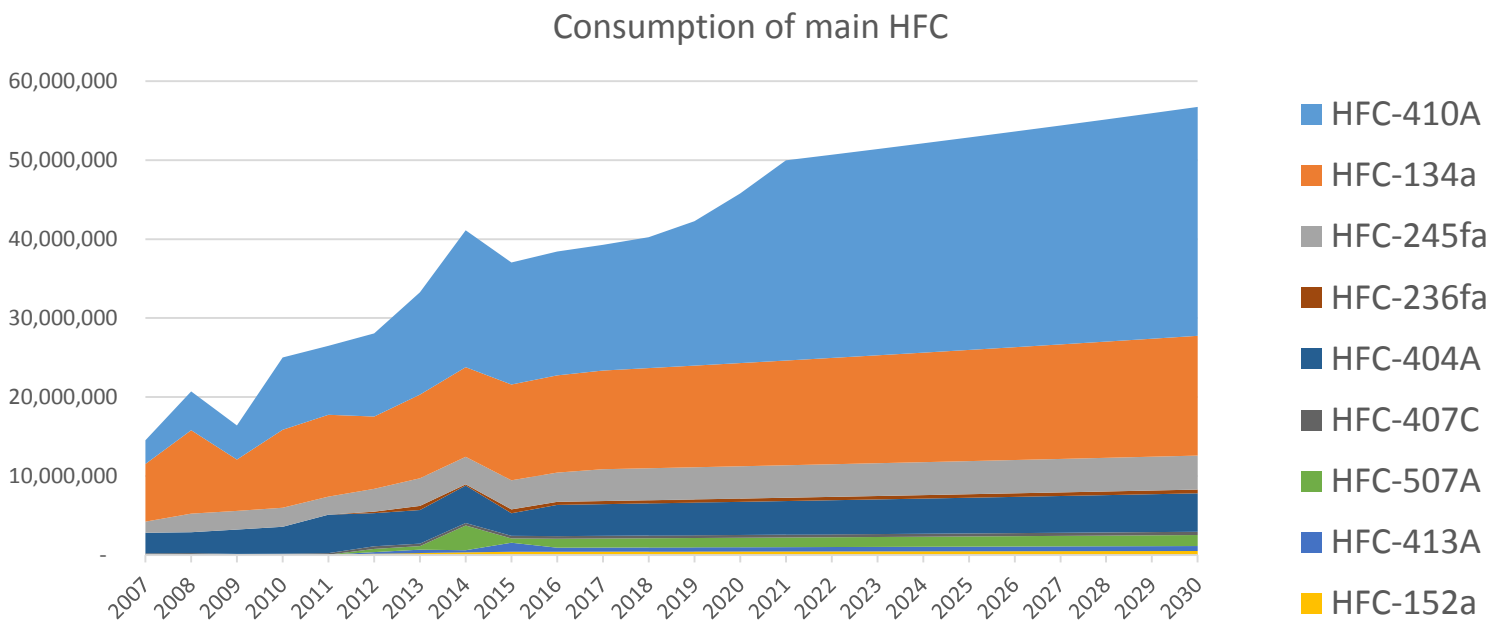
Distribution for ODS alternatives consumption in Mexico during 2015.

