



Green Cooling

Accelerating the transition to climate-friendly and energy-efficient refrigeration and air conditioning

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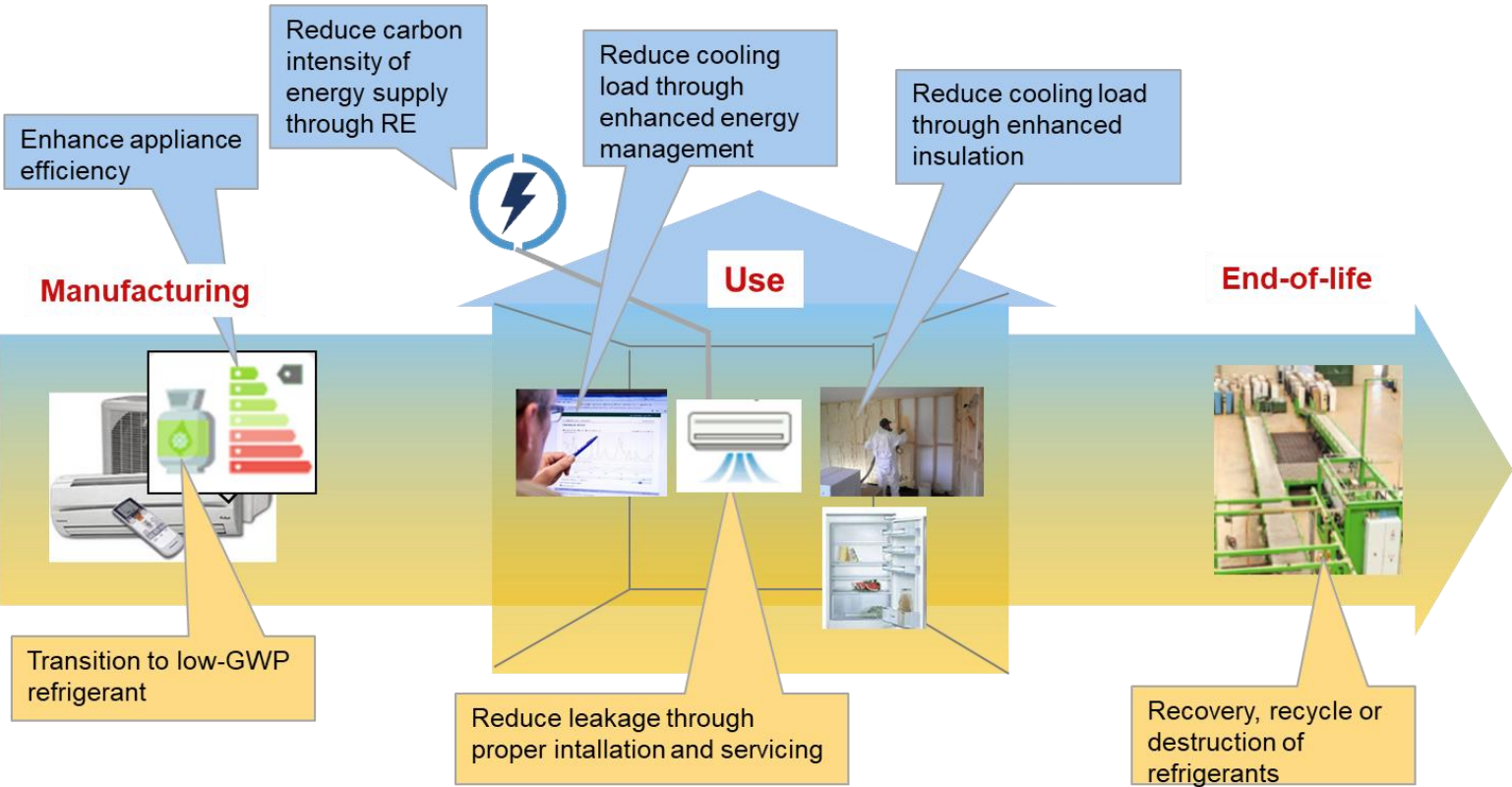
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Global cooling trend

