



Key Developments in Cooling Technologies and Policies

UN Environment United for Efficiency COP23 Side Event:

Energy-Efficient Lighting, Appliances and Equipment: Opportunities for Developing and Emerging Economies

November 15, 2017 – Bonn, Germany

In cooperation with:



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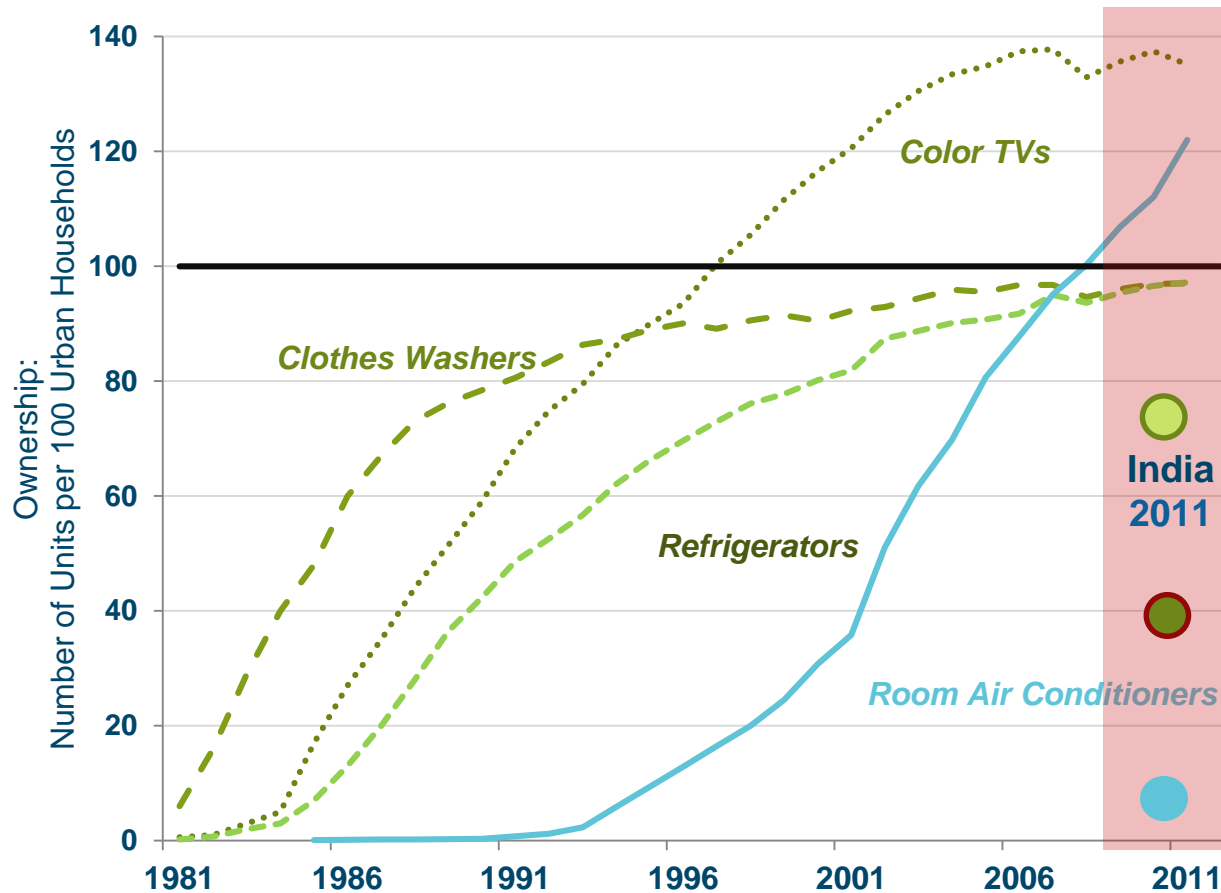


Key trends

- The cooling sector is one of the fastest growing energy consuming sectors in developing countries, with an estimated growth rate of 7% per annum until 2050 (IEA, 2016).
- The sector-related large GHG emissions result from the use of highly climate-damaging refrigerants (HFCs) as well as with the use of fossil fuel-based electricity for appliances.
- The combined emissions from the RAC sector amount to an estimated 2.7 GtCO₂eq in developing countries, or 10.5% of their total emissions (CAIT, 2012).
- Building AC makes is responsible for major share of cooling-related GHG emissions in emerging economies and developing countries



