European Commission

Öko-Recherche
Büro für Umweltforschung und- beratung GmbH

Assessing the implications of the (draft) EU HFC amendment proposal

Studies carried out for the European Commission

Bastian Zeiger

Ozone2Climate Industry Roundtable 2015

09.04.2015

Shanghai, China

New International Expo Center

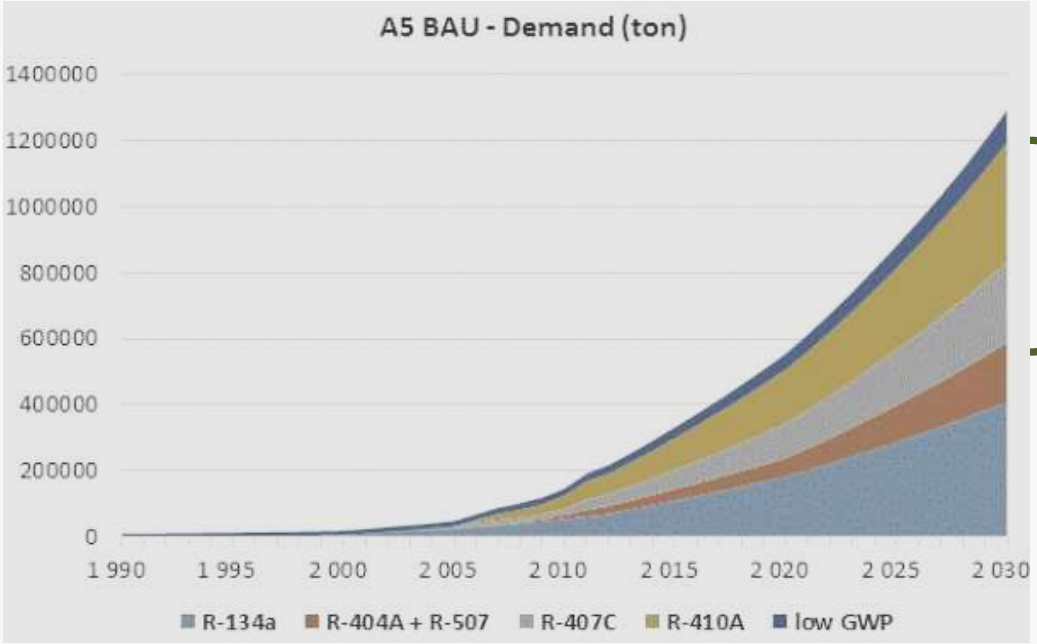
Content

- Drivers of HFC consumption
- (Draft) EU amendment proposal
- Assessing potential to meet proposal in Article 5 countries: Results from the case studies
- Outlook: High ambient temperature conditions
- Implications and conclusions

Drivers of HFC consumption

- HCFC phase-out creates demand for alternatives
- Rapid expected economic growth in particular refrigeration and air conditioning in Article 5 countries
- Current stage of economic development

The technology choice is being made right now!



AC sector

Source: 2014 TEAP Decision XXV/5 Task Force Report

(Draft) EU amendment proposal

- Builds on previous amendment proposals
- Incorporates experience of CFC/HCFC phase-outs under MP
- Differentiated commitments
- Based on experience in EU
- Submission expected end of April 2015

Commitment of Article 2 countries: Reduction of consumption/production

- Baseline (in CO_2eq):
  - 2009-2012 HFC consumption/production
  - 45% GWP weighted HCFC consumption/production allowed in 2009-2012
- HFC reduction schedule for A2:
  - 2019: 85%
  - 2021: 65%
  - 2024: 45%
  - 2027: 30%
  - 2030: 15%

→ **Close to EU HFC phase-down**

Commitment of Article 5 countries: Consumption freeze

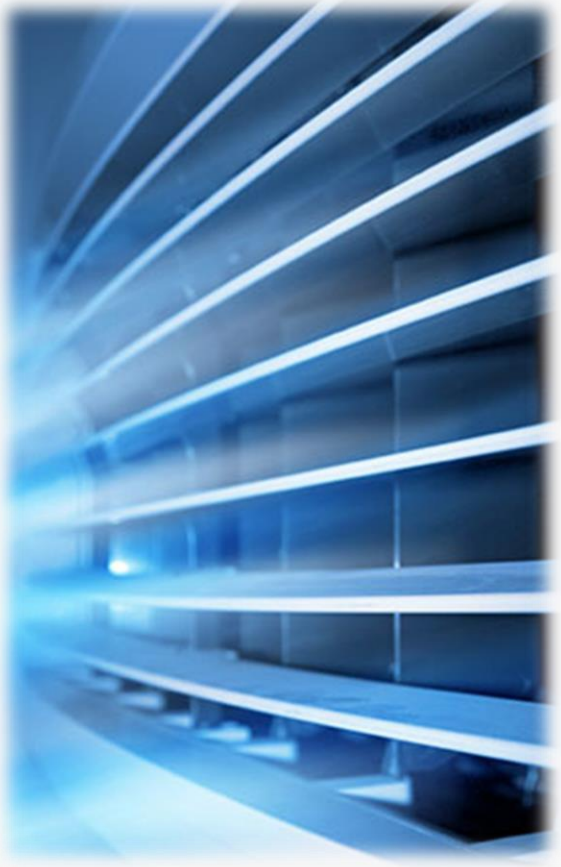
- Freeze of HFC/HCFC consumption (in CO2eq) in 2019
  - Climate impact of the HFC/HCFC basket is capped, the HCFC phase-out schedule (in ODP t) maintained
- Baseline (in CO_2eq):
  - Average 2015/16 HFC consumption
  - Average 2015/16 GWP-weighted HCFC consumption
- Agreement on reduction schedule later (by 2020)

