

Green Cooling Technologies: Reducing Emissions from Refrigeration and Air- Conditioning Sectors

CTCN/GIZ Webinar, 25th November 2015

On behalf of



Federal Ministry for the
Environment, Nature Conservation
and Nuclear Safety

of the Federal Republic of Germany

The Climate Technology Centre and Network

- Operational arm of the UNFCCC Technology Mechanism
- Consortium of organizations from all regions + Network
- Mission to stimulate technology cooperation and enhance the development and deployment of technologies in developing countries
- Technologies include any equipment, technique, knowledge and skill needed for reducing greenhouse gas emissions and for adapting to climate change effects
- Core services include:
 - Technical assistance to developing countries
 - Knowledge platform on climate technologies
 - Support to collaboration and partnerships



CTCN Technical Assistance

Support to remove barriers to technology transfer (financial, technical, institutional)

- ✓ Identification of needs and prioritization of technology, depending on country context
- ✓ Technical recommendation for design and implementation of technology
- ✓ Feasibility analysis of deploying specific technologies
- ✓ Support to scale up use and identify funding for specific technologies
- ✓ Support legal and policy frameworks

Country-driven

- Any organization from developing countries can express need
- Request endorsed and submitted by the NDE

Fast and easy access to assistance

- User-friendly access: 4-pages submission, in all UN languages
- Appraisal of request within 1-2 weeks and response design within 2-8 weeks

CTCN selects and contracts relevant experts

- Assistance provided through Consortium and Network (value up to 250,000 US\$)
- Collaboration with financial organizations to trigger funding



CTCN Technical Assistance

Example of assistance in Namibia, Ghana, Mauritius and Kenya: The Green Cooling Africa Initiative (GCAI)

Request:

- Most cooling technologies not sustainable and emit GHG
- Countries want to shift to sustainable equipment in this sector
- Need to identify the best technologies to do so
- Need to ensure enabling framework in place to enable diffusion of these technologies



CTCN Response:

- Inventory of GHG emission in cooling sector
- Analysis of technology gap and needs base on best available options
- Recommendations on policies and regulations
- Recommendations for country-specific roadmaps

Expected result: Increase understanding and knowledge of policy makers in the sector to prepare appropriate policy measures

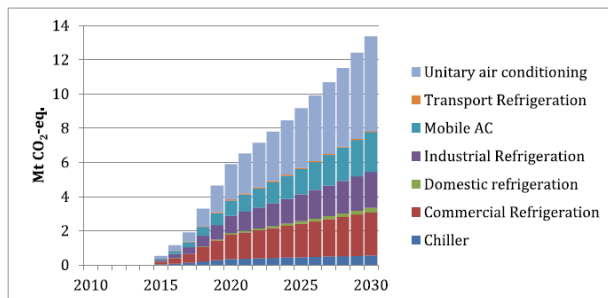


Figure 4. Total estimated CO₂-equiv. GHG emissions mitigation potential in for Ghana, Kenya, Mauritius and Namibia for key cooling sub-sectors¹⁸.



United Nations
Framework Convention on
Climate Change



Networking and Collaboration



Join our network!

Access commercial opportunities: respond to competitive bidding for delivery of CTCN technical assistance services

Create connection: network with national decision makers and other network members to expand your partnership opportunities and learn about emerging areas of practice

Increase visibility: broaden your organization or company's global reach, including within UNFCCC framework

Exchange knowledge: keep updated on the latest information and share via the CTCN's online technology portal

Examples of collaboration

Co-host climate related events

Twinning arrangements with research institutions

Engage in new technology projects

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Leapfrogging to Green Cooling Products

Patrick Blake

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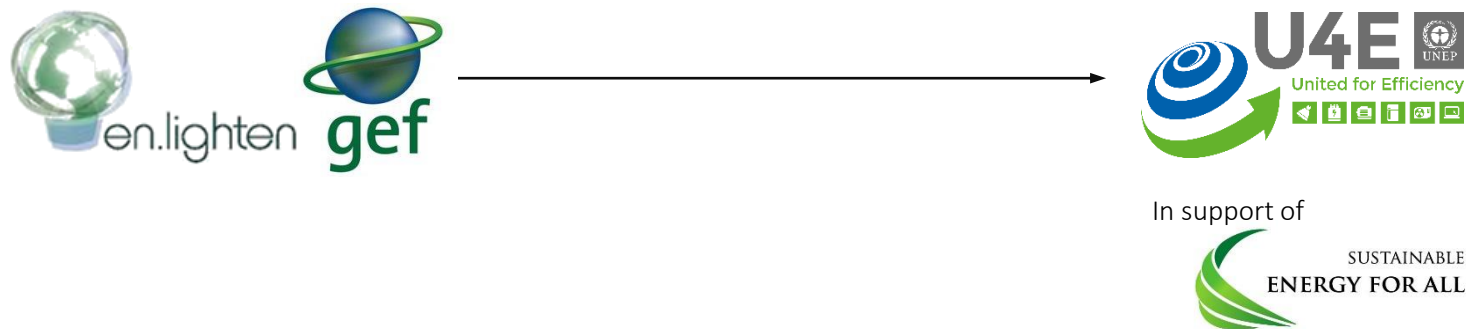
United Nations Environment Programme

GIZ Green Cooling Initiative Webinar

25 November 2015



Efficient Appliances & Equipment – taking the en.lighten approach to the next *low hanging fruits*



- UNDP, ICA, CLASP, NRDC and UNEP launched the United for Efficiency (U4E) in 2014
- The Programme aims to join forces with private and public sector to expand the en.lighten approach to the next *high impact opportunities*,
- Supporting the second goal of the Secretary General’s SE4ALL initiative: double the global rate of improvement in energy efficiency
- The en.lighten and U4E initiatives form part of the SE4ALL Energy Efficiency Accelerators on Lighting and Appliances & Equipment



Project Partners on Lighting, Appliances & Equipment

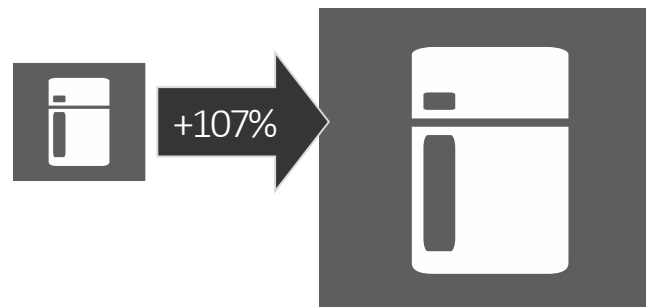
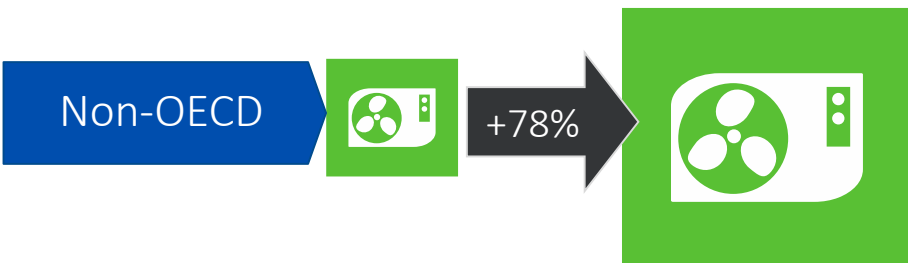
<p>Donors and International organizations</p>	
<p>Partner Organizations</p>	
<p>Supportive Private Sector</p>	



Countries Risk Locking-in Inefficient Products

Global stock of
room air conditioners

Global stock of
refrigerators



2010

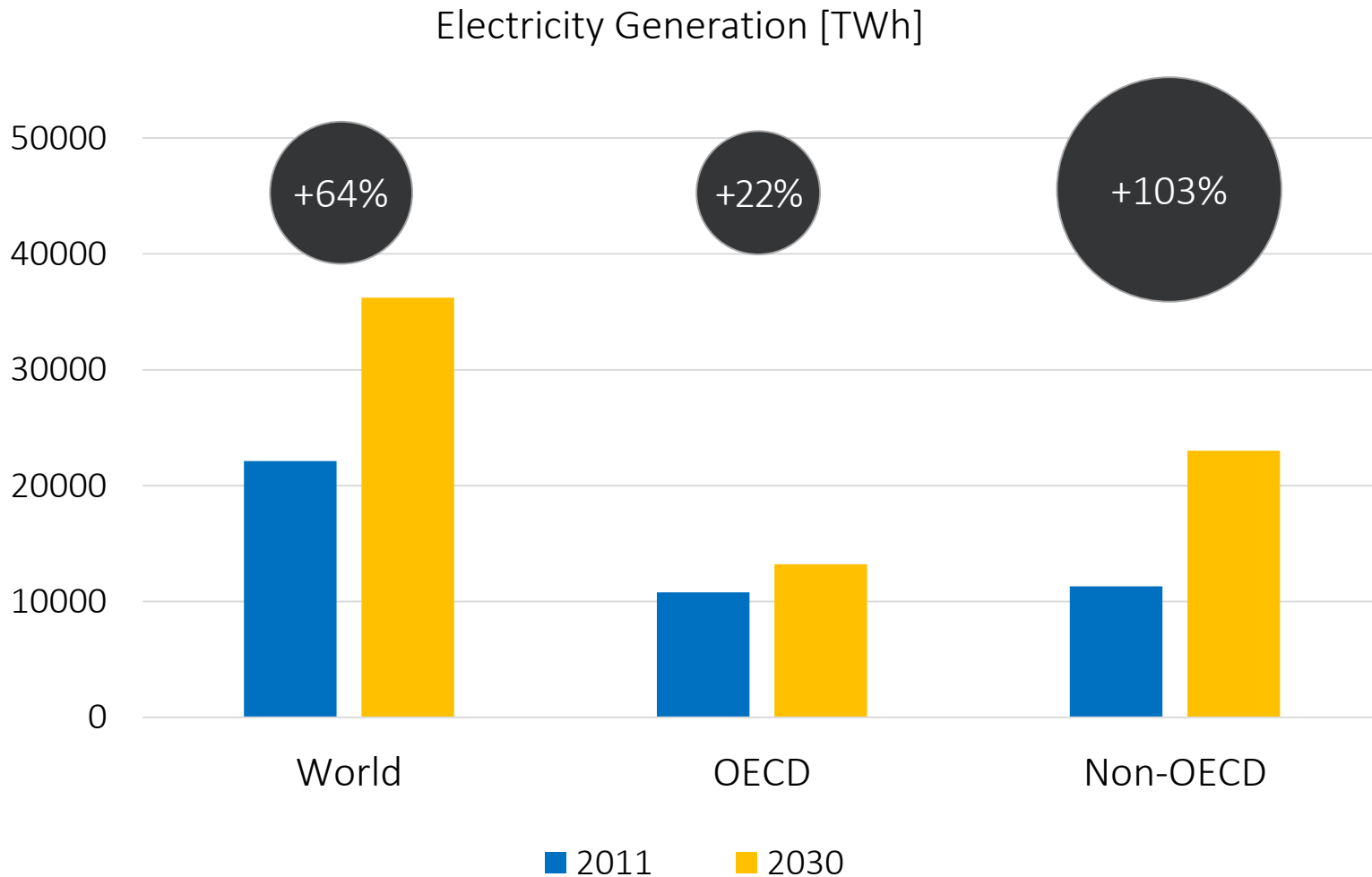
2030

2010

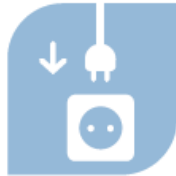
2030



With No Action, Electricity Demand in non-OECD Countries Will Double by 2030



Potential Global Savings Per Annum of Energy Efficient Refrigerators and Air Conditioners



Save electricity
→ by over **800 TWh**
→ By **4%** of electricity use



...equivalent to
180 power plants
[500MW]



Save **115 billion US\$**
on electricity bills



Reduce CO2 emissions by
580 million tonnes per year
...equivalent to
300 million
passenger cars



The Multiple Benefits of Leapfrogging to Efficient Appliances & Equipment



Savings on electricity bills increase purchasing power

Free power generation capacity for development



Meet Tomorrow's Energy Needs by Leapfrogging to Efficient Appliances & Equipment Today!