History: Growth in China's AC and refrigerator market

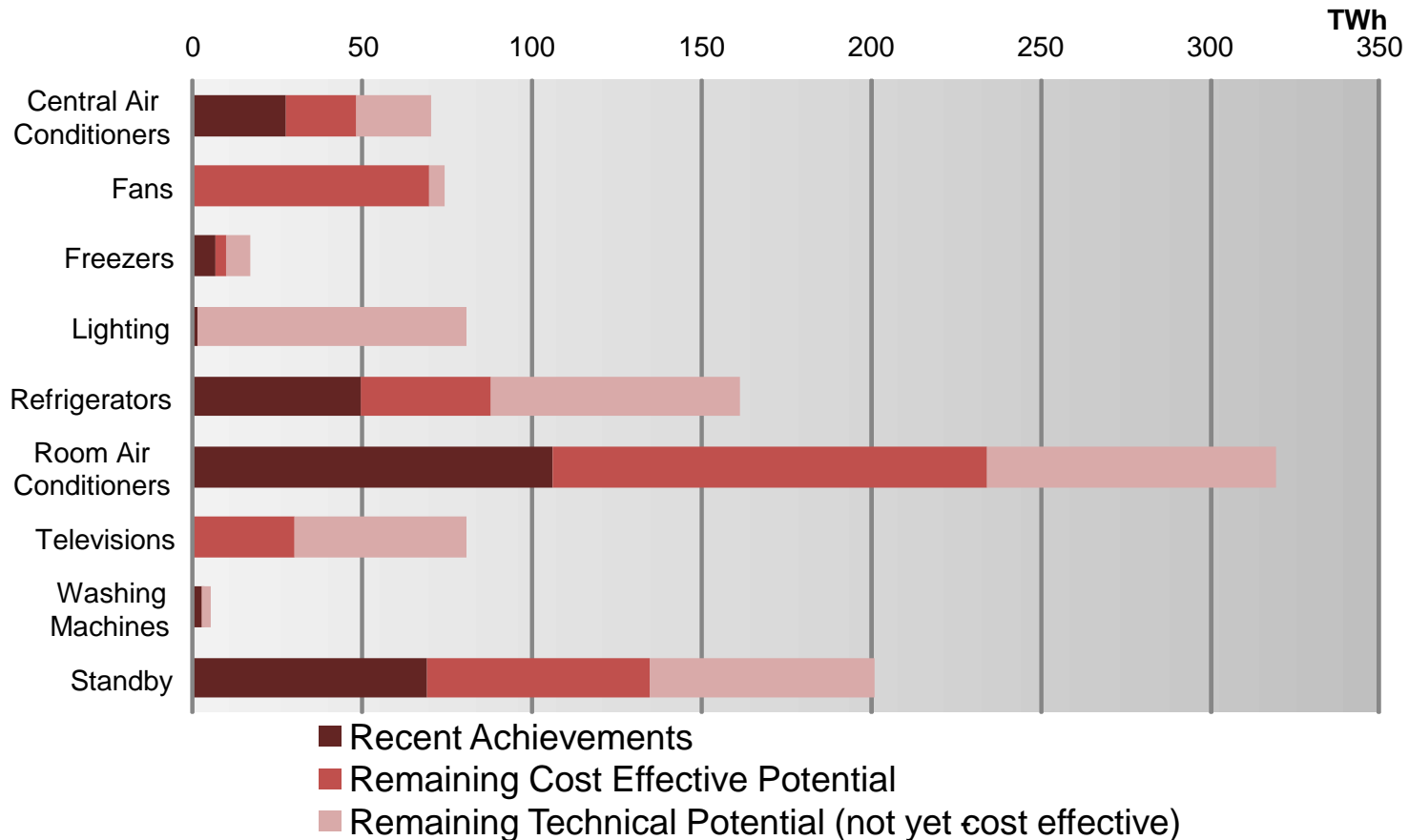


Source: NSSO, 2012,
Fridley et al., 2012

- Urban AC ownership ~0% in 1990, grew 100% in 15 years and over 140% today
- ~50 million ACs (~80GW of load) added per year; ~120 ACs / 100 urban dwelling
- Similar sharp growth rate in refrigerator ownership