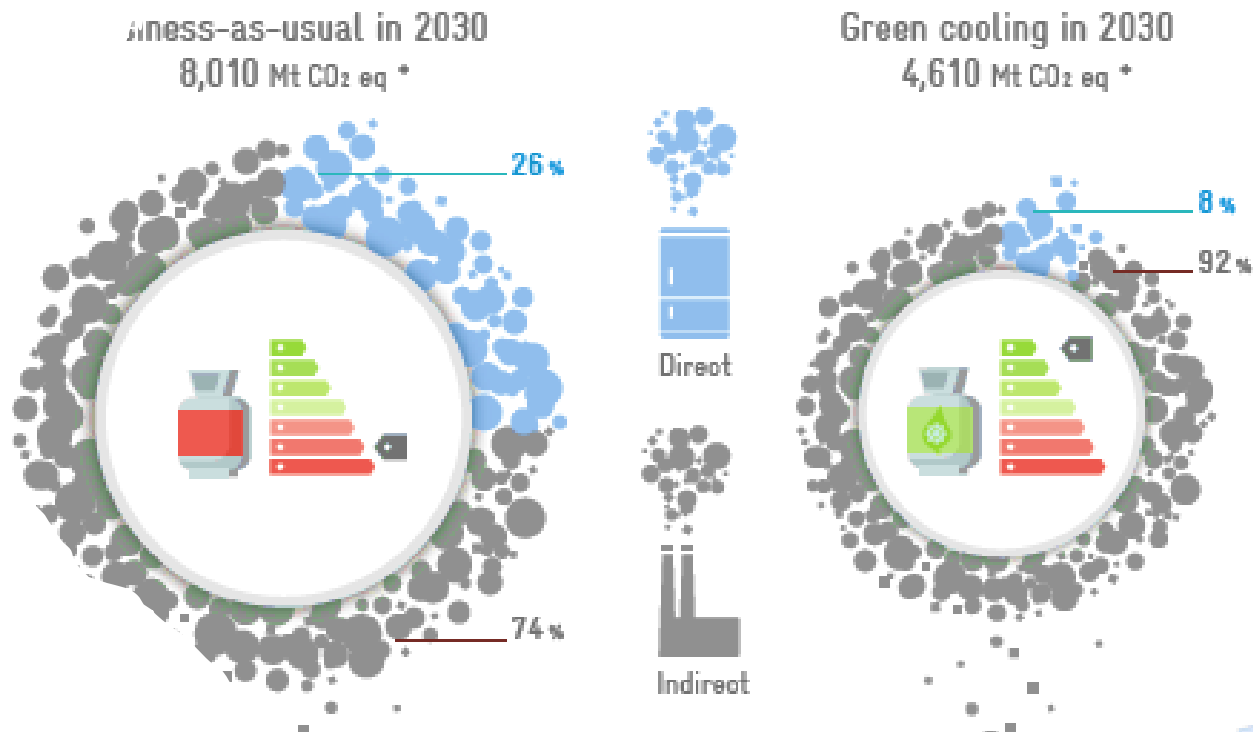
- Population growth, an increasing middle class, changing lifestyles and rising ambient temperatures drive the increasing demand for refrigeration and air conditioning (RAC)
- The fast growth (7% per annum until 2050) comes with vastly growing sector-related GHG emissions, which result from fossil fuel-based electricity use for cooling appliances and the wide-spread use of highly climate-damaging refrigerants.
- The combined emissions from the RAC sector amount to an estimated 2.7 GtCO₂eq in developing countries, or 10.5% of their total emissions (GIZ Proklima 2017).
- From the total RAC emissions in developing countries, more than two thirds result from air-conditioning.