Reduce CO₂ emissions & mitigate climate change

Accelerate economic development



Making the Case Country Assessments



Guatemala

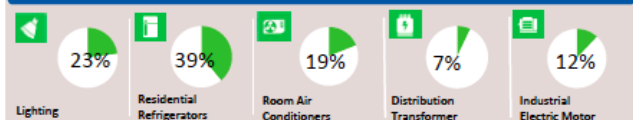


Energy efficiency benefits from lighting, residential refrigerators, room air conditioners, distribution transformers and industrial electric motors with the implementation of globally benchmarked minimum energy performance standards

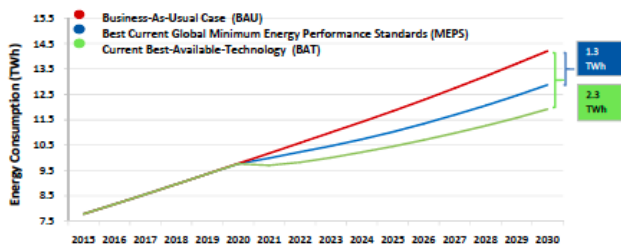
ANNUAL SAVINGS IN 2030

- Reduce electricity use**
 - by over **1.3 TWh**
 - **10.0%** of future national electricity use
- Save electricity worth 320 million USD**
equivalent to **3 Power Plants [100MW]**
- Reduce CO₂ emissions by 480 thousand tonnes**
equivalent to **270 thousand Passenger Cars**

PERCENTAGE OF EACH PRODUCT'S SAVINGS TO THE COUNTRY'S TOTAL SAVINGS IN 2030



EVEN GREATER SAVINGS POSSIBLE WITH BAT MEPS



PAGE 1

THE PATHWAY TO ENERGY EFFICIENCY



ANNUAL SAVINGS IN 2025 and 2030

	Lighting		Residential Refrigerators		Room Air Conditioners		Distribution Transformers		Industrial Electric Motors	
	2025	2030	2025	2030	2025	2030	2025	2030	2025	2030
Electricity (GWh)	308.8	305.7	255.4	523.0	129.4	241.1	51.8	98.9	74.6	161.6
Electricity Bills (million USD)	76.0	75.2	62.8	128.6	31.8	59.3	12.7	24.3	15.2	32.8
CO ₂ Emissions (thousand tonnes)	112.3	111.1	92.9	190.1	47.1	87.6	18.8	30.4	27.1	58.7

CUMULATIVE SAVINGS (2020 - 2030)

	Lighting	Residential Refrigerators	Room Air Conditioners	Distribution Transformers	Industrial Electric Motors
Electricity (TWh)	2.68	2.84	1.39	0.58	0.85
Electricity Bills (million USD)	658.60	697.79	341.50	142.16	172.35
CO ₂ Emissions (thousand tonnes)	973.25	1,031.15	504.65	177.41	308.30

OTHER BENEFITS IN 2030

- Direct GHG emissions reduced by → 476.7 thousand tonnes**
- Increased grid connection to → 665.1 thousand households**
- Reduced emissions by → SO₂ 1.1 thousand tonnes, NO_x 620.8 tonnes**

PAGE 2



Policy Status



Brazil



Energy Efficiency Policy Assessment for Lighting, Residential Refrigerators, Room Air Conditioners, Distribution Transformers and Industrial Motors.

Lighting

	Policy Description	Policy Type	Mandatory or voluntary	Status
Minimum Energy Performance	MEPS for incandescent lamps/sodium lamps/CFL	MEPS		Implemented
Supporting Policy	EE Label for CFL, HID, incandescent/ballasts for HID	Label Comparative	Mandatory	Implemented
	EE Endorsement Seal for CFL/HID/incandescent/ballasts for	Label Endorsement	Voluntary	Implemented
Monitoring, verification and enforcement	Mechanisms of MV&E	MVE		Implemented
Environmentally sound management	Initiatives dealing with the recycling of fluorescent lamps			

Comments: For more details please visit <http://map.enlighten-initiative.org/>

Refrigerators

	Policy Description	Policy Type	Mandatory or Voluntary	Status
Minimum Energy Performance	Ordinance Interministerial No 326/2011	MEPS	Mandatory	Implemented -2011
Supporting Policy	Procel - Refrigerators	Label Endorsement	Voluntary	Implemented -2010
	Ordinance Inmetro nº 20 de 01/02/06	Label Comparative	Mandatory	Under reversion 2006
Monitoring, verification and enforcement	Ordinance Interministerial No 326/2011	Verification and Enforcement	Mandatory	Implemented -2011
Environmentally sound management	Refrigerator Recycling Programme-a pilot facility	Recycling Facility...		Completed 2013

Comments:

Room Air Conditioners

	Policy Description	Policy Type	Mandatory or voluntary	Status
Minimum Energy Performance	Ordinance Interministerial No 323/2011	MEPS	Mandatory	Implemented -2011
Supporting Policy	Procel - Air conditioners	Label Endorsement	Voluntary	Implemented -2013
	RAC annexed to Inmetro Portaria No. 007 04/01/2011	Label Comparative	Mandatory	Implemented -2011
Monitoring, verification and enforcement	ORDINANCE INTERMINISTERIAL No 323, OF 26 MAY 2011	Verification and Enforcement	Mandatory	Implemented -2011
Environmentally sound management	Sectorial Plan Agreement	Agreement for recycling scheme...	Mandatory	Implemented -2013

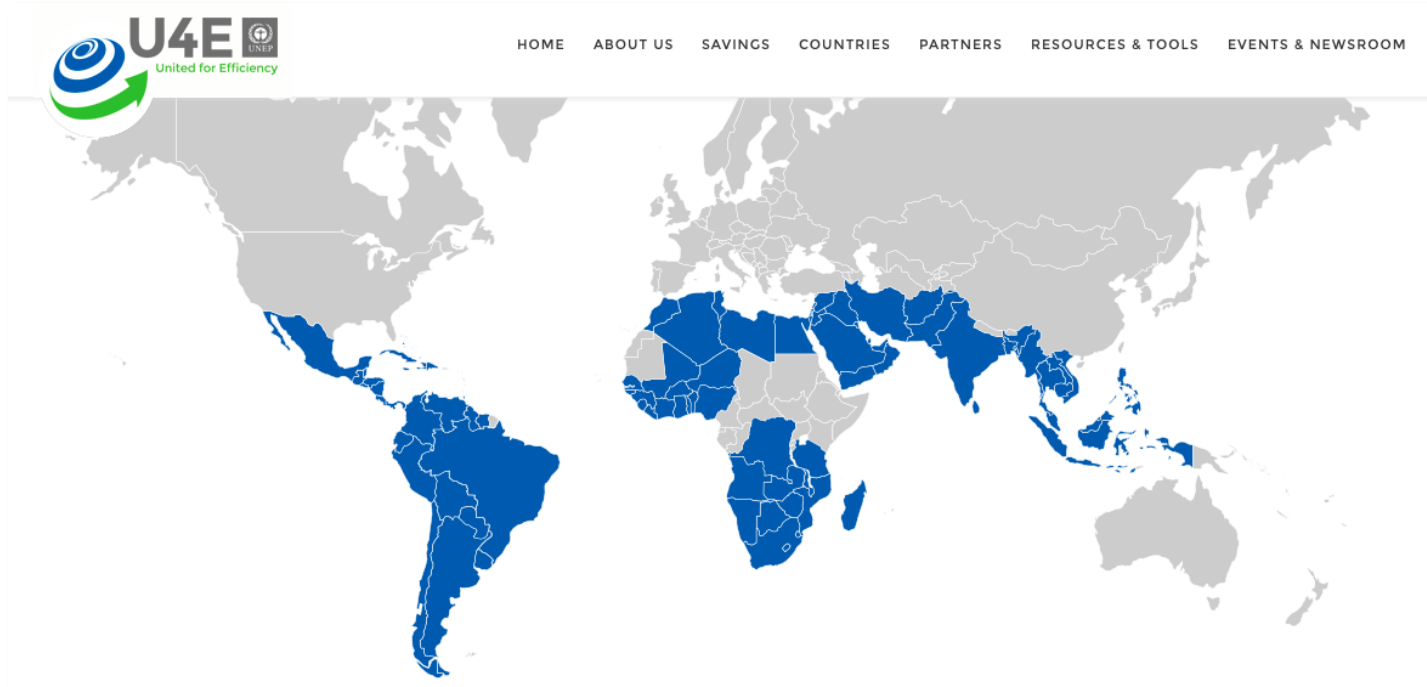
Comments:



100 Country Savings & Policy Assessments to be Released During COP21!



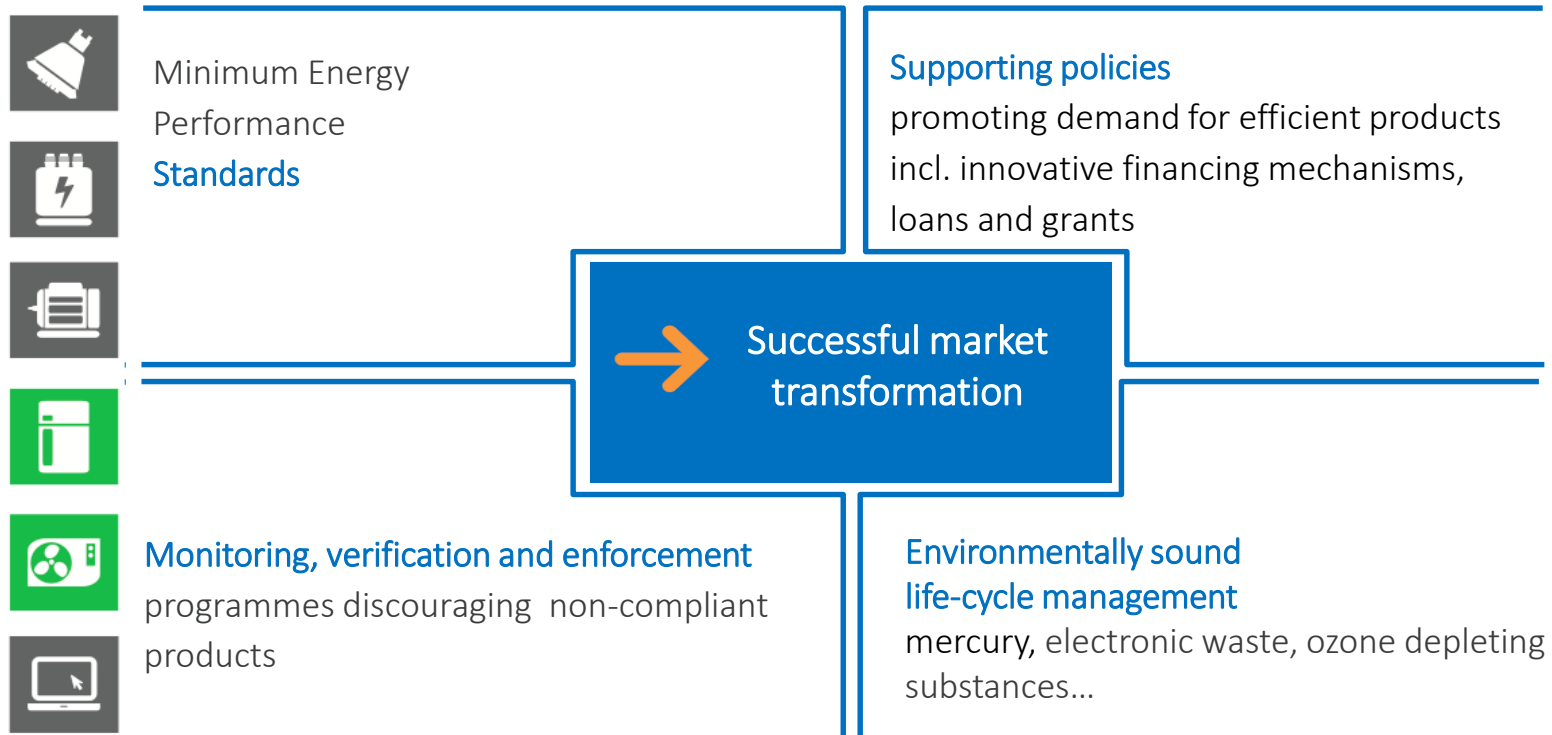
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SUR LES CHANGEMENTS CLIMATIQUES
COP21·CMP11



See <http://united4efficiency.org>



Integrated Policy Approach to Transform Markets



Providing Expertise & Developing Tools

The global “Centre of Excellence”



Support in the development of project proposals and providing access to financing



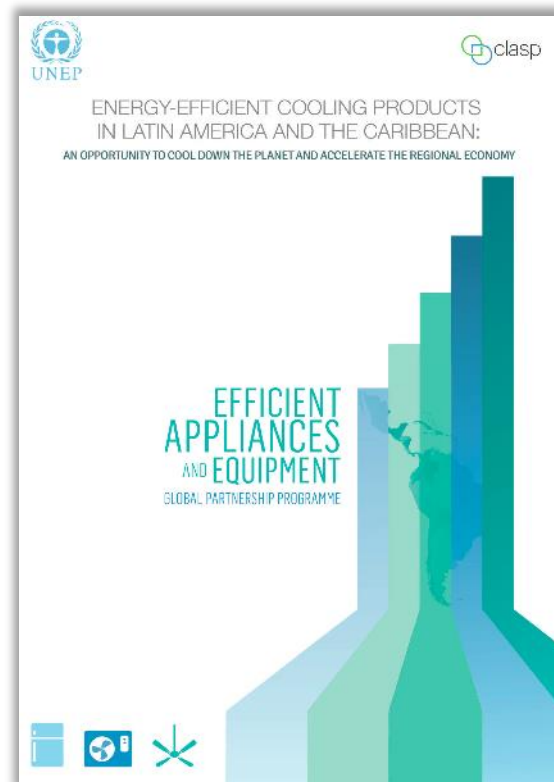
Training (online and face to face) on particular aspects of the integrated policy approach



Expertise provided throughout the implementation of projects advancing energy efficiency in lighting, appliances and equipment;



Development of individual country lighting, appliance, and equipment assessments.



Example: Latin America Regional Report on Cooling Products

Green Cooling Technologies: Reducing Emissions from Refrigeration and Air- Conditioning Sectors

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**Philipp Denzinger (philipp.denzinger@giz.de)
Proklima International**

On behalf of



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Green Cooling Initiative

About the project:

- Global Project
- 2012-2017 (Phase I.)
- Financed by the German Ministry of Environmental
- Political decision makers, technology suppliers and importers, research institutes, trainers, technicians, NGOs

Objective:

Promote climate-friendly and sustainable cooling technologies globally

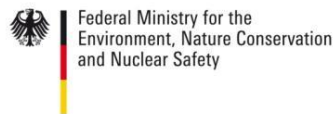
Activities:

- Support of the UN Technology Mechanism (TEC/CTCN)
- Establish Green Cooling Network and Platform
- Encourage technology partnerships
- Provide material and instruments for promoting Green Cooling.