Energy Savings Potential by Appliance in the Major economies by 2030



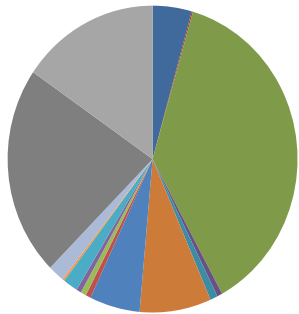
Source: LBNL BUENAS 2015



Current and Future Estimated Stock

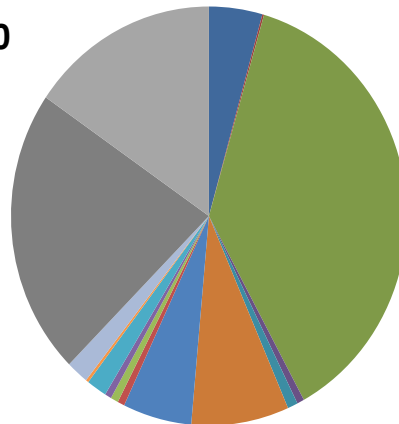
Global AC Stock Forecast

2015



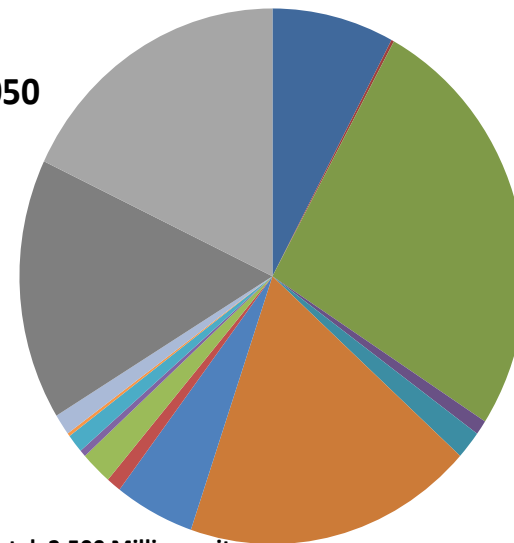
Total: 900 Million units

2030



Total: 1,600 Million units

2050



Total: 2,500 Million units

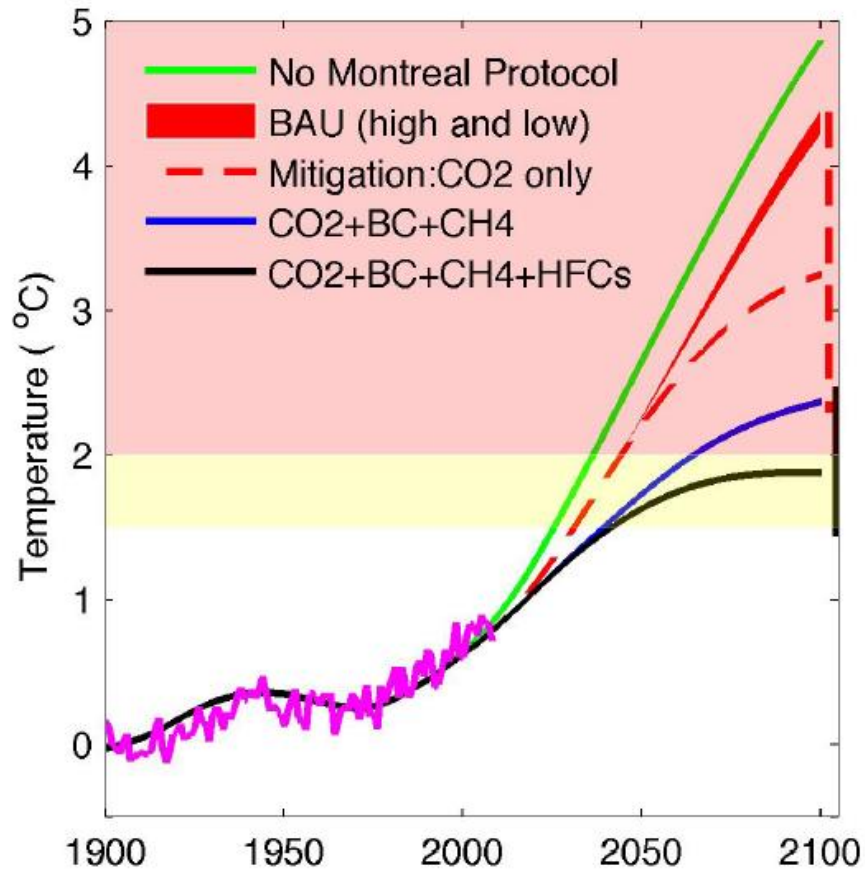


Source: Shah, Wei, Letschert and Phadke, 2015

- Significant growth through 2050, mainly China, India and SE Asia, along with Brazil.
- Projections from LBNL BUENAS model (also used by IEA's World Energy Outlook)



Control of CO₂ and HFC emissions needed



(Source: Xu *et al.*, 2013)