GHG mitigation options in the cooling sector



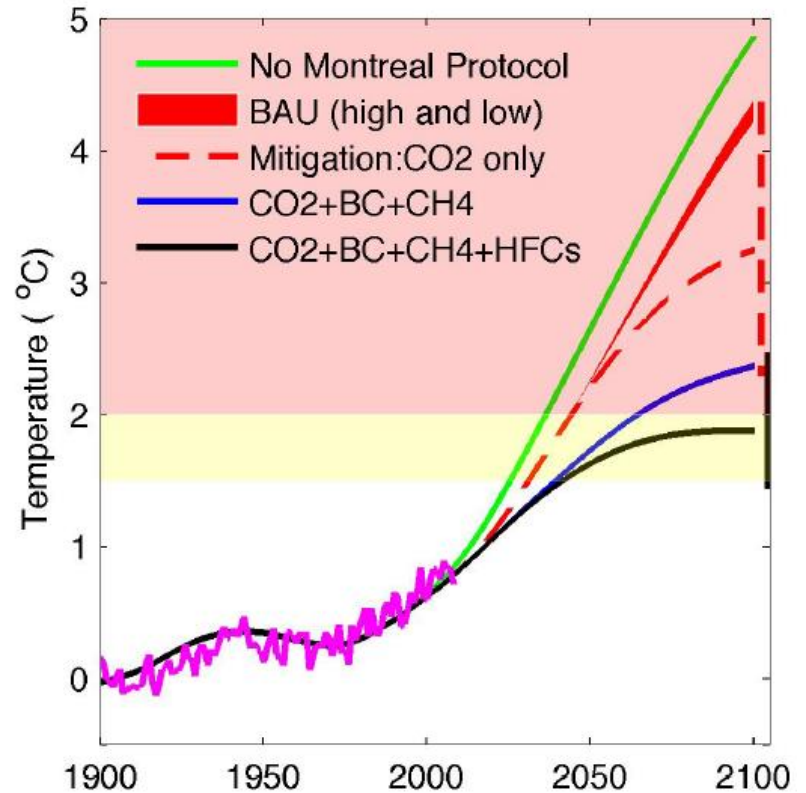
Climate impact of refrigeration and AC



Sources: ¹GCI 2014/ IEA 2012 (data both 2012); ²GCI 2014

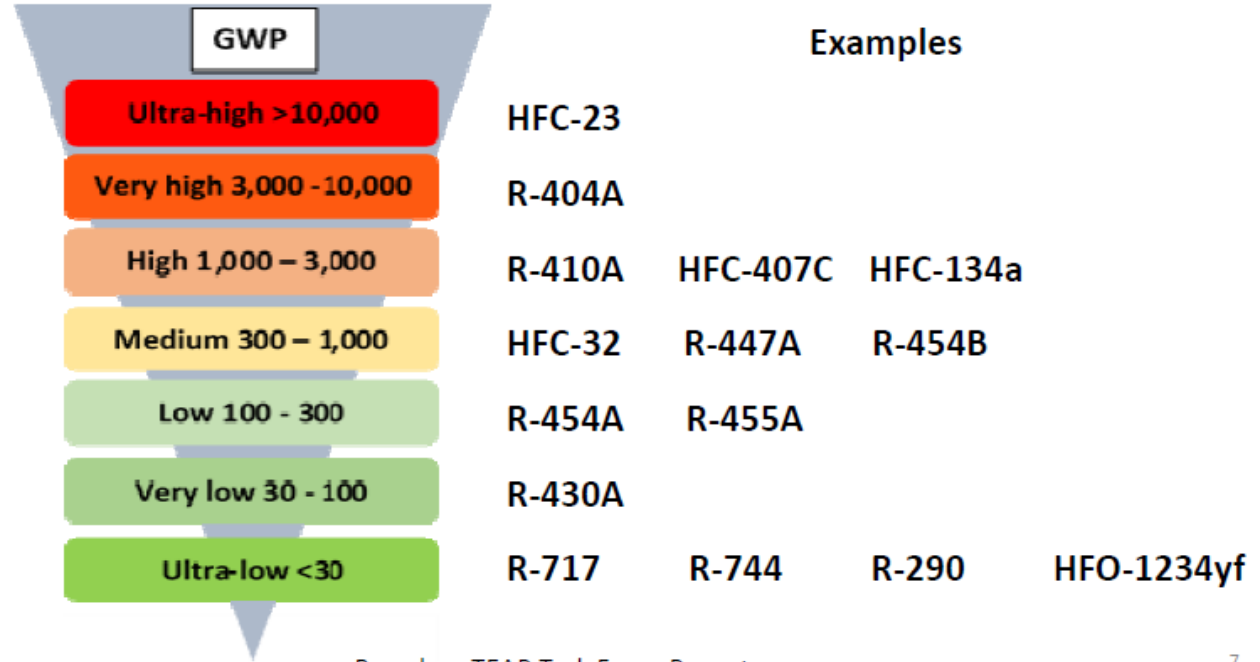
HFC emissions trend