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On behalf of



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What is Green Cooling?

Aiming at a reduction of emissions from the cooling sectors, the Green Cooling Initiative combines three approaches:

- **promoting natural refrigerants,**
- **maximising energy efficiency,**
- **fosters a sustainable approach to private and commercial energy consumption.**

The term "green cooling technologies" is used to describe equipment with maximized energy efficiency that is using natural refrigerants, thereby minimizing its environmental impact.



COUNTRY DATA

The refrigeration and air conditioning sectors around the world

Our world map allows you to explore a wide variety of data: refrigeration and air conditioning appliances in use, unit sales, emissions and emission mitigation potentials in the cooling sectors both today and in the future.

[explore data >](#)

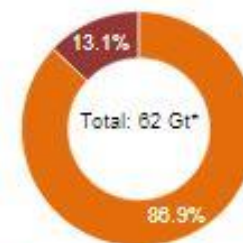


COOLING SECTORS

Global greenhouse gas emissions in 2030

Global greenhouse gas emissions and percentage contributed by the cooling sector (projections for 2030)

[switch to Table](#)



*in CO₂ eq



NETWORK

Our network and best practice examples

Do you want to contribute to making green cooling a worldwide success story? The Green Cooling Initiative is looking for network members and best practice examples.



TECHNOLOGY

Green cooling - markets and technologies



Natural refrigerants and high energy efficiency are



ABOUT

Green Cooling Initiative

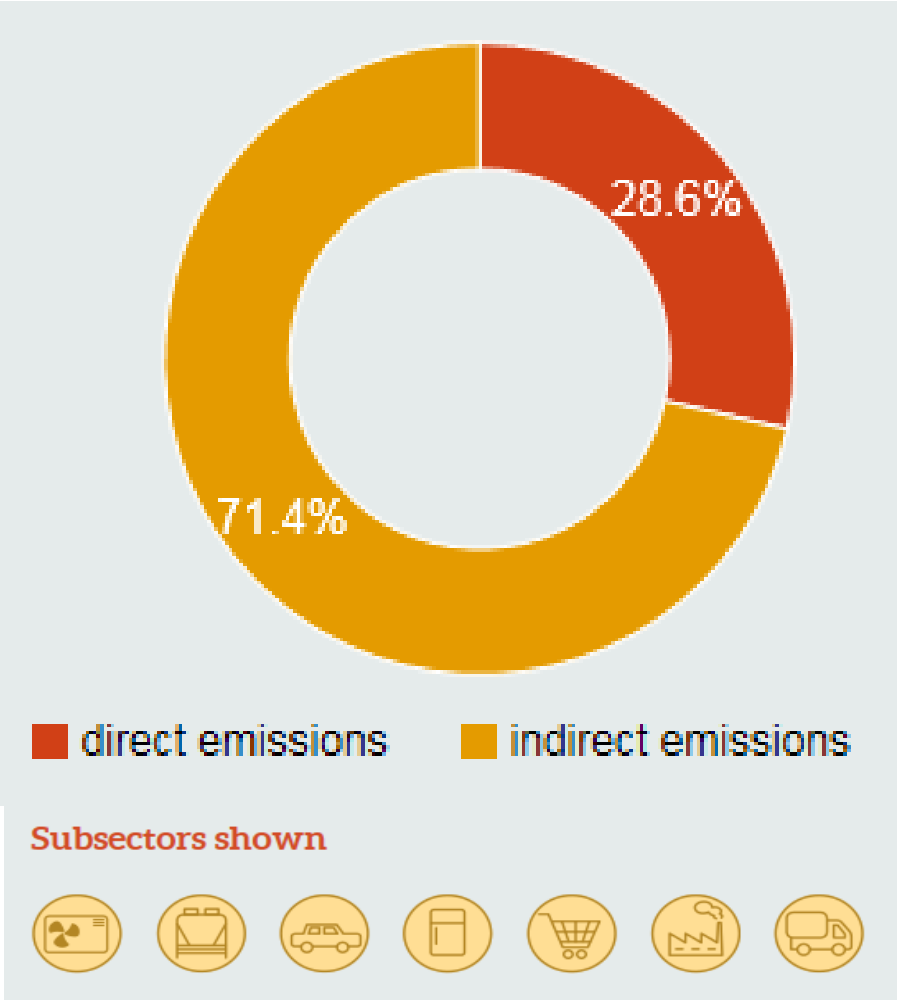
Refrigeration and air conditioning are responsible for a significant share of the global greenhouse gas emissions. Especially in developing and emerging countries, the demand for cooling equipment is rising. Low levels of efficiency and high leakage rates of refrigerant gases with high global warming

Global direct & indirect GHG emissions for the cooling sector

2014
3.74 Gt CO₂eq

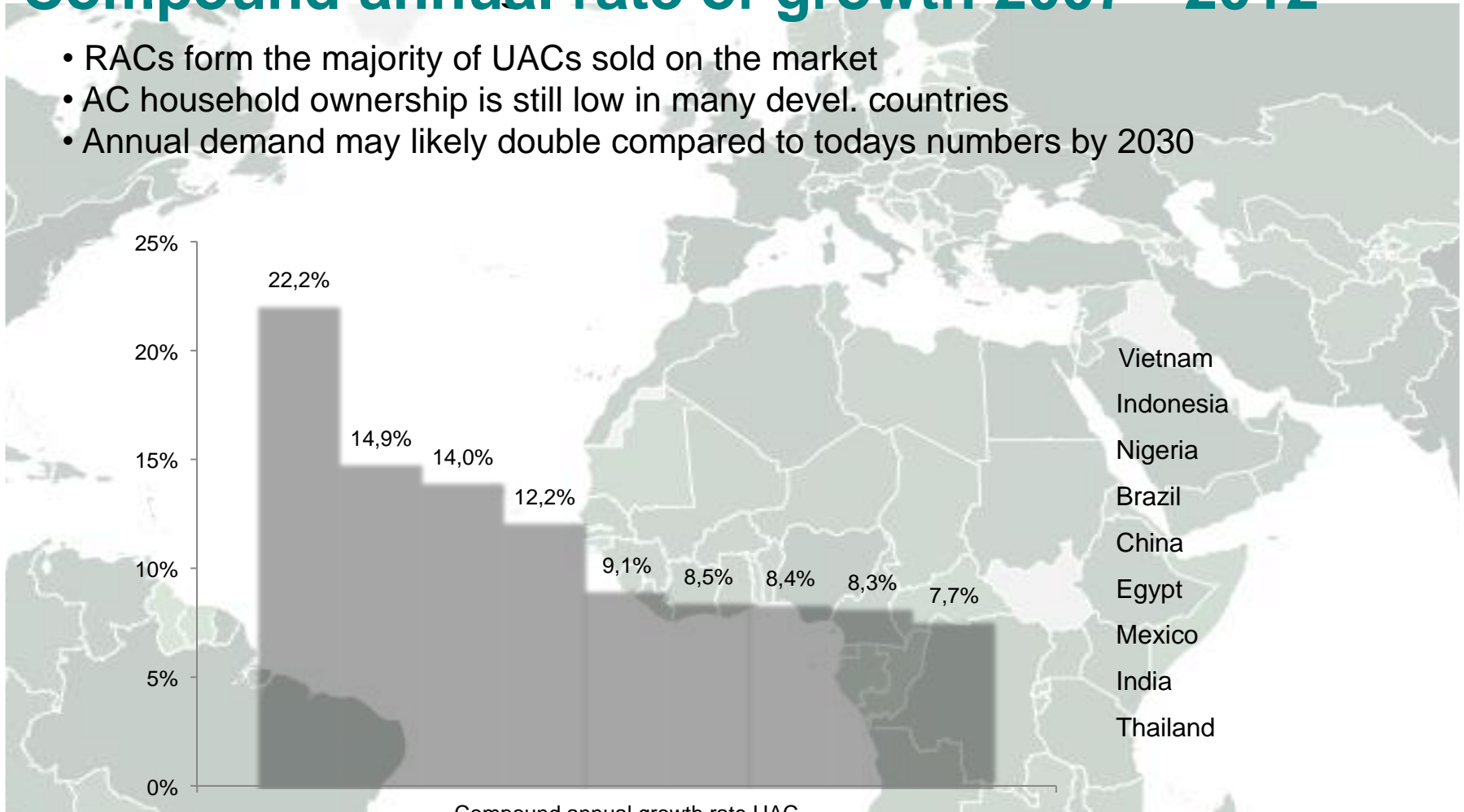
indirect emissions
(electricity consumption - fossil fuels)
2.67 Gt CO₂eq

direct emissions
(refrigerants leakages, high GWP)
1.07 Gt CO₂eq



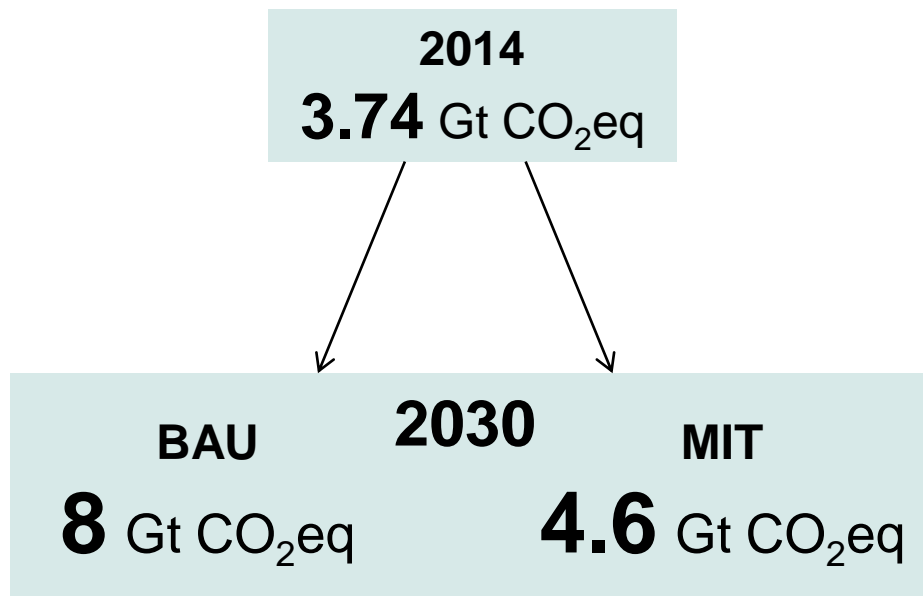
Compound annual rate of growth 2007 - 2012

- RACs form the majority of UACs sold on the market
- AC household ownership is still low in many devel. countries
- Annual demand may likely double compared to todays numbers by 2030