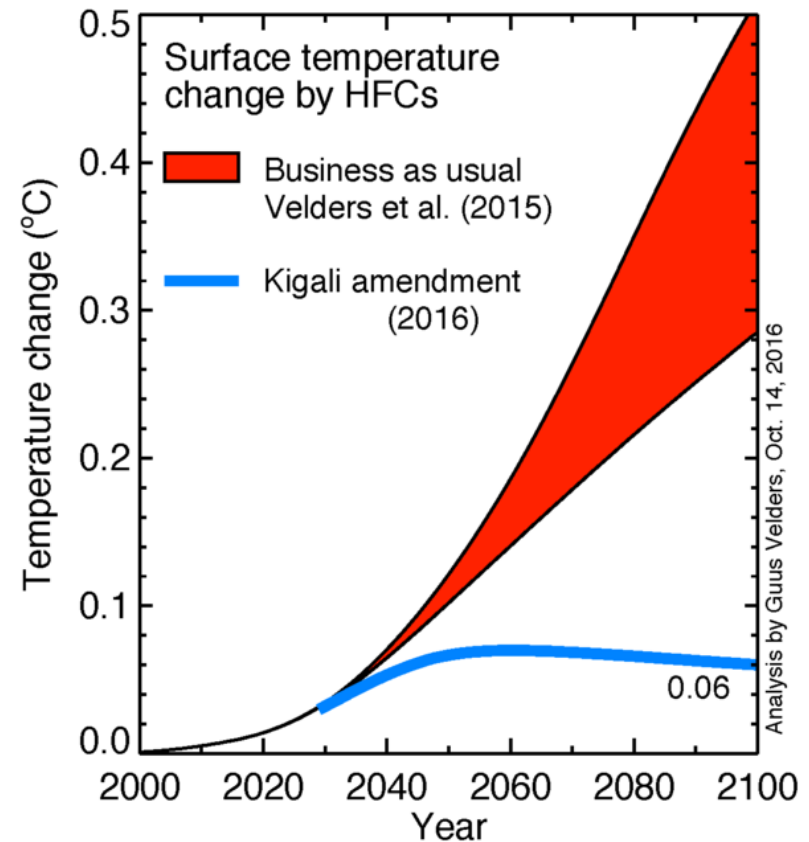
Refrigerant	100 year GWP
R134a (HFC)	1430
R404A (HFC)	3900
R410A (HFC)	2100
R22 (HCFC)	1810

- HFC fastest-growing non-CO₂ GHG (EPA, 2014)
- Without an international control, continuing growth of HFCs will be responsible for 0.1°C temperature rise in 2050, with potential of increasing up to 0.5°C by 2100



Kigali Amendment to Montreal Protocol

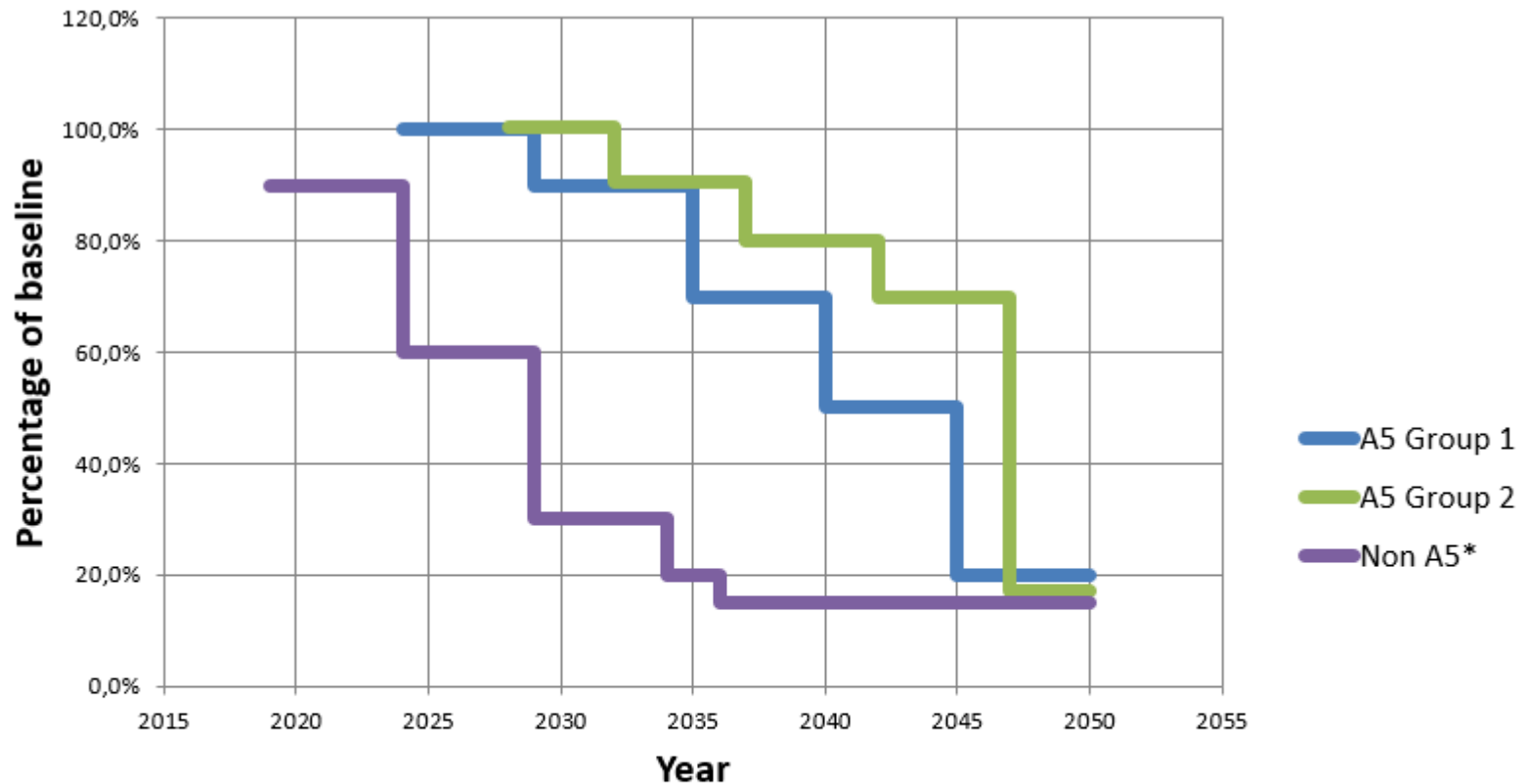
- Former US Secretary Kerry: “It is likely the single most important step we could take at this moment to limit the warming of our planet and limit the warming for generations to come.”
- Objective: Reduction of 72 GTCO₂eq until 2050