- 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
- Replace HFC refrigerant: 100 million tonnes CO2 eq saved by 2030, including EE significantly higher.



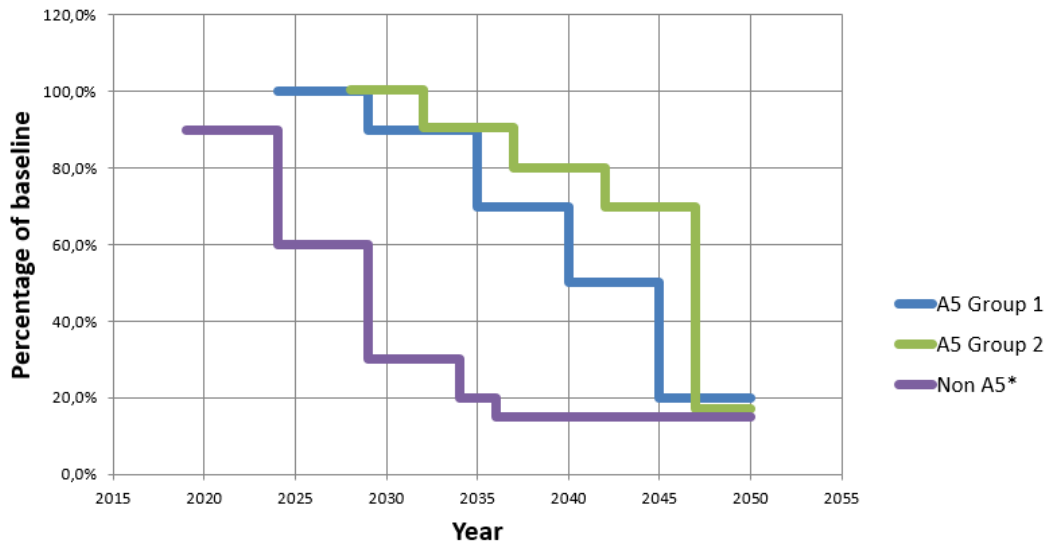
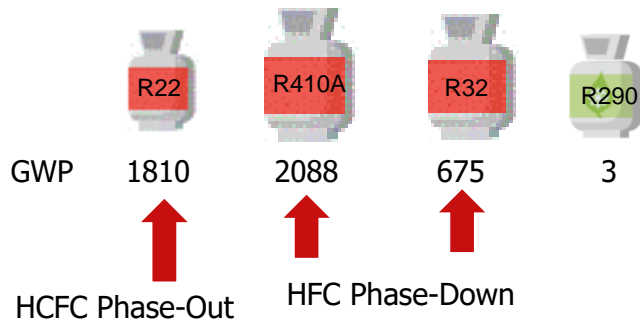
(Source: Xu *et al.*, 2013)