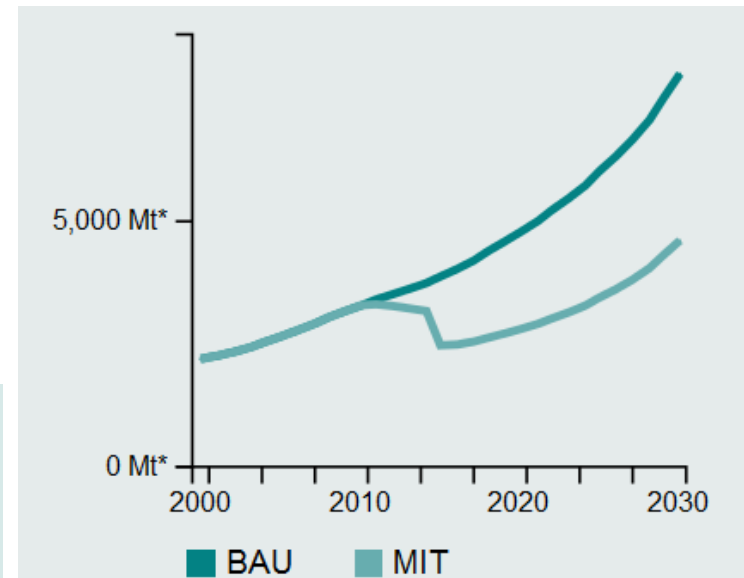


Compound annual growth rate UAC
2007-2012

Global Business as Usual and Mitigation Potential up to 2030



⇒ **43.5% reduction potential**
= 3.4 Gt CO₂eq



* in CO₂ equivalents

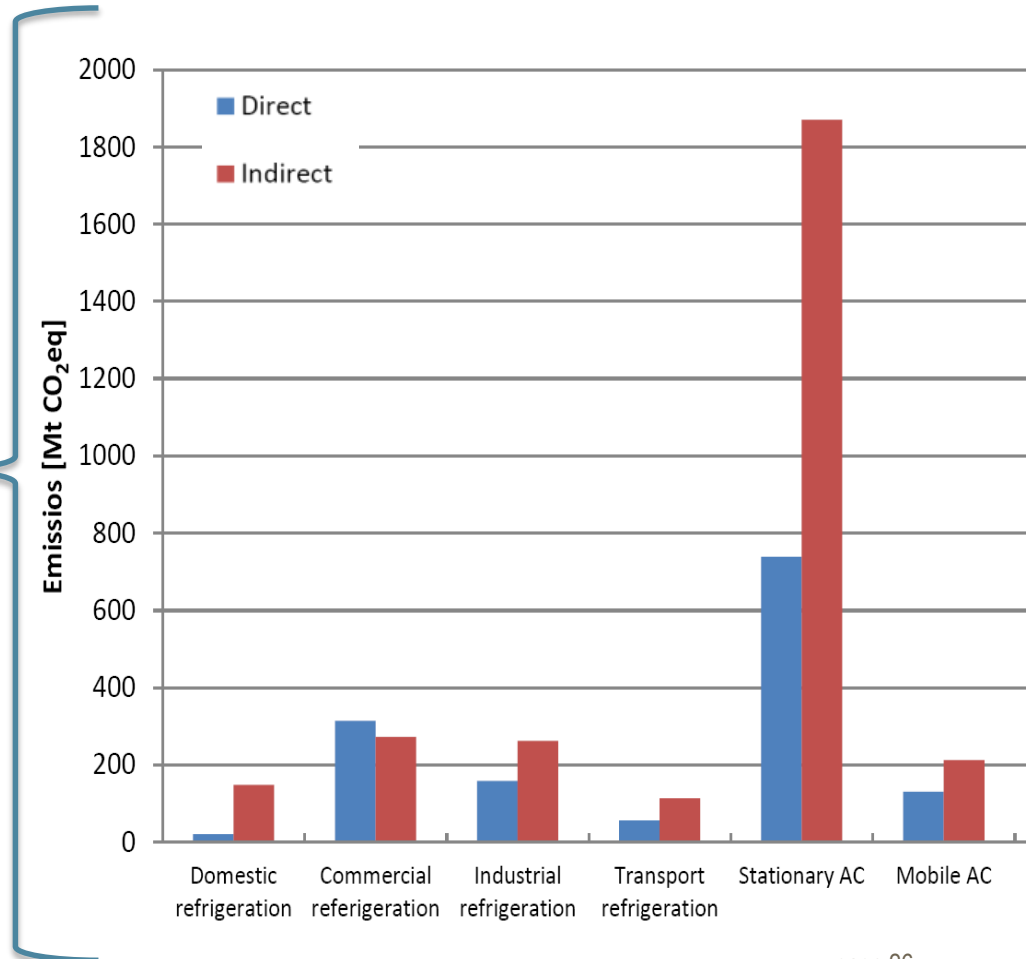
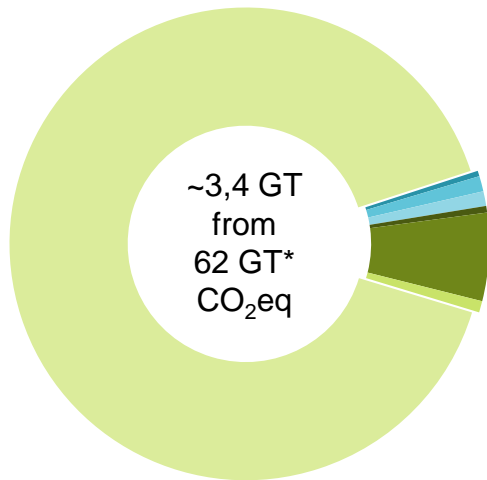
BAU = Business as usual

Subsectors shown



The accelerated spread of green cooling technologies can mitigate ~5% of global total Greenhouse Gas emissions in 2030

- Domestic ref
- Commercial ref
- Industrial ref
- Transport refr
- UAC
- MAC
- Other, non-RAC



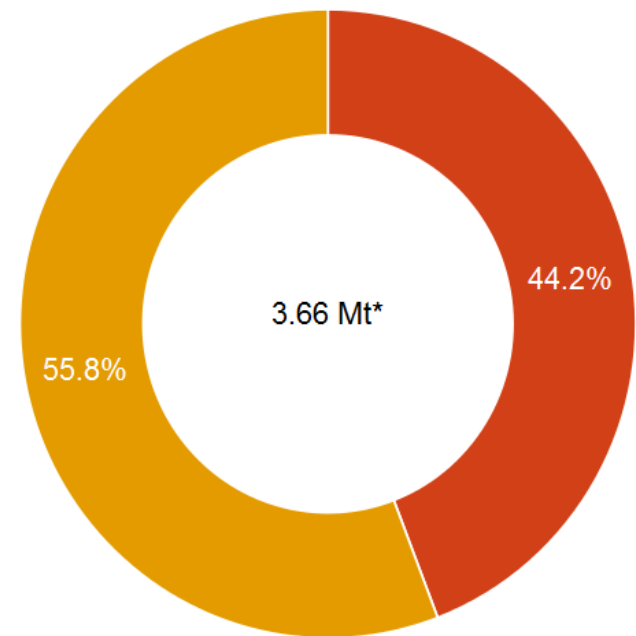
Example: Greenhouse gas emissions from the Ghanaian RAC sector (current)

Direct emissions

- Refrigerant leakage of high GWP HCFCs and HFCs
- Relatively high in Ghana due to leakage from old appliances

Indirect emissions

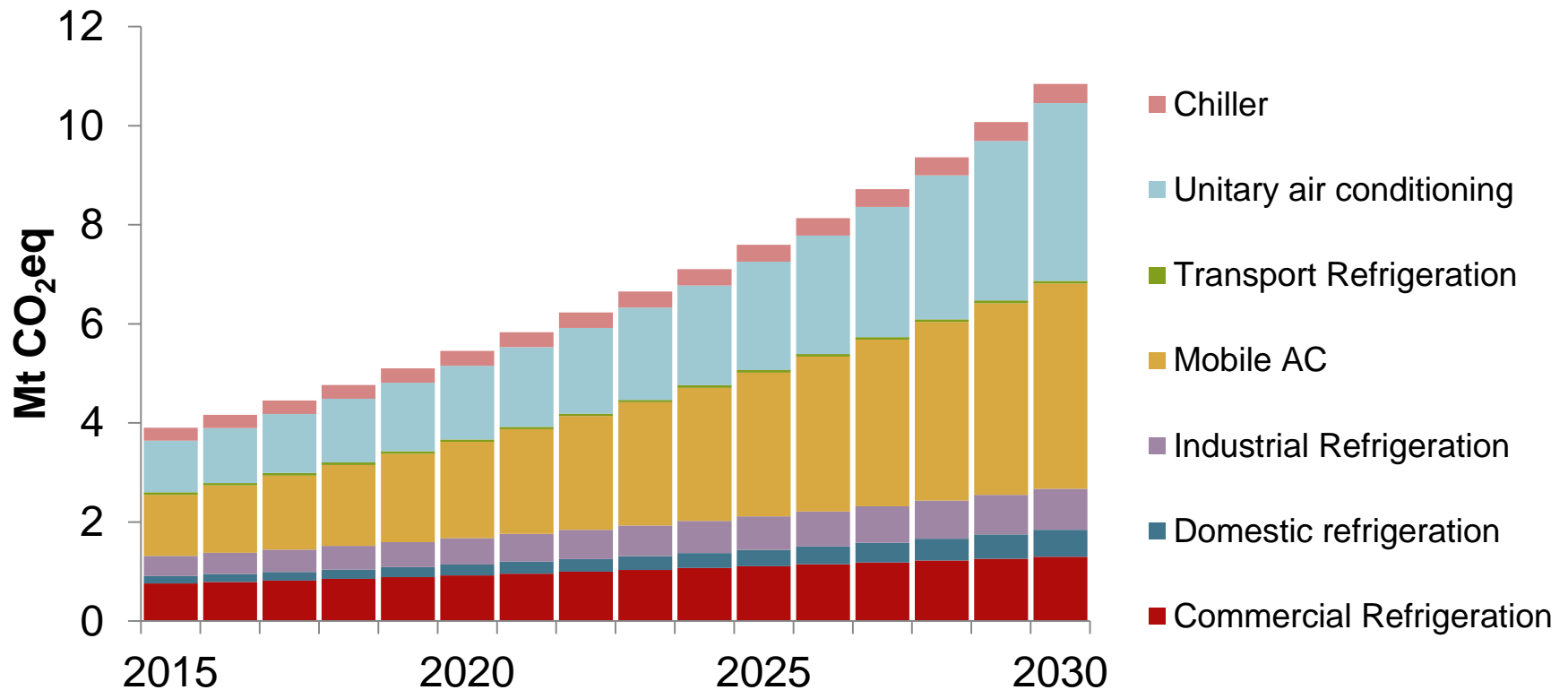
- Energy use of RAC appliances
- Relatively low in Ghana due to low carbon share



■ direct emissions ■ indirect emissions

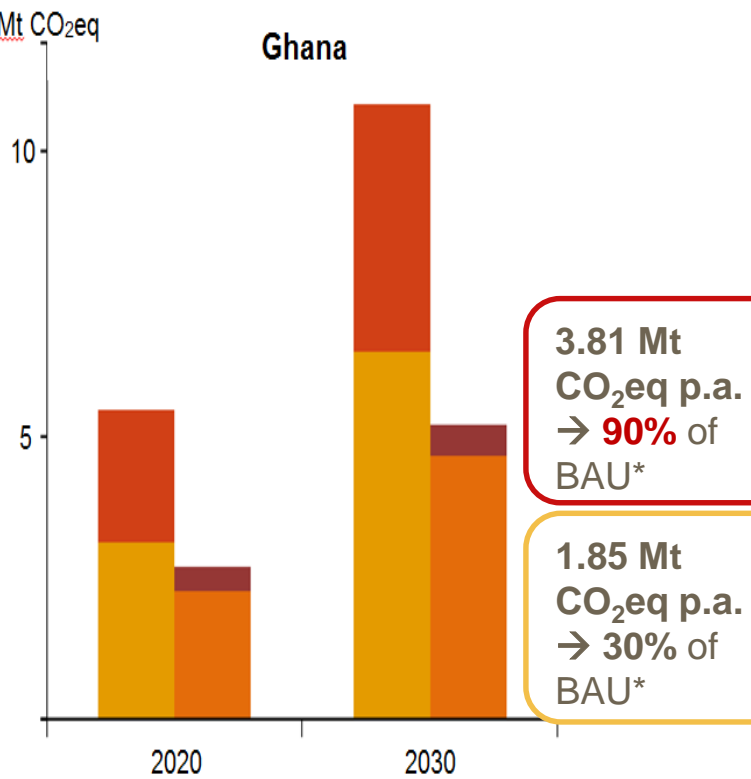
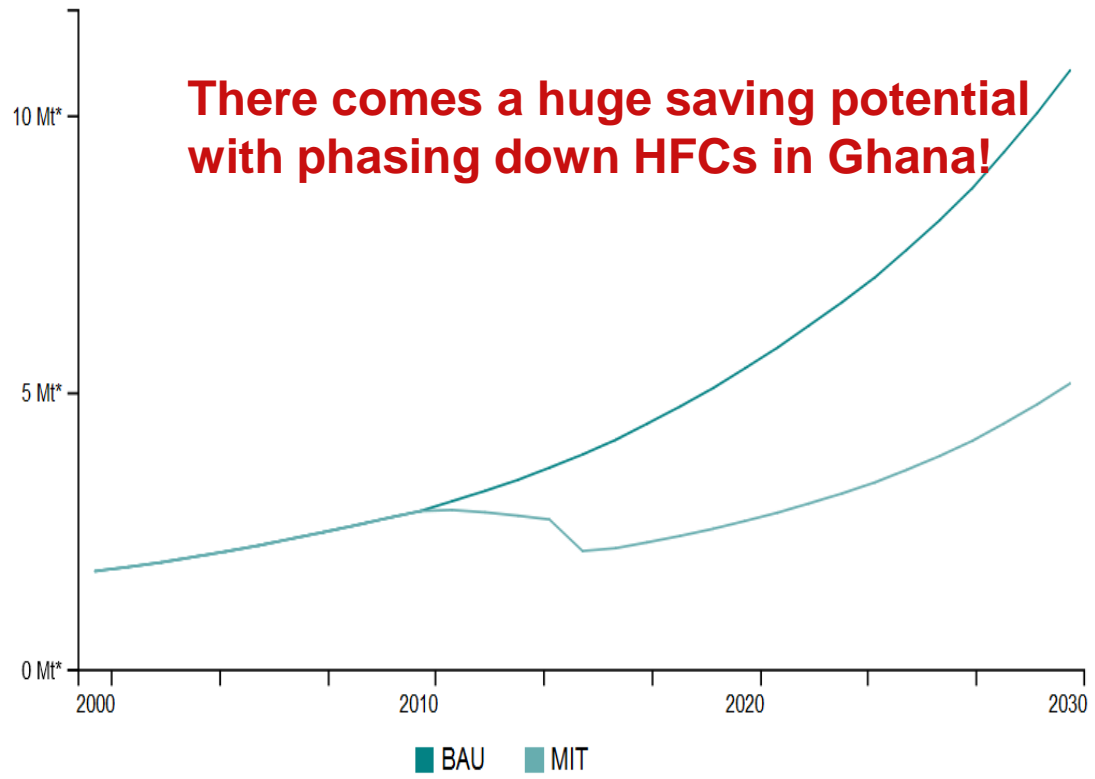
Total emissions 2014: 3.66 Mt CO₂eq

Example: Greenhouse gas emissions from the Ghanaian RAC sector (projected)



Example: Ghana Mitigation potential vs. BAU for RAC in 2030

Business-as-usual and mitigation scenario until 2030 (in Mt CO₂eq)