(Source: Velders et al, 2016)



Kigali Amendment to Montreal Protocol



- **Baseline for Non A5** = Average HFC consumption levels for 2011-2013 + 15% of HCFC baseline*

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

- **Baseline for A5 Group 1** = Average HFC consumption levels for 2020-2022 + 65% of hydrochlorofluorocarbon (HCFC) baseline
- **Baseline for A5 Group 2** = Average HFC consumption levels for 2024-2026 + 65% of HCFC baseline

NOTE: the same phasedown schedule and formula apply to production and consumption



Huge Momentum with Paris Agreement and Kigali Amendment

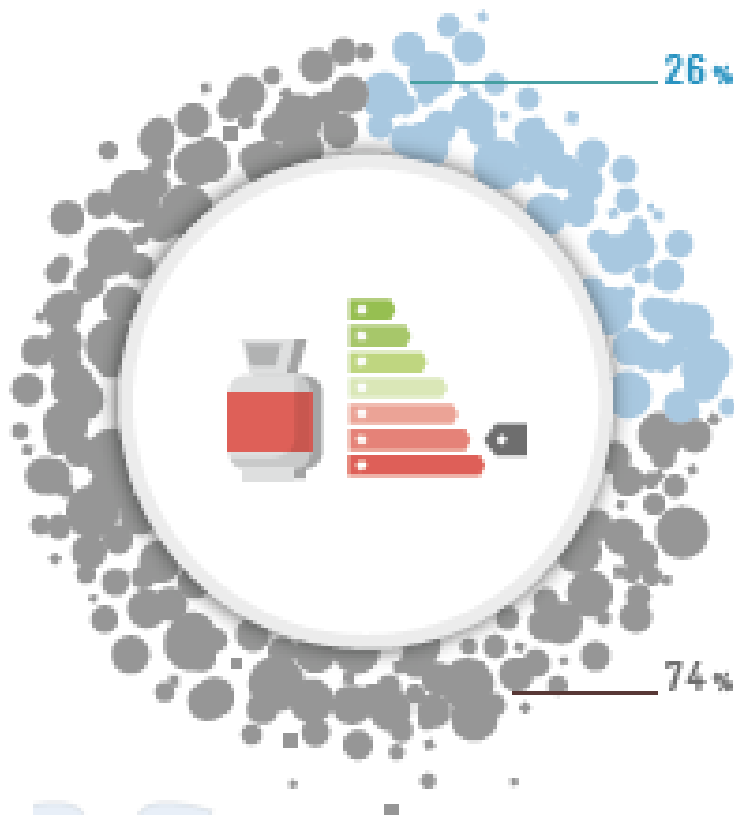
- Kigali HFC amendment to the Montreal Protocol defines turning point towards sustainable RAC, however, timely HFC-phase down essential for achieving Paris 2° target.
- NDC development provides good opportunity to address HFC phase-down within larger sustainable sector strategies
- Parties increasingly address HFCs and efficiency in NDCs
- Need for coordination of regimes in various aspects:
 - Closer coordination among key stakeholders
 - Emissions reporting
 - Coordinated cooling sector financing (private investments, HFC phase-down, energy efficiency)