Current refrigerant options and their climate impact



Kigali Amendment requires the market to change

Example: Room ACs



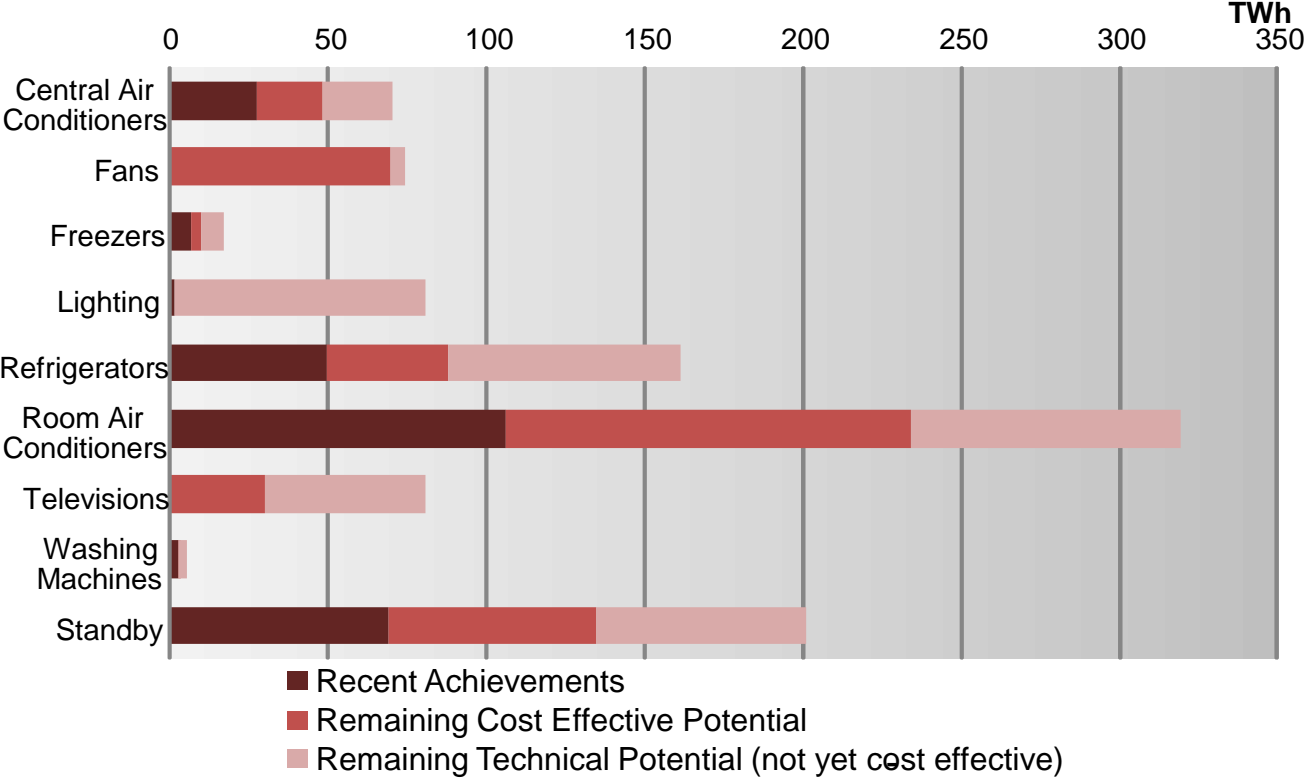
- **Baseline for Non A5** = Average HFC consumption levels for 2011-2013 + 15% of HCFC baseline*