3.81 Mt CO₂eq p.a.
→ **90%** of BAU*

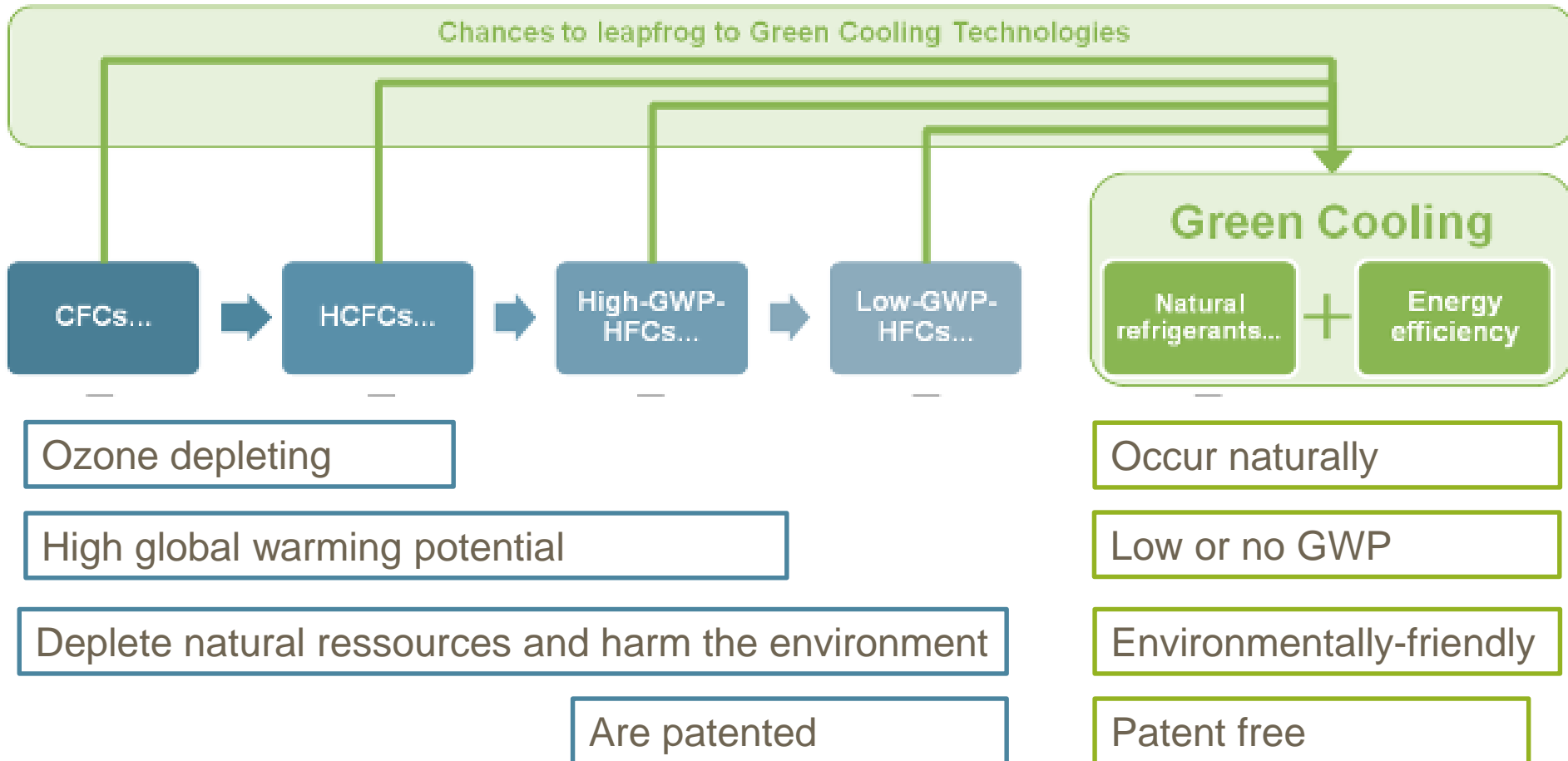
1.85 Mt CO₂eq p.a.
→ **30%** of BAU*

- BAU = Business-as-usual
- MIT = Mitigation scenario

Ref. www.green-cooling-initiative.org

- BAU: indirect emissions
- BAU: direct emissions
- MIT: indirect emissions
- MIT: direct emissions

Leapfrogging - Saving green house gas emissions saving tremendous costs by avoiding multiple conversions!



“Low Hanging Fruit” **RAC & Foam Subsectors with high emission reduction potential**

Split ACs

Household refrigerators

Mobile Airconditioning

Production of XPS insulation sheets

Supermarket refrigeration

Chillers (i.e. Solar Cooling)

Transport refrigeration

Buildings (District Cooling, Absorption cooling/trigeneration)



What do we need to have in place to phase down HFCs?

- **RAC Inventories/country data**
- **Standards (MEPS, safety, etc.), trainings and certification**
- **Climate friendly, cost effective and energy efficiency technology alternatives** (start with the low hanging fruits)
- **Strategies to phase down HFCs:** Technology Road Maps (TRMs);
Apply for funding e.g. CTCN (up to 250.000 USD funding)
- **Access to finance for implementation**
 - **RAC sector must be included in the Intended Nationally Determined Contributions (INDCs)**
 - TRMps -> RAC NAMAs, etc.
 - Green Climate Fund (GCF), MLF, multi- & bilateral donors...

Further information:

- Go on www.green-cooling-initiative.org and get your country data
- Become a member and join the network <http://www.green-cooling-initiative.org/network/>
- Follow us on [LinkedIn](#), [Twitter](#) and register for the GCI newsletter
- Participate at the training „Cool Training“ in Germany <https://www.giz.de/expertise/downloads/giz2014-en-cool-training.pdf>
- Sign up to our webinars <http://ctc-n.org/calendar/webinars>
- Download publications, training manuals, etc. www.giz.de/proklima

Alternative technology options, safety and standards

Presenter:

Dr Johanna Gloël (HEAT)

November 25th 2015



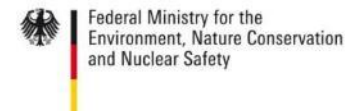
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cooling initiative



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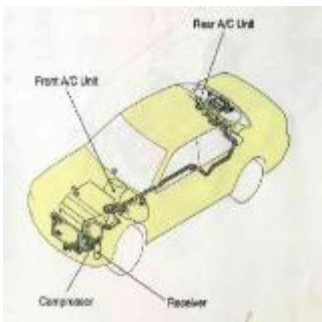
On behalf of



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green^{❄️} cooling initiative

Natural refrigerant technologies exist for all applications!



Mobile AC

**Domestic
Ref.**

**Comm.
Ref.**

**Industr.
Ref.**

AC

Foams



CO₂/HC

HC

CO₂

NH₃

HC

**CO₂/
HC**

Characteristics of different refrigerants

	HCFC	HFC	u-HFC	NH ₃	CO ₂	HC
Ozone depletion	●	●	●	●	●	●
High GWP	●	●	●	●	●	●
Persistent wastes	●	●	●	●	●	●
Depletable resources	●	●	●	●	●	●
Recycling/disposal	●	●	●	●	●	●
Safety issues	●	●/●	●	●	●	●
Energy efficiency	●	●	●	●	●/●	●
Costs	●	●	●	●	●	●
Local production	●	●	●	●	●	●

Best practice example: Conversion of split air-conditioners to R-290 with Godrej (India) assisted by GIZ

- Development & demonstration of ACs with hydrocarbon refrigerant propane (R-290)
- Conversion of production line
- Production of R-290 ACs of up to 100.000 appliances p.a./ line
- More than 200.000 units sold so far



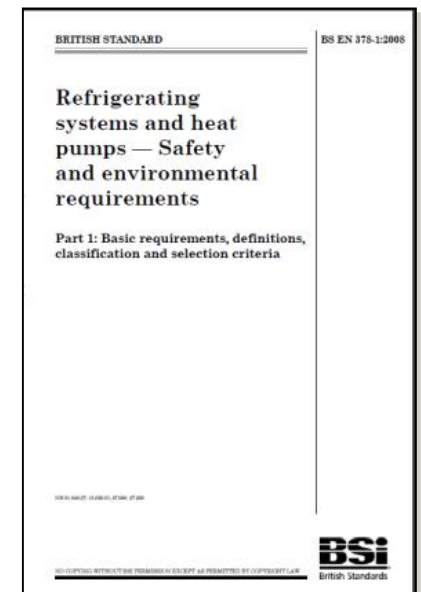
Benefits

Godrej – Best practice example

- Refrigerant GWP of 3 & reduced charge size
- Nearly 100% reduction of direct emissions
- Energy efficiency improvement compared to standard R-22 unit: +23% in India
- No IPR on refrigerant
- Suitable for EU market (F-gas directive)
- Same price as standard R-22 AC model

Safety standards – general requirements

- Two main safety standards for RAC
 - EN 378: 2008 European standard for environmental and safety requirements of refrigeration and air conditioning
 - IEC 60335-2-40 Particular requirements for safety of household appliances, electrical air conditioners, heat pumps and dehumidifiers
- Main requirements cover
 - Sources of ignition
 - Charge amount limit
 - Markings and warnings
 - Manuals/instructions



Applied safety standard: Charge size limits

Godrej – Best practice example

- Charge limit as per EN 378 – 1: 2008

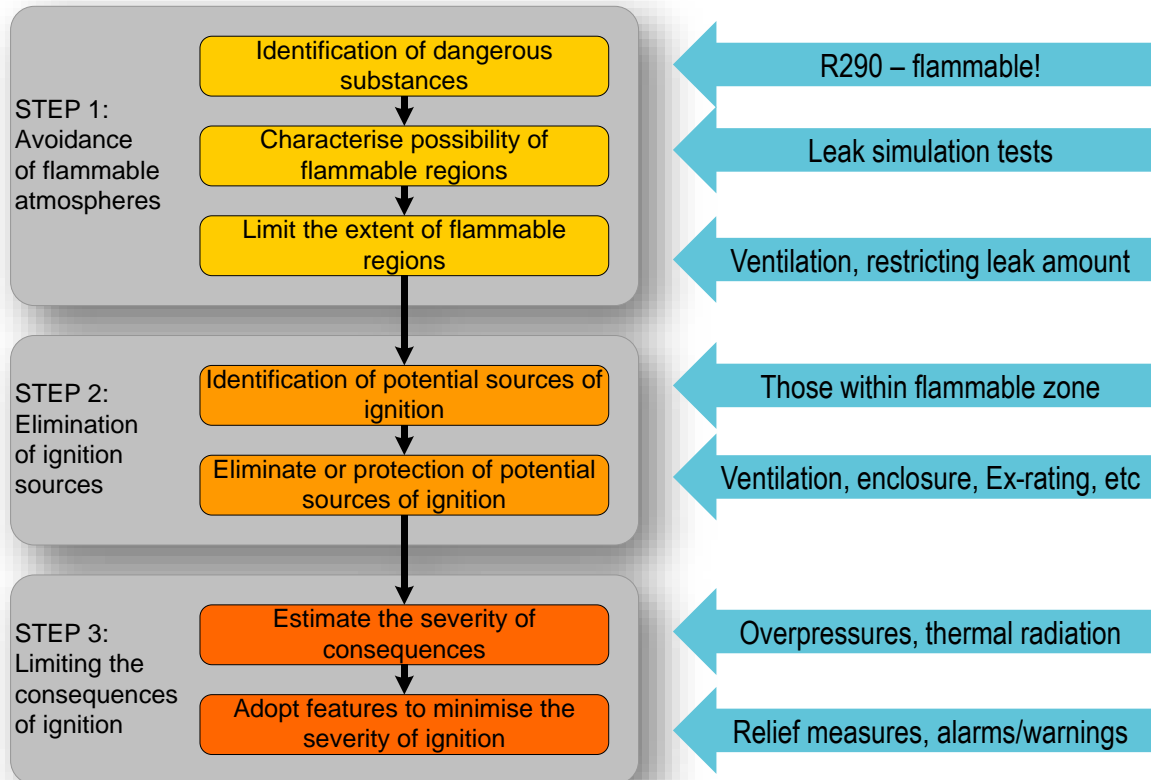
$$m_{\max} = 2.5 \times \text{LFL}^{5/4} \times h_0 \times A^{1/2}$$

- m_{\max} is the allowable maximum charge in a room in kg;
- A is the room area in m^2 ;
- LFL is the lower flammable limit in kg/m^3 ;
- h_0 is the installation height of the appliance in m.