1. Pursue an integrated green cooling approach

Business-as-usual in 2030

8,010 Mt CO₂ eq *



Green cooling in 2030

4,610 Mt CO₂ eq *





Simultaneous Efficiency Improvement and Refrigerant Transition

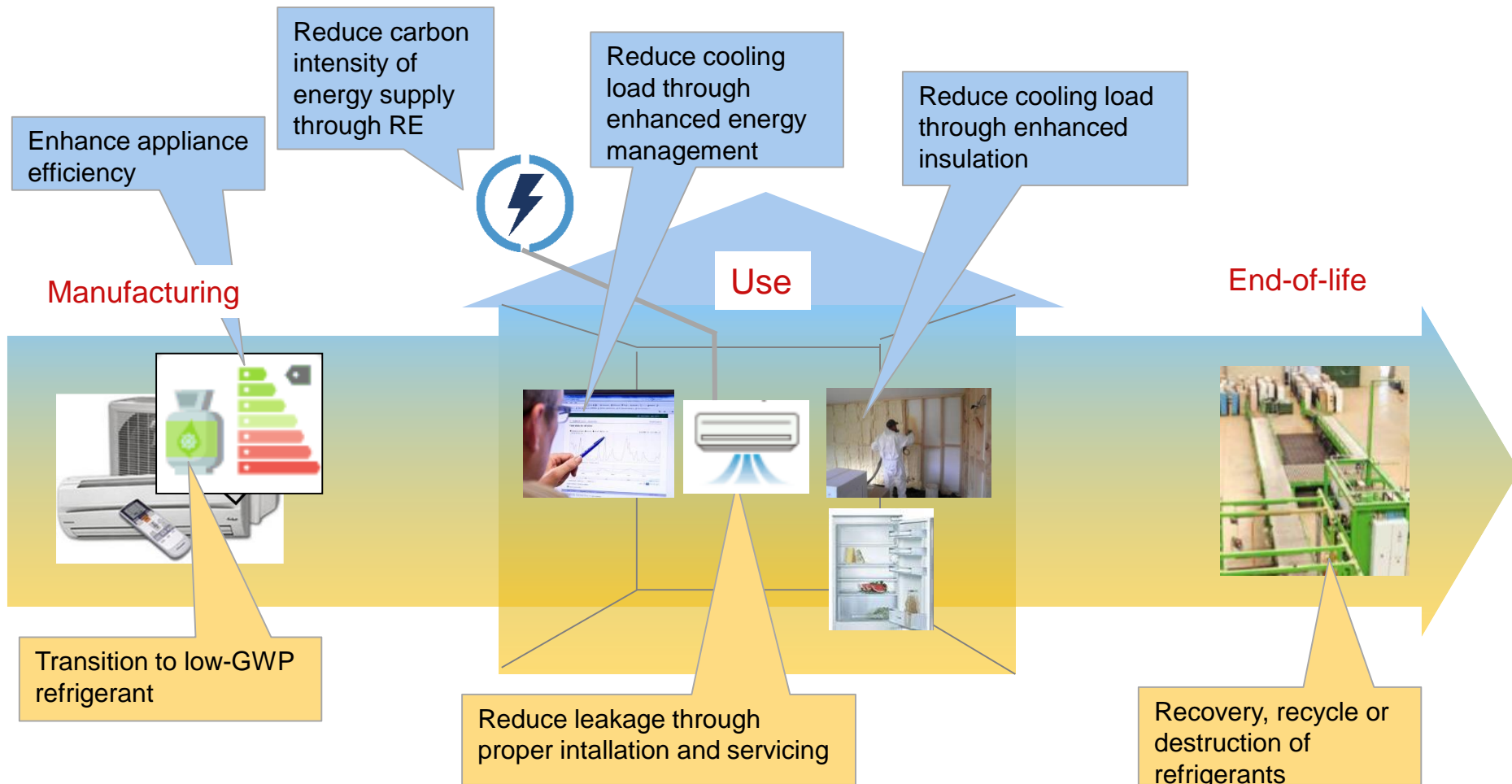
- ACs and refrigerators are often regulated for energy efficiency and will also undergo refrigerant transition under current HPMPs and Kigali Amendment.
- These changes typically require redesign of appliances and retooling of manufacturing lines, which should be coordinated to keep costs low for consumers, manufacturers and utilities.
- How?
 - When efficiency policy is enacted – implement simultaneous low-GWP criterion.
 - When refrigerant transition policy is enacted – implement simultaneous efficiency improvement.

Opportunity for leadership!

(Source: Shah 2017)