*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

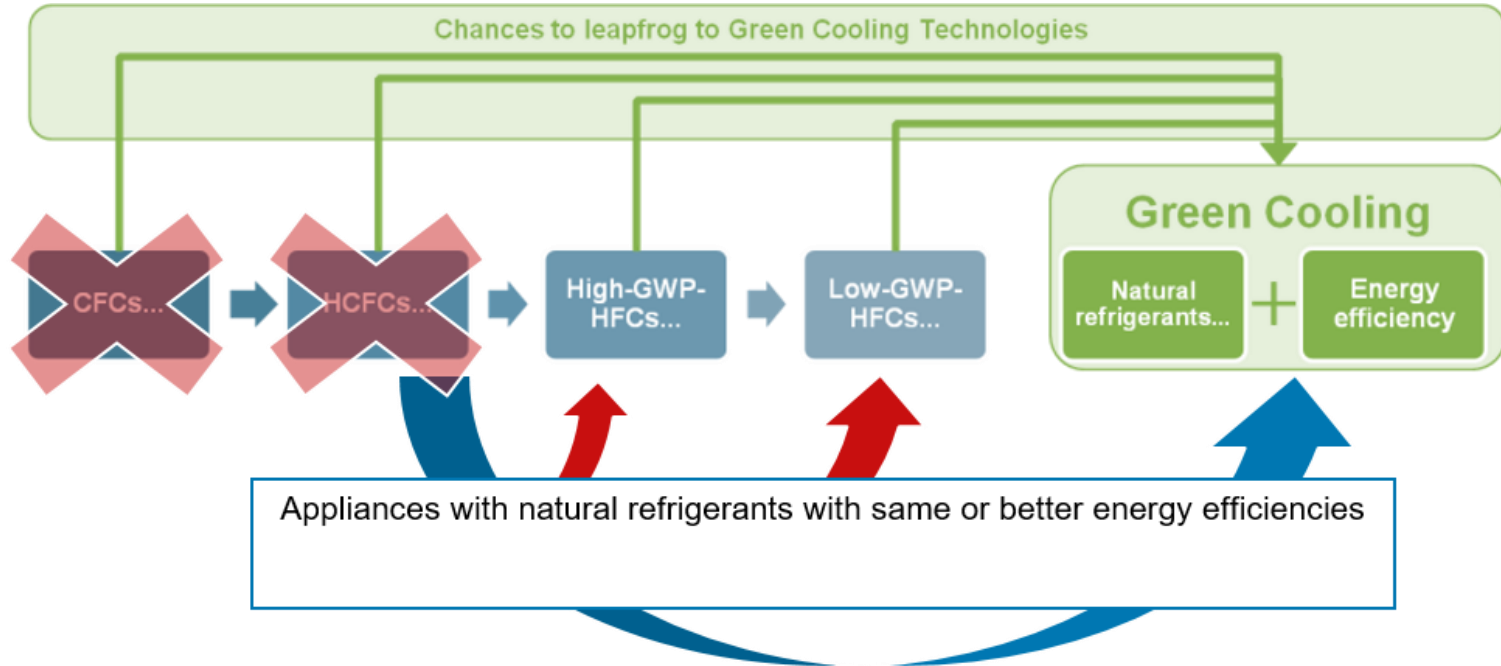
NOTE: the same phasedown schedule and formula apply to production and consumption

Energy Savings Potential by Appliance in the Major economies by 2030



Source: LBNL BUENAS

Green Cooling Approach



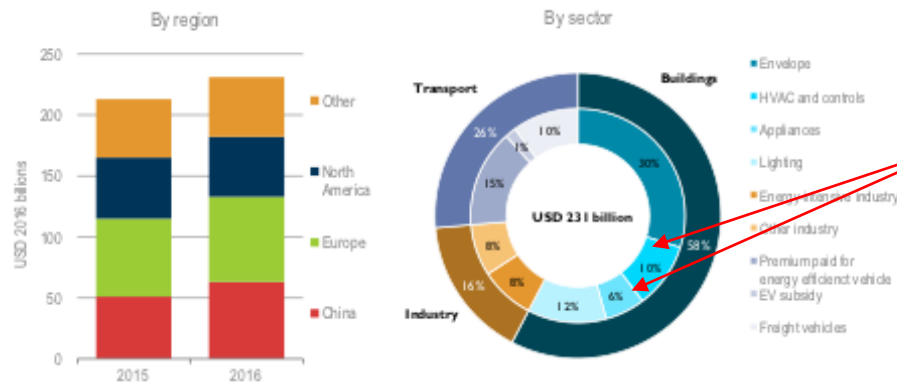
Project example: Development of Green AC market in India

- Technical Assistance to local AC manufacturer Godrej & Bocye in converting HCFC-22 based split AC production to efficient HC-290 AC.
- Training of AC technicians Establishment of a qualification, certification and registration system to enhance skill levels of AC technicians on proper handling of flammable refrigerants during HC-290 split AC manufacturing, installation, servicing and repair.
- So far, Godrej sold more than 1 mio. units in the market with a capacity of 1 TR (3,37 kW) and 1,5 TR (5 kW), Current inverter HC-290 split AC models are top in efficiency in their capacity category