For a typical 5kW split AC unit:

$$\begin{aligned} m_{\max} &= 2.5 \times 0.038^{5/4} \times 2.3 \times 14^{1/2} \\ &= 0.361 \text{ kg} \end{aligned}$$

General Risk Assessment approach according to EN1127-1:2011



Applied safety standard: avoid sources of ignition

Godrej – Best practice example

- Carry out leak simulation test
- Replace with non-sparking components



Before:
Soldered wire terminal strands



After:
Connected in thimble, insulating sleeve

green^{❄️} cooling initiative

Activity phases

Six general activity phases:

- Production
- Transfer
- Storage
- Transport
- In-use
- Servicing/
maintain



Product Installation and Servicing Measures

Godrej – Best practice example

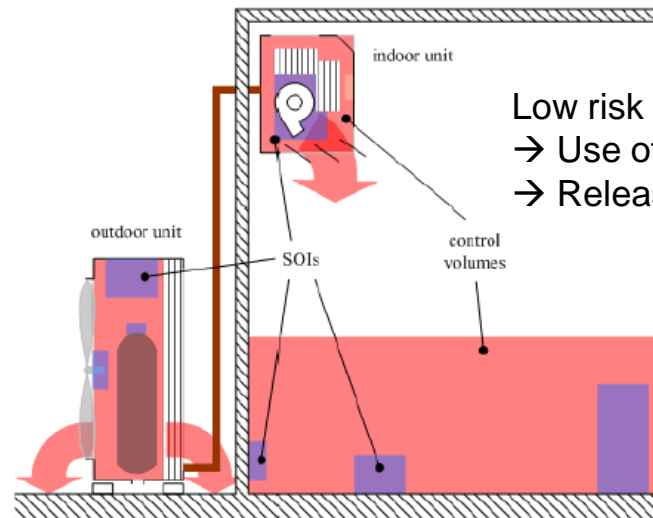
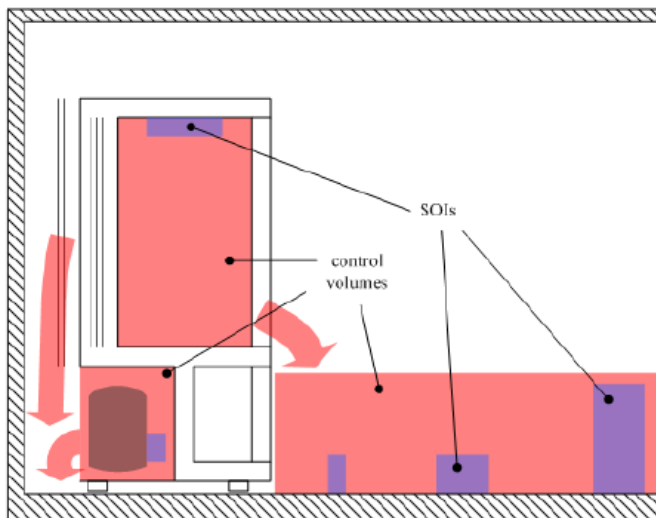
- Field installations by trained technicians only
- Five-day comprehensive training program for master technicians
- Room size and piping length (charge size) are checked by technician
- Free installation & one year warranty
- Factory-made flared connections for indoor and outdoor units
- Extended producer responsibility: Trained technician will be responsible for decommissioning

Comparative risk assessment of HC refrigerant in refrigerator and split AC (Colbourne, 2014)

Standards also based on experience → only from refrigeration equipment

Extremely good safety record for refrigerators

Quantitative risk assessment for AC in comparison



Low risk for AC units because of
→ Use of fan
→ Release at high level

Best practice example – safe handling of hydrocarbon refrigerants

Content

- Safety infrastructure
- Quality systems for safety
- Training
- Production and manufacturing facilities
- Equipment design and development
- Working on systems and equipment
- Case studies





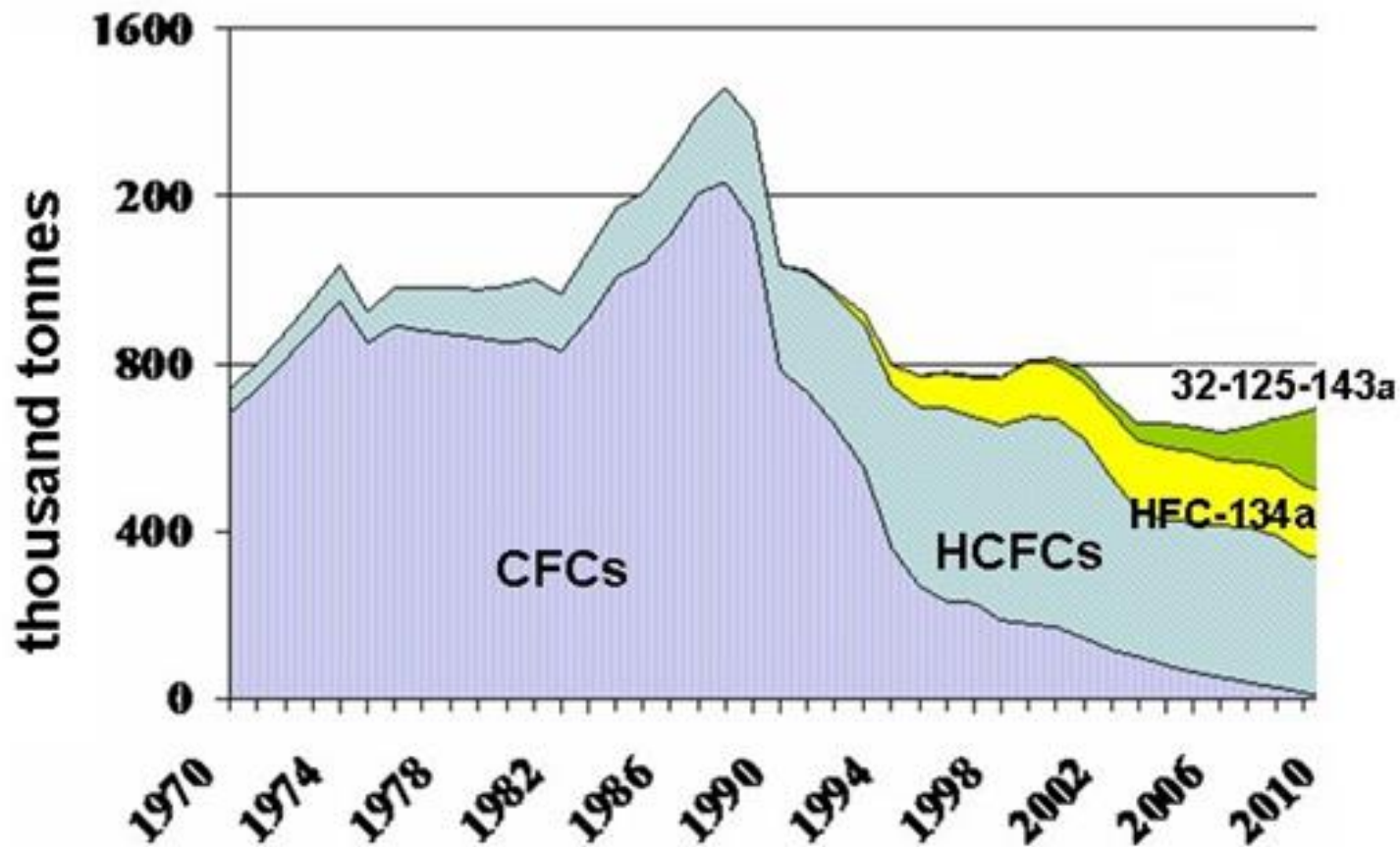
The EU Regulation on fluorinated greenhouse gases and its impact on global markets

Paving the way towards an international HFC agreement under the Montreal Protocol

**Green Cooling Initiative
Webinar - 25 November 2015**

**Dr. Cornelius Rhein
European Commission
DG Climate Action**

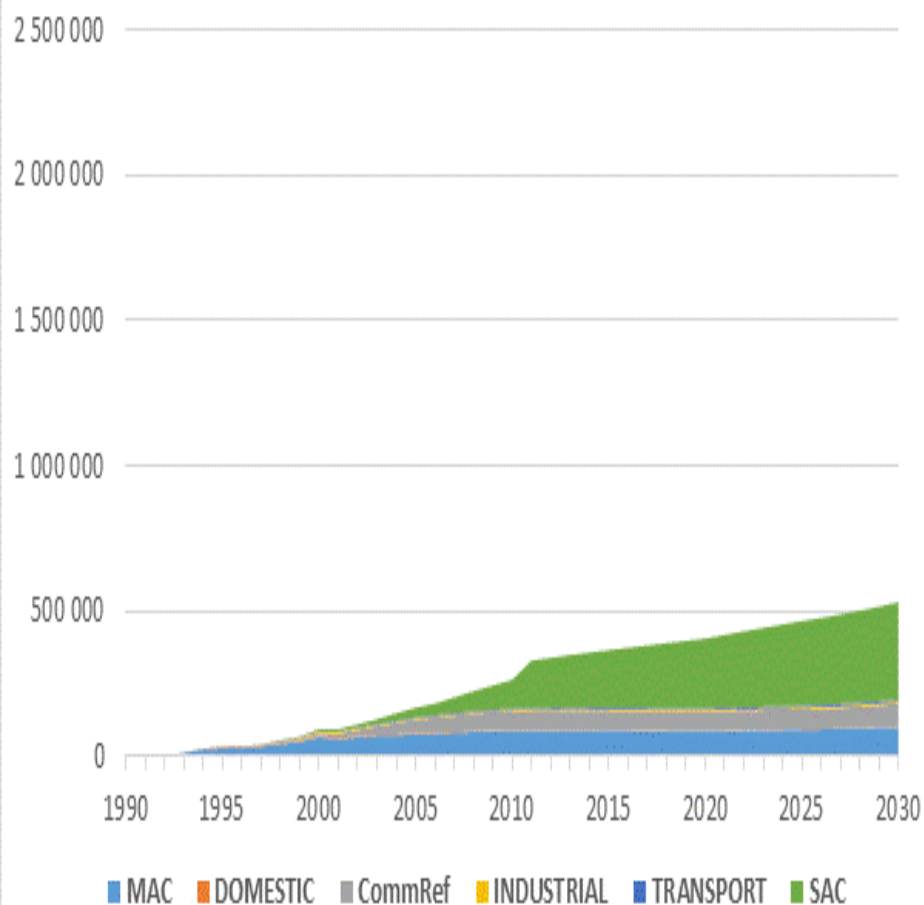
HCFC phase-out = HFC phase-in ?



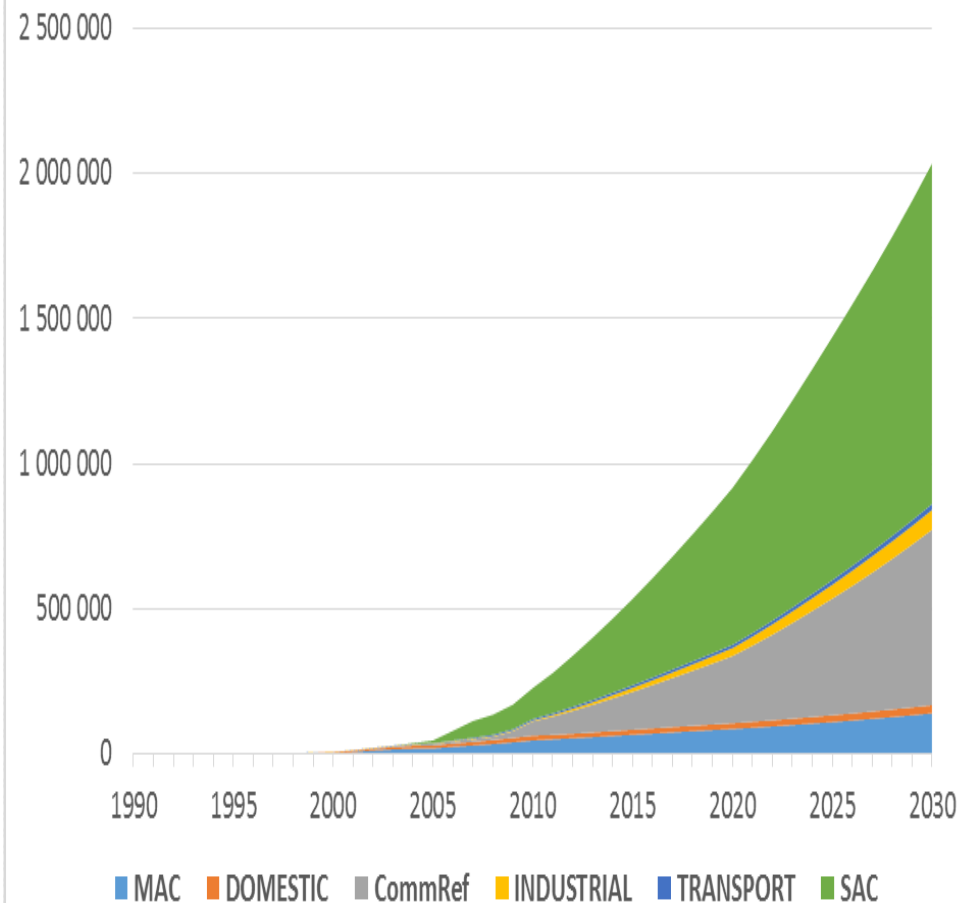
TEAP estimates



nA5 BAU Total demand HFC (ktonnes CO2)



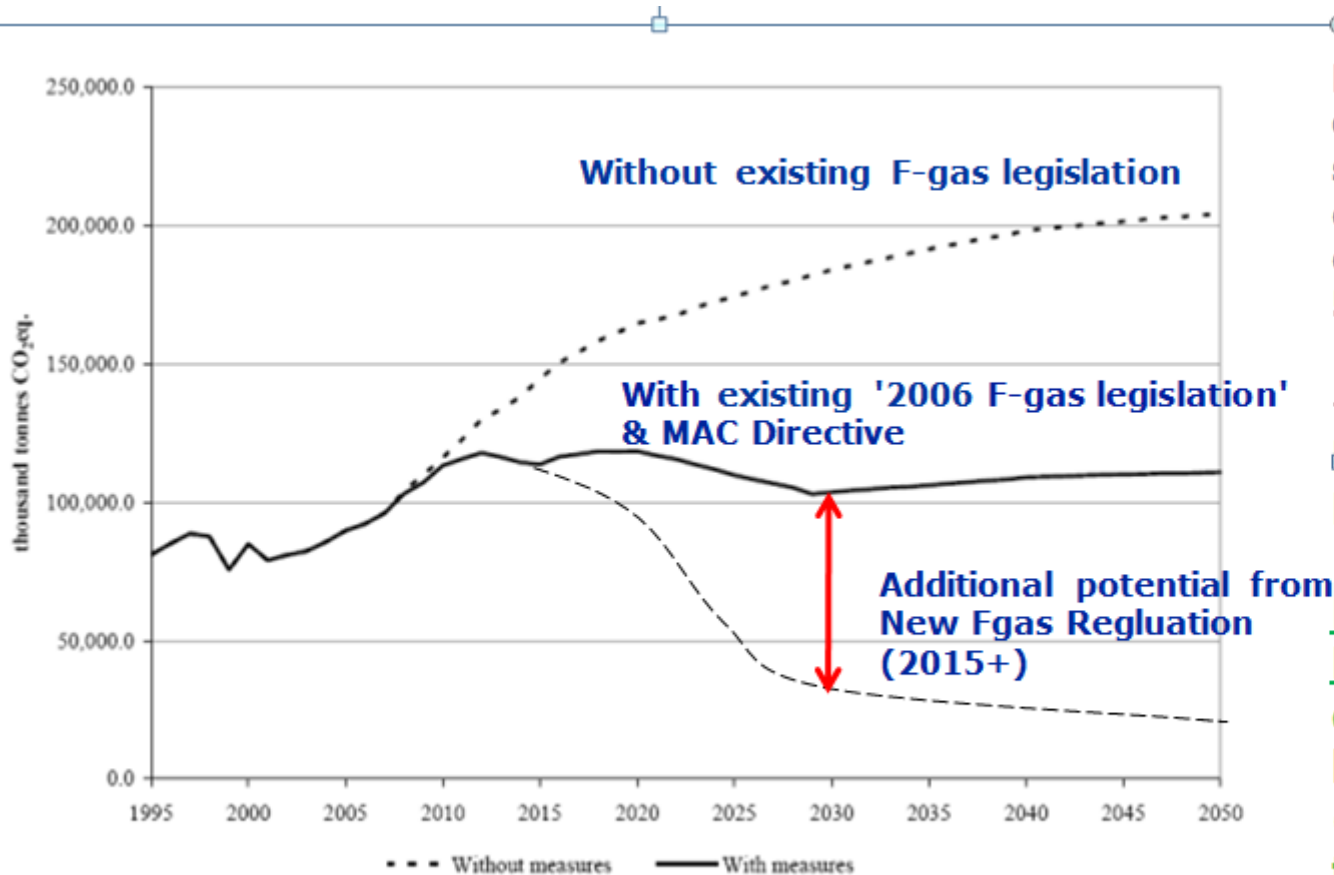
A5 BAU Total demand HFC (ktonnes CO2)