GHG mitigation options in the RAC sector

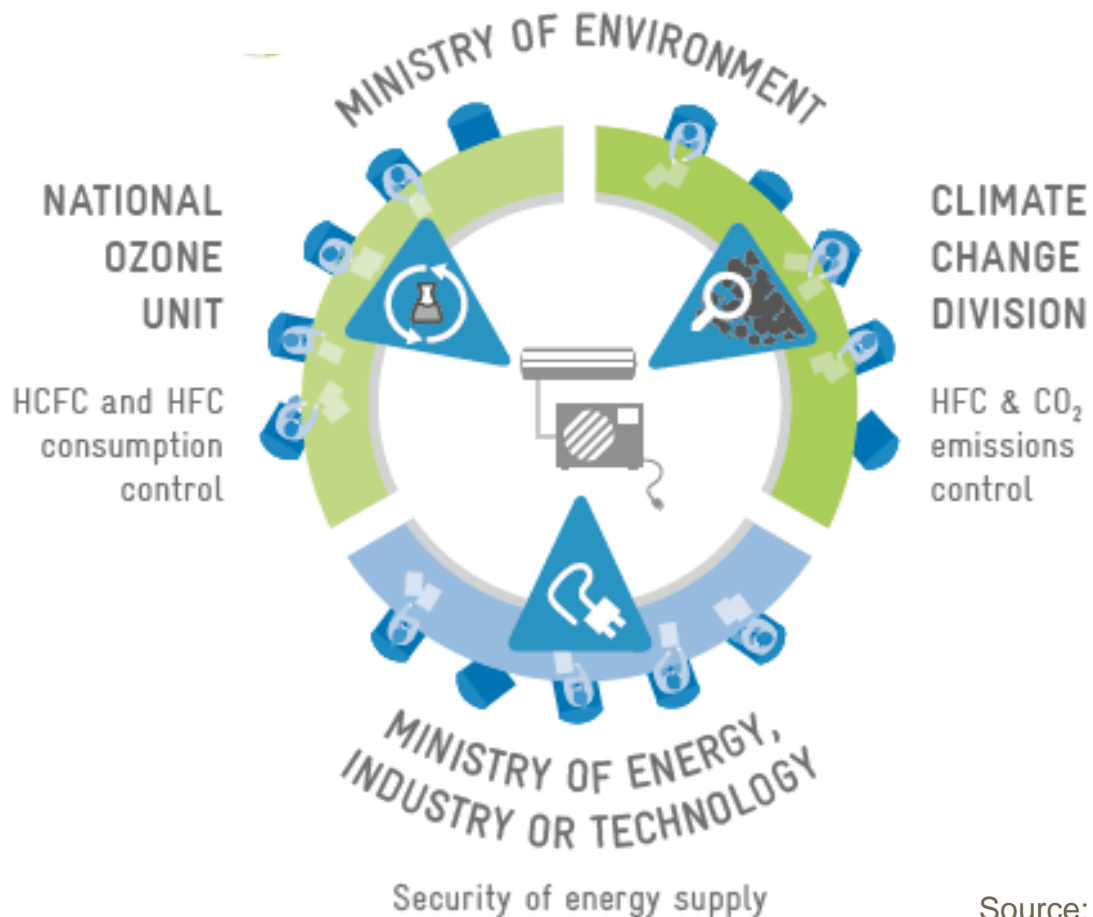


= Reduction options of direct emissions

= Reduction options of indirect emissions



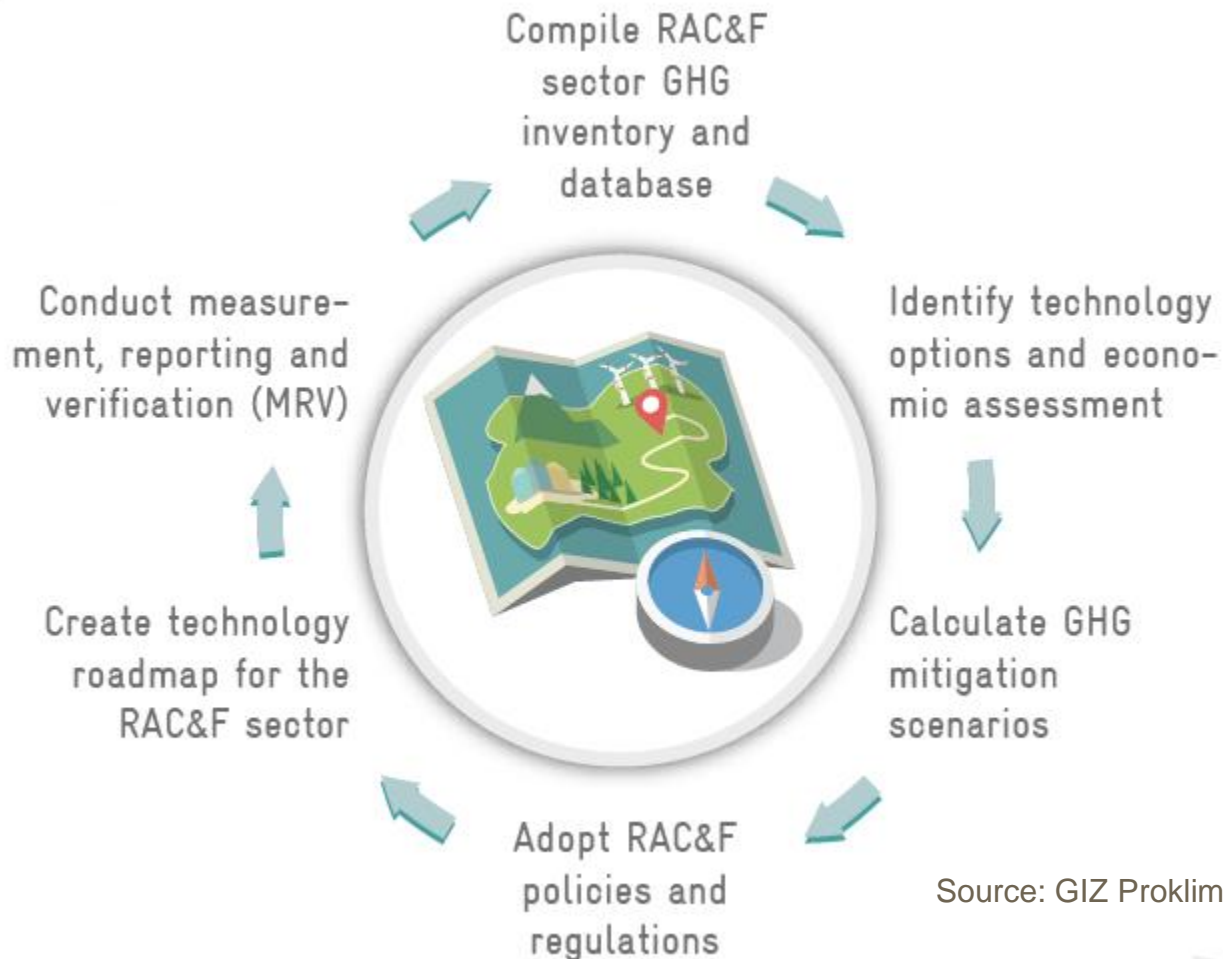
2. Join forces: coordination among key actors