Global building sector is leading investments in EE

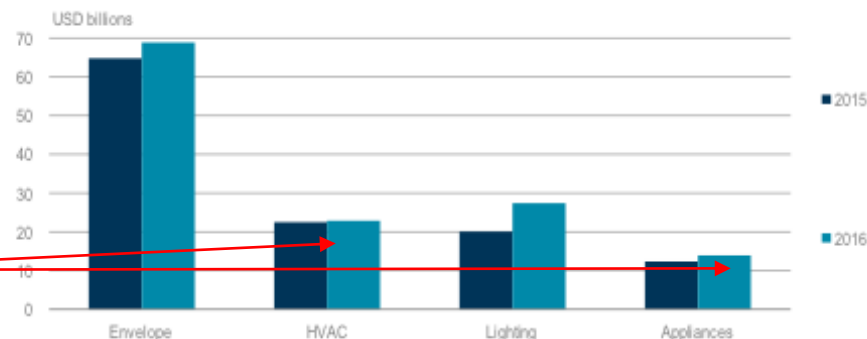
Energy efficiency investment by region and sector



Sources: IEA Energy Efficiency Investment Database; Navigant Research (2016), *Energy Efficiency Buildings Global Outlook* (database www.navigantresearch.com); CEE (2016), *CEE Annual Industry Report*; IHS Markit (2016), *Vehicle Registrations and Other Characteristics Model Level*; Marklines (2017), *Connect to the Global Automotive Industry*; and IEA 4E-TCP (unpublished), *Phase-out of Inefficient Li A Global Market Move*.

HVAC and appliances make 16% of global energy efficient investments (Industrial cooling not included)

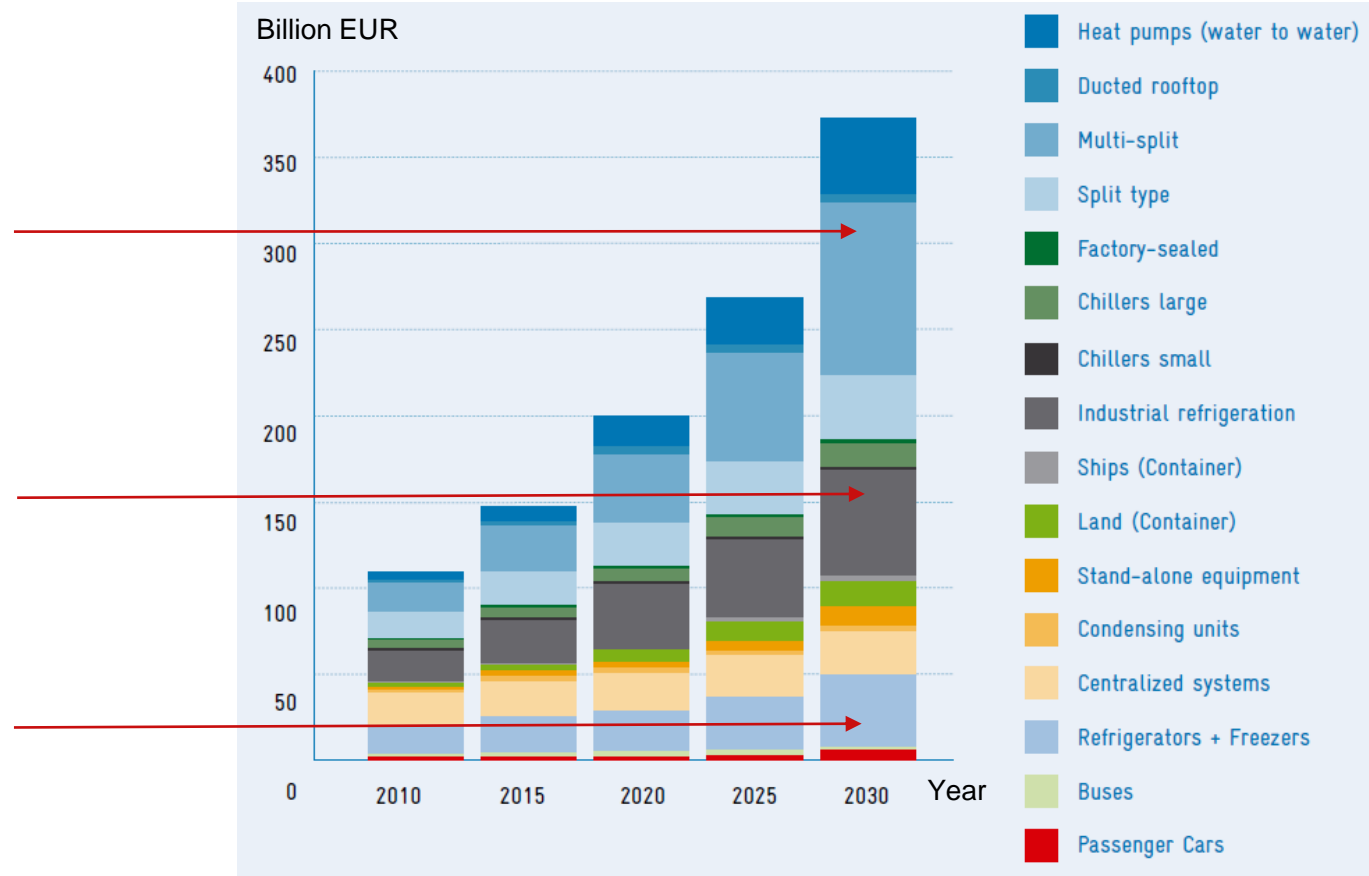
Incremental energy efficiency investment in buildings, 2015-16