European
Commission

F-gas emissions in 1995-2050 without measures and the effects of the F-gas Regulation/MAC Directive



Legislation from 2006 can achieve a stabilization of emissions, reducing emissions by almost 50%

→ Not sufficient for EU climate goals, Roadmap

New Fgas Regulation will decrease emission by >70 Mt CO₂eq. (two-thirds of today!)



Two strategies to prevent emissions

- Prevent leakage and emissions
 - Emission prevention and leak checks
 - Control of by-production
 - End of life treatment of products and equipment
 - Training and qualification
 - Information for users (labelling, product information)
- Avoid the use of F-gases
 - Training and qualification
 - Ban on new applications
 - Ban on certain uses (high GWP HFCs, PFCs and SF₆ first!)
 - **Phase-down of HFC supply**



Containment measures

- Operators must prevent leakage
- Leakage checks, frequency depending on charge size
- Detection systems for larger charges
- Labelling of products and equipment, extended to foams
- Proper recovery and recycling, reclamation or destruction
- Training & certification of service personnel, including information on alternatives

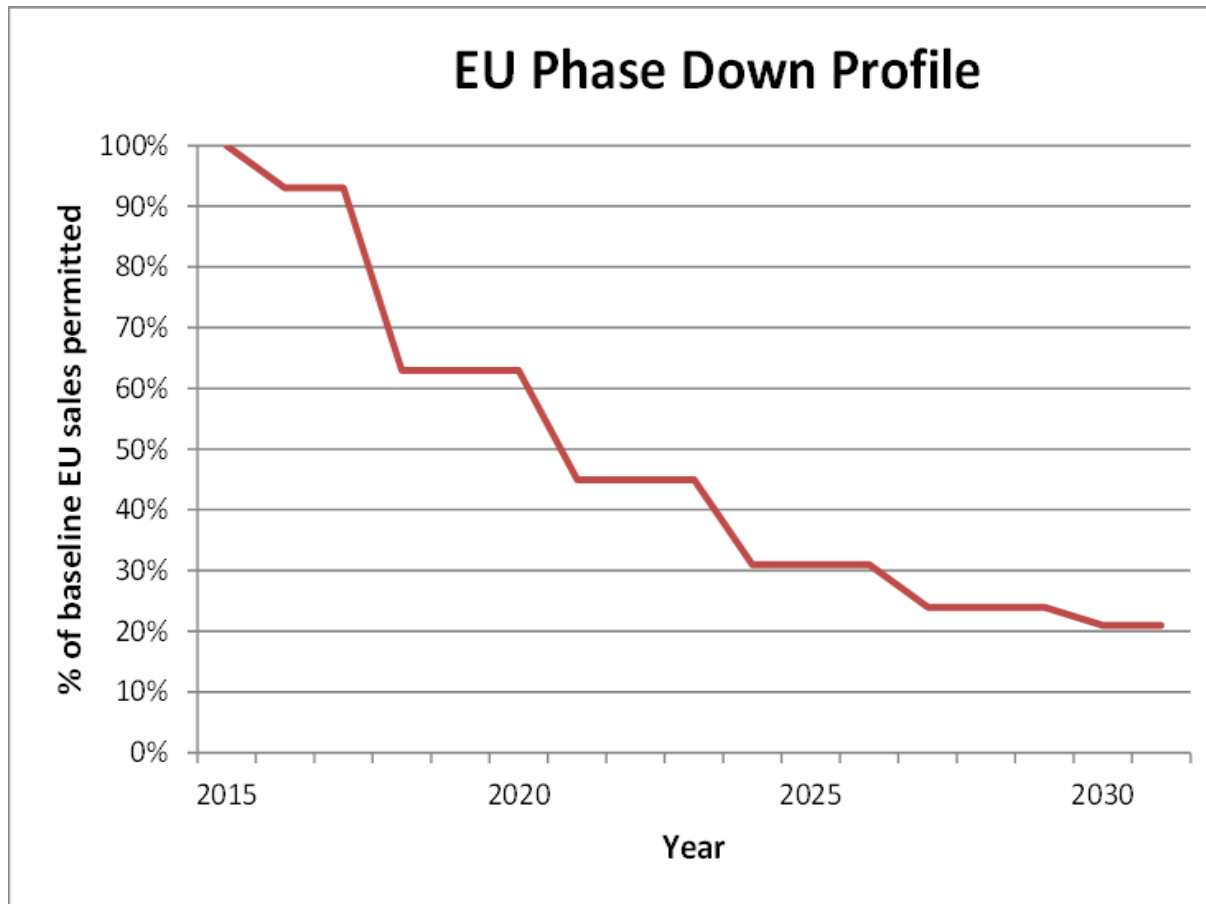
Applies to stationary refrigeration, air-conditioning, heat pumps, fire protection systems, *refrigerated trucks and trailers, organic Rankine cycles and electrical switchgear with SF₆*



HFC phase-down – the main novelty

- HFC bulk placed on the EU market
- Schedule: freeze 2015, first step 2016, reduction of HFC supply by 79% in 2030 (in CO₂ equivalent)
- Baseline: Quantities reported in 2009-2012
- Quota allocation based on historical sales + 'new entrants reserve'
- Monitoring: Independently verified reports

Phase-down of HFC bulk supply





HFCs in pre-charged equipment

- Of the EU HFC demand, **11%** is imported in pre-filled equipment, rising to **18%** in 2030
- If not addressed, risk of circumvention of the phase-down!

Solution: As of 2017, obligation to ensure that all HFCs quantities filled in equipment are "accounted for" under the EU phase-down

- Filling in the EU, or
- outside the EU, with HFCs bought in the EU, or
- with HFC from a non-EU HFC producer with own EU quota and authorisation to use quota from a quota holder

Verification through declarations of conformity and audited reports
(obligations for the EU importer, not the manufacturer)



HFCs in pre-charged equipment (2)

- Registration for *importers* of pre-charged equipment in the electronic quota register
Please note:
 - This applies only to importers (= EU entities)
 - Equipment importers do not hold an HFC import quota (only bulk gas importers/producers!)
 - Importers may use authorisations to use quotas held by gas importers or producers (also non-EU gas producers)
- Yearly reports by *importers* of pre-charged equipment and submission of verification document (audited report)
- Manufacturers of pre-charged equipment may be asked by their EU importers/customers to document the origin of HFCs used



HFC-23 by-production recovery/destruction

Placing on the market of HFC, PFCs, SF₆ and HFOs (and other listed in Annex II) requires evidence, that HFC-23, produced as a by-product, has been destroyed or recovered for subsequent use

- Includes production of feedstock (i.e. HFC-22)
- Importers or EU producers have to provide evidence
- Applies as of 11 June 2015



Bans and their context

1. Addressing non-HFCs and by-production

- Use bans for SF₆ in magnesium production
- Recovery/destruction of HFC-23 by-production

2. Steering the HFC phase-down

- Ban to service existing equipment with high GWP HFCs,
- Additional placing on the market bans for new equipment

Guiding principles:

- Existing equipment should not become obsolete
- Bans only when alternatives are available (= safe, energy efficient, economically viable)



Ban on servicing with high GWP HFCs

1. Applies as of 2020
2. Large refrigeration equipment
 - Above 40 tonnes CO₂ eq charge size
 - Excluding equipment for temperatures below -50°C
3. HFCs above GWP 2500
 - Mainly R-404a and R-507
4. Recycled HFCs can be used until 2030



Additional placing on the market bans (1)

- Extension of the ban on PFCs in fire protection systems/extinguishers to HFC-23
- Foams blown containing HFCs with GWP ≥ 150 (unless required by national safety standards)
 - Extruded polystyrene (XPS) – (2020)
 - Other foams – (2023)
- Technical aerosols, HFCs with GWP ≥ 150 , unless required by national safety standards (2018)



Additional placing on the market bans (2)

- Domestic refrigerators and freezers with HFCs
GWP ≥ 150 (2015)
- Refrigerators and freezers for commercial use
(hermetically sealed systems) with HFCs
 - GWP ≥ 2500 (2020)
 - GWP ≥ 150 (2022)



Additional placing on the market bans (3)

- Stationary refrigeration equipment, HFCs with GWP \geq 2500 (2020)
 - Exemption for equipment for temperatures below -50°C
- Multipack centralised refrigeration systems, commercial use, capacity of 40kW or more, with HFCs with GWP \geq 150 (2022)
 - Exemption for equipment with indirect cascade systems with HFCs below GWP 1500

Regulation (EU) No 517/2014



	RAC Market	% 2010 HFC Demand	Approximate GWP Threshold for New Product Ban				Restrictions in EU legislation
			150	700	1400	2500	
Refrigeration	Domestic refrigeration	0.2%	●				banned from 2015 (GWP>150)
	Commercial Small Hermetic	0.2%	●				banned from 2020 (>2500) and 2022 (>150)
	Commercial Condensing Units	4%	●	●	●	●	banned from 2020 (>2500)
	Commercial Multipack	33%	●	●		●	banned from 2020 (>2500) and 2022 (>150) [allowing cascades with GWP<1500]
	Transport Refrigeration	1%	●	●		●	
	Industrial Small / Medium DX	8%	●	●	●	●	banned from 2020 (>2500)
	Industrial Large DX	3%	●			●	banned from 2020 (>2500)
	Industrial chillers	1%	●	●			banned from 2020 (>2500)
	Industrial flooded	0.1%	●			●	banned from 2020 (>2500)

Key to Traffic Lights

●	Ban suitable (but may need small number of exemptions in some sectors)
●	Ban may be suitable for part of sector, but more commercial development needed
●	Ban not suitable at this time



Additional placing on the market bans (4)

- Movable room air-conditioners (hermetically sealed), HFCs equal/above GWP 150 (2020)
- Single split air-conditioning systems, less than 3kg charge size of, F-gases with GWP ≥ 750 (2025)

Regulation (EU) No 517/2014



RAC Market		% 2010 HFC Demand	Approximate GWP Threshold for New Product Ban				Restrictions in EU legislation
			150	700	1400	2500	
Air-Conditioning and Heat Pumps	Small portable units	1%	●				banned from 2020 (<150)
	Split systems	20%	●	●			banned from 2025 (<750)
	Packaged systems	0.4%	●	●			
	VRF systems	2%	●	●			
	Small and medium chillers	6%	●	●			
	Large chillers	2%	●				
	Domestic hydronic heat pumps	1%	●	●			
	Other heat pumps	1%	●	●			
	MAC: cars and vans	10%	●				banned via MAC Directive (2011 for new car types, 2017 for new cars)
	MAC: large vehicles	7%	●	●			

Key to Traffic Lights

●	Ban suitable (but may need small number of exemptions in some sectors)
●	Ban may be suitable for part of sector, but more commercial development needed
●	Ban not suitable at this time



Great attention by stakeholders on the bans...

***but it's the phase-down** that will drive most changes (even though not sector-specific and thus flexible)*

Average GWP today ~2000

-> In 2030 average GWP <400 (21%)

i.e. **A solution with GWP 700 is not good enough unless other sectors do more...**

Good savings potential is e.g. given by avoiding refrigerants with GWP > 2500 (R-404A, R-507)



Implications for the HCFC phase-out on global markets

- Increased demand for low GWP alternatives to HFCs, and in the same time HCFCs, will spur innovation
- Economies of scale will reduce costs for a transition to low GWP alternatives
- But: Risk of 'dumping' of out-dated technology (also new equipment!) using high GWP HFCs in Article 5 countries' markets (...R-404a, R-507...)