28,600 metric tons



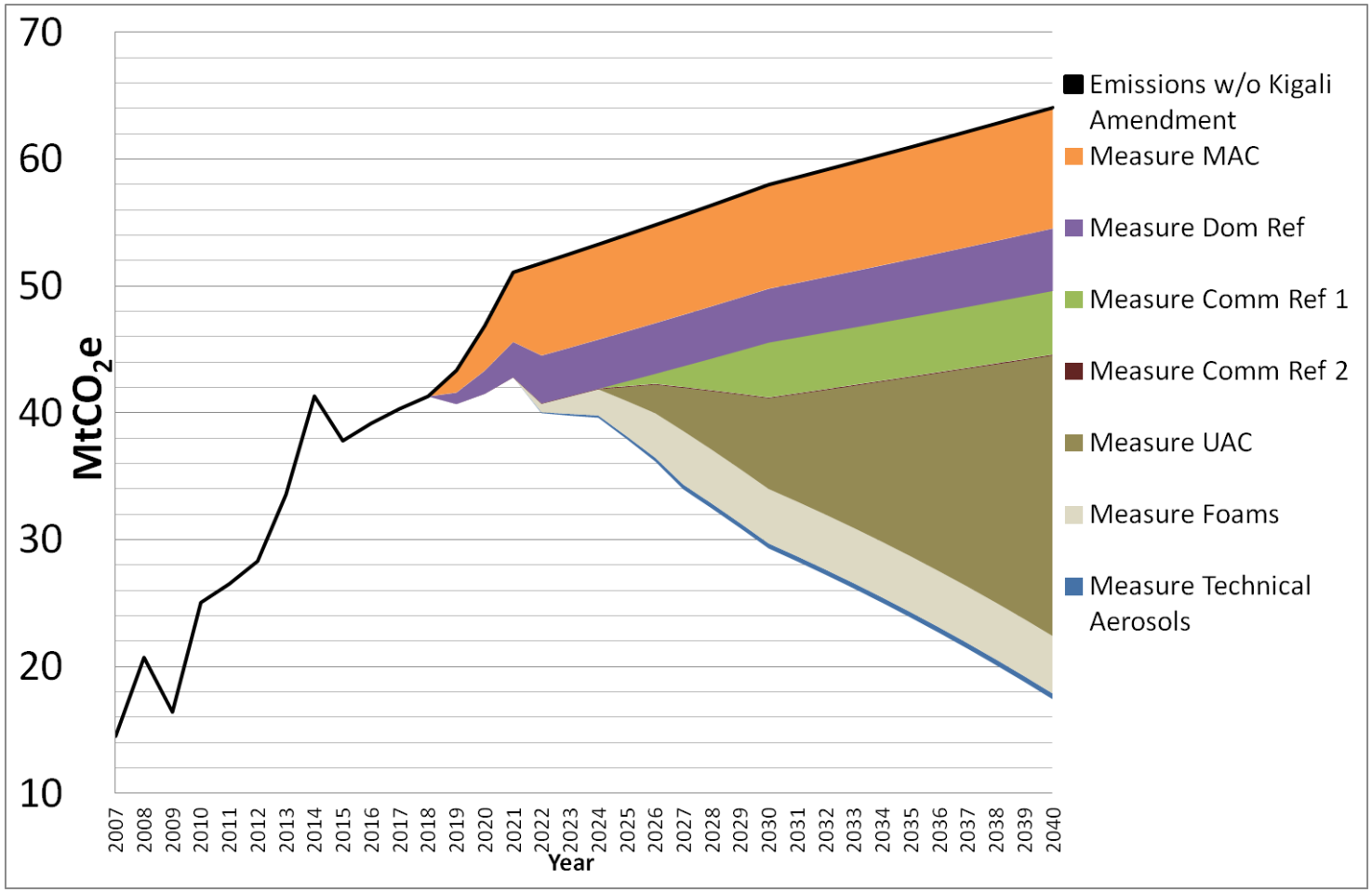
- HFCs → HFC-134a, HFC-245fa
- HFC Blends → R-410A
- Natural refrigerants → NH_3, CO_2. R-290, R-600a, C-Pen
- HFOs → HFO-1233zd & HFO 1234yf

Potential emission (consumption in metric tons of CO_2e) trend of main HFCs to 2030.



- ➢ Growth rates for each substance.
- ➢ HPMP Implementation Impact
- ✓ Aerosol Sector
- ✓ Foam Sector
- ✓ AC Sector

Potential Mitigation Scenarios



Regional GAPs and Challenges have been identified.

Should they be faced the same way ?