Sources: IEA Energy Efficiency Investment Database; Navigant Research (2016), *Energy Efficiency Buildings Global Outlook* (database www.navigantresearch.com); CEE (2016), *CEE Annual Industry Report*; and IEA 4E-TCP (unpublished), *Phase-out of Inefficient Lighting: A Global Market Move*.

HVAC and appliances make 28 % of energy efficient investments in the building sector compared to 51%for envelope.

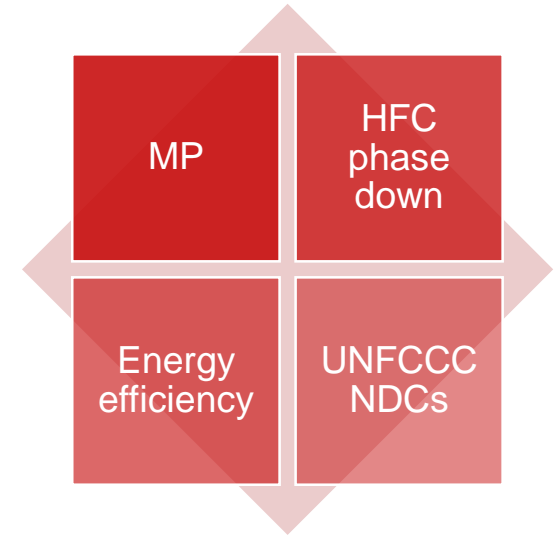
Market volume



Source: based on Schwarz et al, 2011

Financing green cooling

- Provision and effective deployment of finance to enable widespread uptake of climate friendly technologies one of the challenges to achieve Paris Agreement goals.
- RAC sector faces a particular challenge in the implementation of effective finance strategies:
 - Cross-sectoral nature – extending from manufacturing of gases and appliances to energy use in various fields of application
 - different institutional responsibilities as well as policy and compliance regimes
- Need for effective finance strategies, securing necessary funding from national and international sources, based on robust estimation of costs and investment needs in the RAC sector.



Coordinating finance in the cooling sector

Main findings:

- The RAC sector is a rapidly growing sector that offers highly cost-effective mitigation potentials.
- The RAC sector falls within the scope of two international regimes.
- The Kigali Amendment is a first step towards the integration of the two regimes at the global level.
- Development synergies are an effective incentive for national stakeholder engagement
- Enhanced coordination of finance flows under the climate regime, MLF, GEF, GCF, NAMA Facility and development banks



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