Directly concerned sectors:

- HFC producers wishing to export to the EU: Quotas and reporting required
- Manufactures of equipment or foams: Bans may apply, HFC quantities in RAC systems have to be accounted in the EU HFC phase-down



The international implications

- The new EU F-gas Regulation demonstrates that ambitious measures on F-gases are feasible
 - Increasing demand for alternatives to HFCs trigger innovation and economies of scale also in other markets
 - The EU takes an active role in the negotiations on an HFC amendment under the Montreal Protocol
- EU amendment proposal submitted in April 2015**

HFCs under the Montreal Protocol: The EU proposal

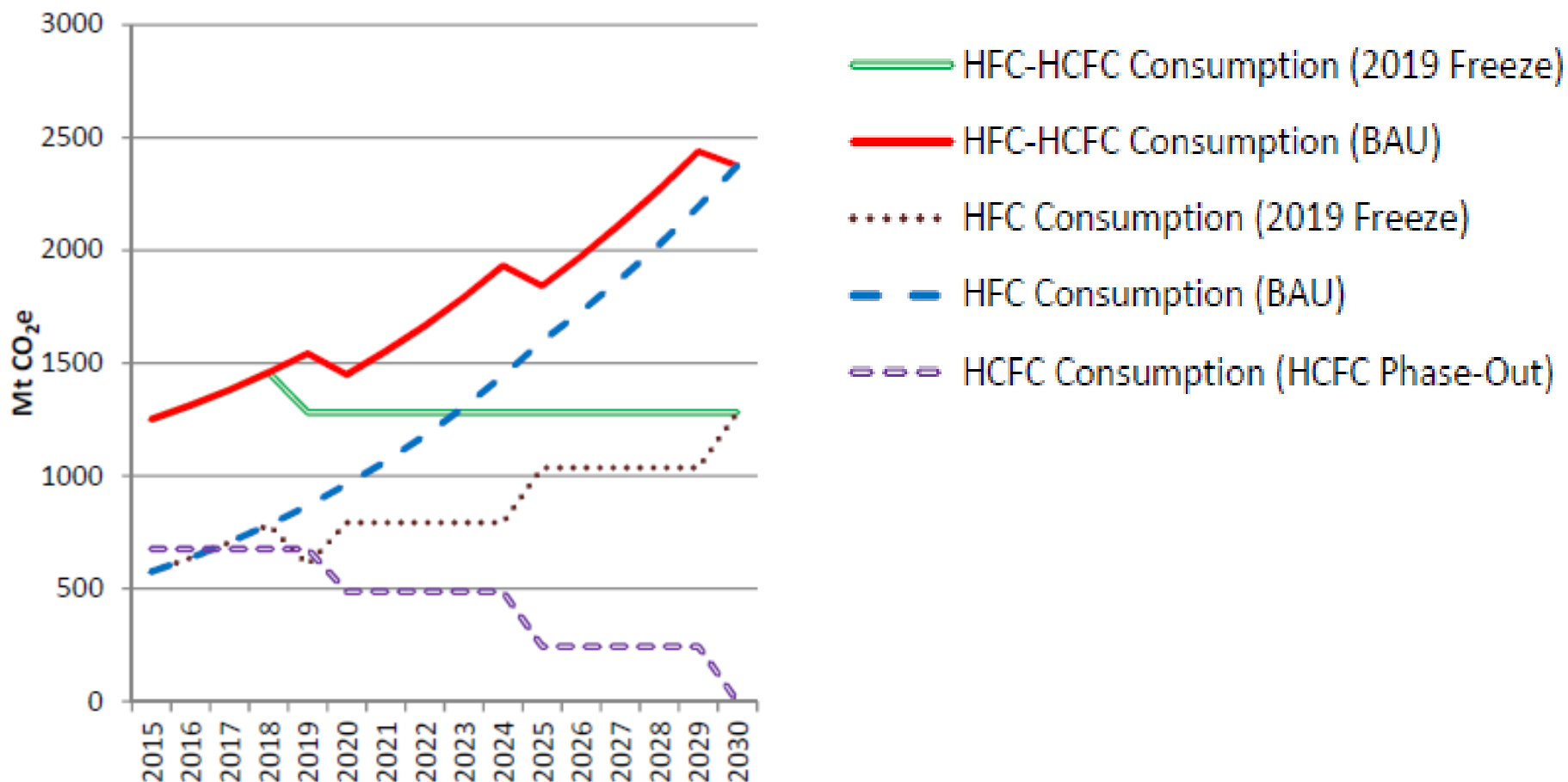


- Encourage other Article 2 parties to pursue a similar level of ambition as the new EU Regulation
- Key elements of the EU proposal:
 - Focus on maximizing **climate benefits of the HCFC phase-out**
 - For Article 5 parties: **Freeze of combined HCFC and HFC consumption**, expressed in CO₂ equivalents
 - Collection of data on HFCs before deciding on long-term reduction schedule

HFCs under the Montreal Protocol: The EU proposal



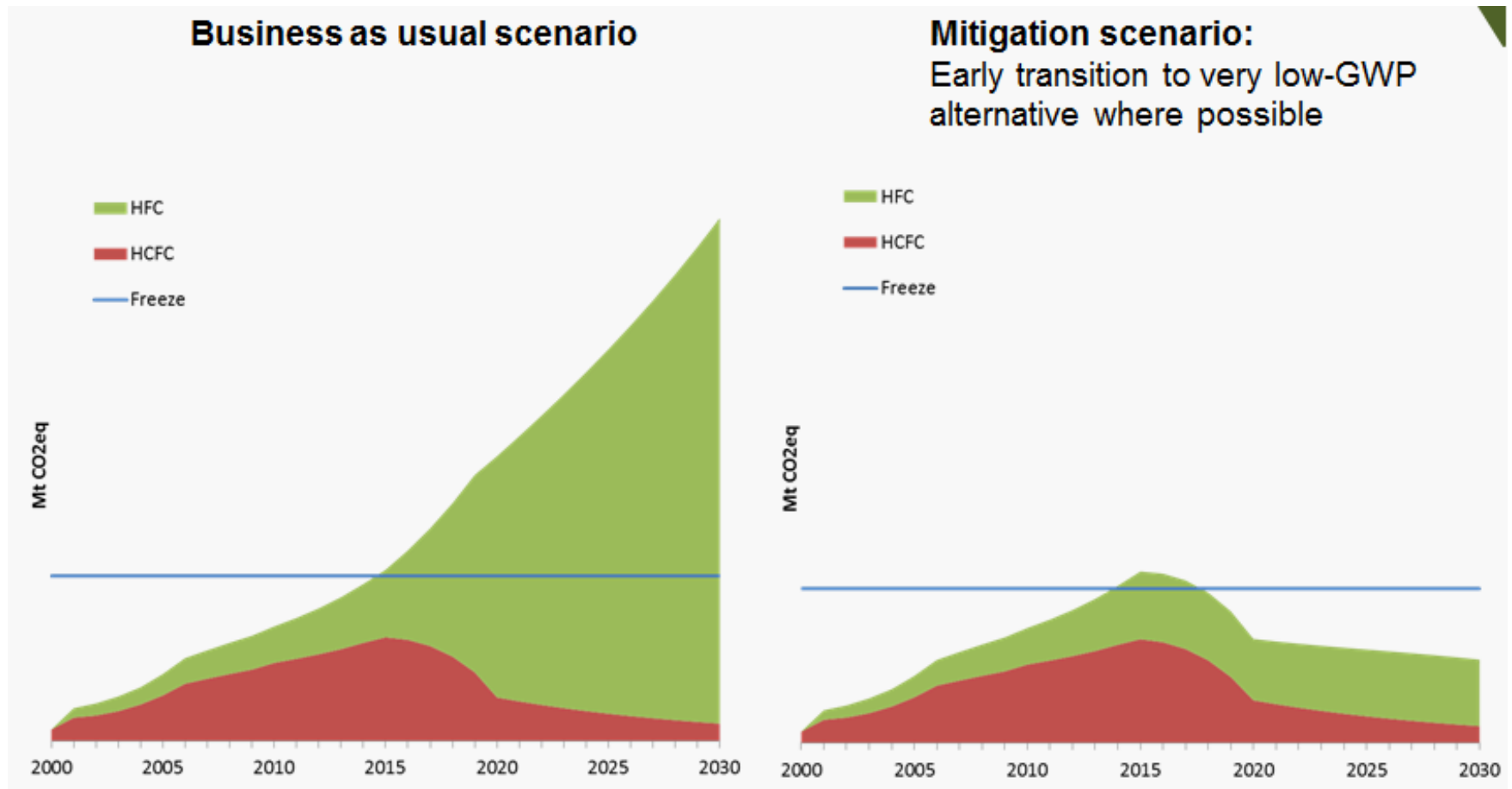
2019 Freeze of HFC-HCFC Basket



HFCs under the Montreal Protocol: The EU proposal



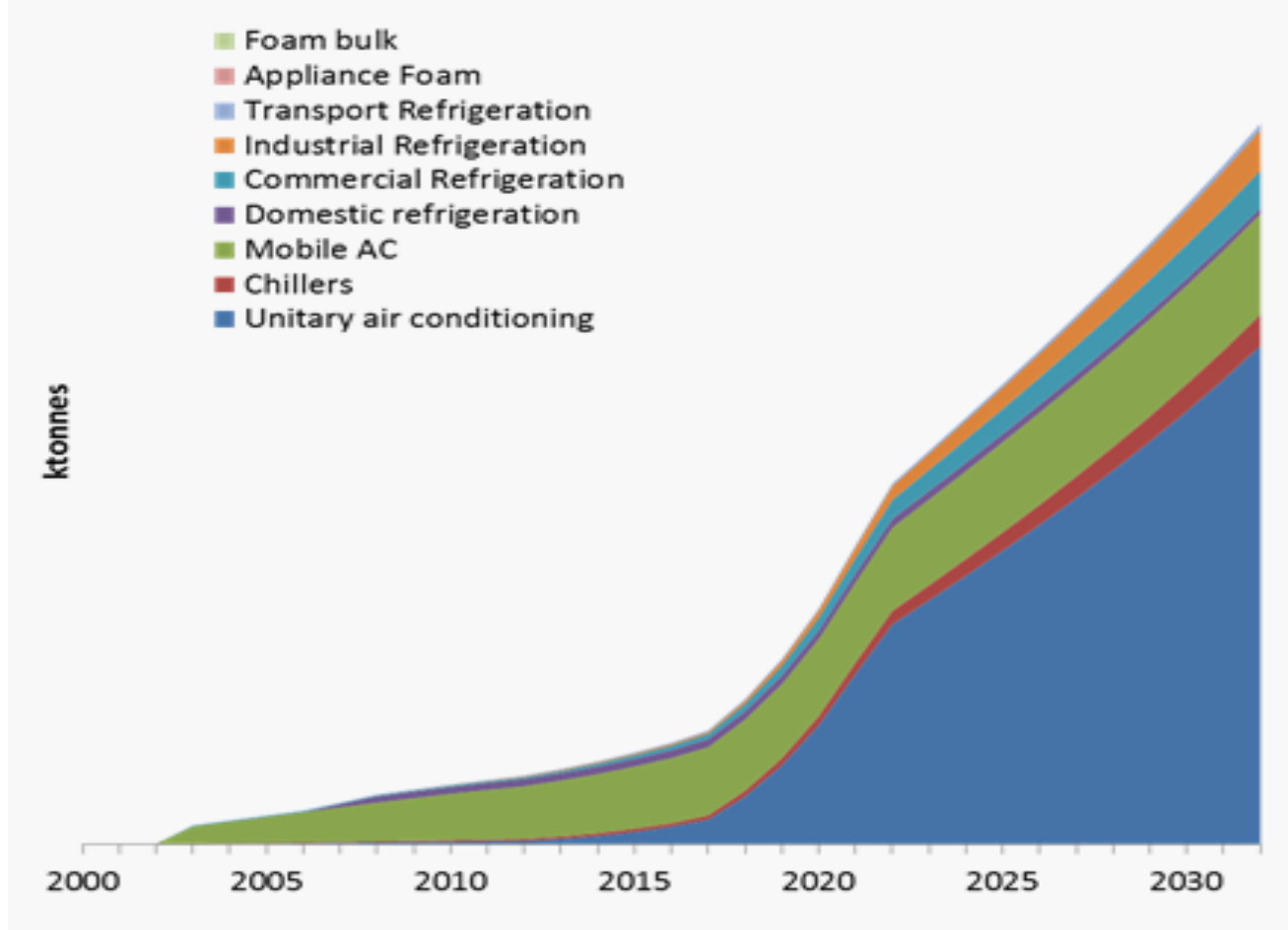
Results from case studies for individual countries



HFCs under the Montreal Protocol: The EU proposal



BAU:





Conclusions from case studies:

- Unitary air-conditioning is the most important sector
- Mobile AC also major contributor followed by industrial and commercial refrigeration and to a lesser extent chillers; foams, transport and domestic refrigeration play a minor role
- If conversion of the unitary AC sector to low GWP alternatives starts early - before the freeze date - the freeze can be reached and maintained
- After reaching the freeze, reductions result from the transitions undertaken and the HCFC phase-out

To know more...

...about the EU legislation and underlying technical analysis

http://ec.europa.eu/clima/policies/f-gas/legislation/documentation_en.htm

...about the EU HFC amendment proposal

http://ec.europa.eu/clima/news/articles/news_2015043001_en.htm

...about the availability of low-GWP alternatives, also for high ambient temperatures

http://ec.europa.eu/clima/policies/f-gas/legislation/studies_en.htm

http://ec.europa.eu/clima/policies/f-gas/legislation/docs/alternatives_high_gwp_en.pdf

http://ec.europa.eu/clima/policies/f-gas/legislation/docs/alternatives_high_gwp_annex_en.pdf

...or contact: Cornelius.Rhein@ec.europa.eu

Thank you for your attention!