Source: GIZ Proklima 2016

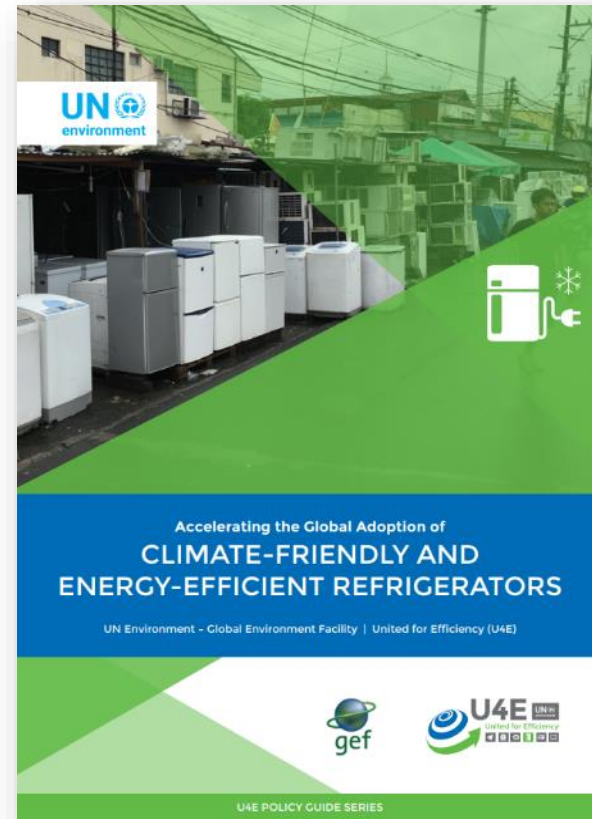
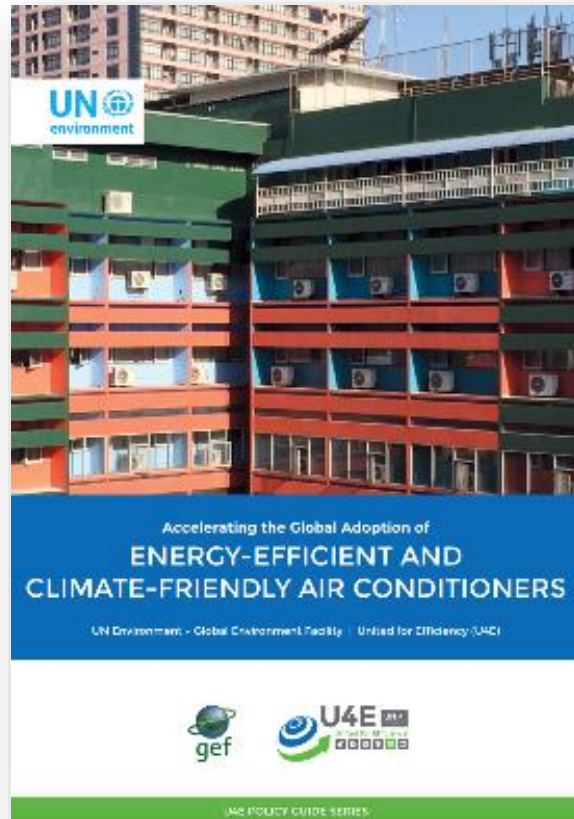


3. Develop cooling mitigation strategy



Source: GIZ Proklima 2016

Policy Guides by U4E



- Window, Split and portable ACs
- Can improve efficiency 60-70% via inverters, electronic expansion valves, better compressors & heat exchangers.

- Freezers, Fridges and Fridge-freezers
- Can improve efficiency 60% via better insulation, compressors and controls.



Thank you for your attention!

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GIZ Proklima Project Manager

On behalf of:



Federal Ministry
for the Environment, Nature Conservation,
Building and Nuclear Safety

of the Federal Republic of Germany

Have a look at our projects and publications at:

➤ GIZ Proklima

<https://www.giz.de/expertise/html/4809.html>

➤ Green Cooling Initiative

www.green-cooling-initiative.org