Commitment of Article 5 countries: Production freeze and reduction target

- Freeze of HFC/HCFC production in 2019
- Baseline (in CO_2eq):
  - Average 2009 – 2012 HFC production
  - **PLUS:** 70% of GWP-weighted HCFC production in 2009 - 2012
- Reduction to 15% in 2040

Case study rationale

- Focus on Article 5 country needs
- Country-specific assessment of required actions
- Determining important (sub-)sectors
- Overview of the potential of already available technology
- Overcome current lack of data on HFCs



Data sources for assessment in Article 5 countries

- HPMPs for HCFC data, substance mix and phase-out schedule and to calibrate model
- No reported data on HFCs
- Stock model for HCFC and HFC stocks
- Data from Green Cooling Initiative for unit sales and future growth rates
- Additional data points (mostly AC) and country characteristics
- 2030 penetration rates for alternatives from prep. study for F-gas Regulation and technical paper on HAT

HFC consumption scenarios

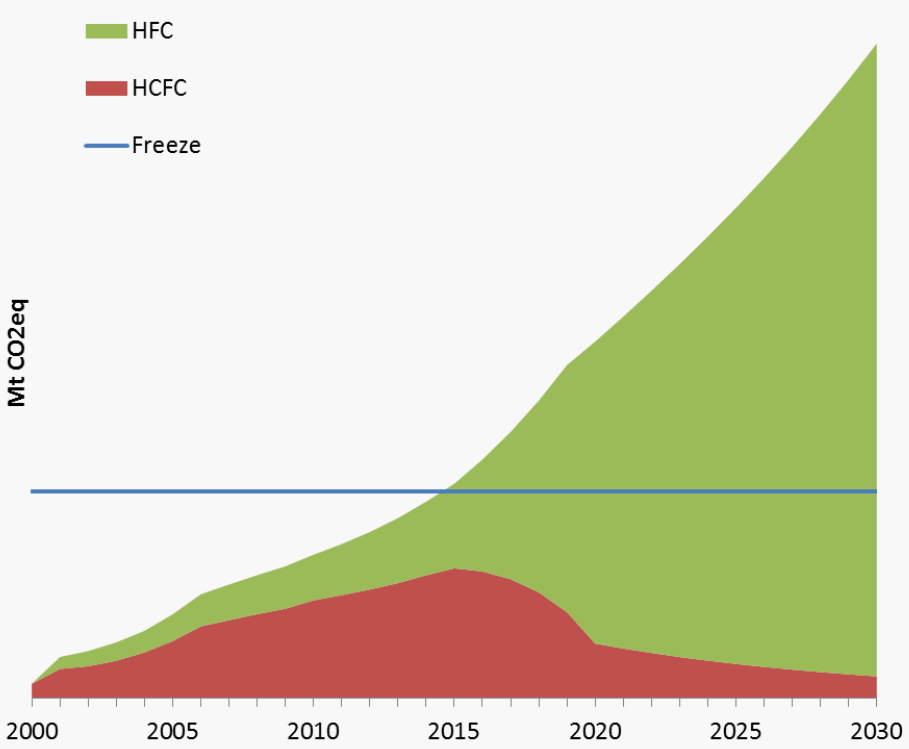
- Stock and sales remain the same in all scenarios -> technology choice differs
- BAU follows TEAP's BAU
- MIT assumes available alternative technology
- Additional scenarios were modelled if required

Sector	Prev. tech. BAU	Prev. tech. MIT
Unitary AC	R410A, R407A/C/F, R134a	HC-290, R32
Chillers		HC-290, R717, R1234ze
Mobile AC	R134a	R1234yf, HC-290
Domestic ref	HC-600a	HC-600a
Commercial ref	R134a, R404A, R407A/C/F, R422D	HC-290, HC-600a, R744, R1234yf
Industrial ref		R717, HC-290
Transport ref		HC-290, R744, R1234yf
Appliance foam	Transition to hydrocarbons	HCs, Pentanes, R1234ze
Foam bulk		

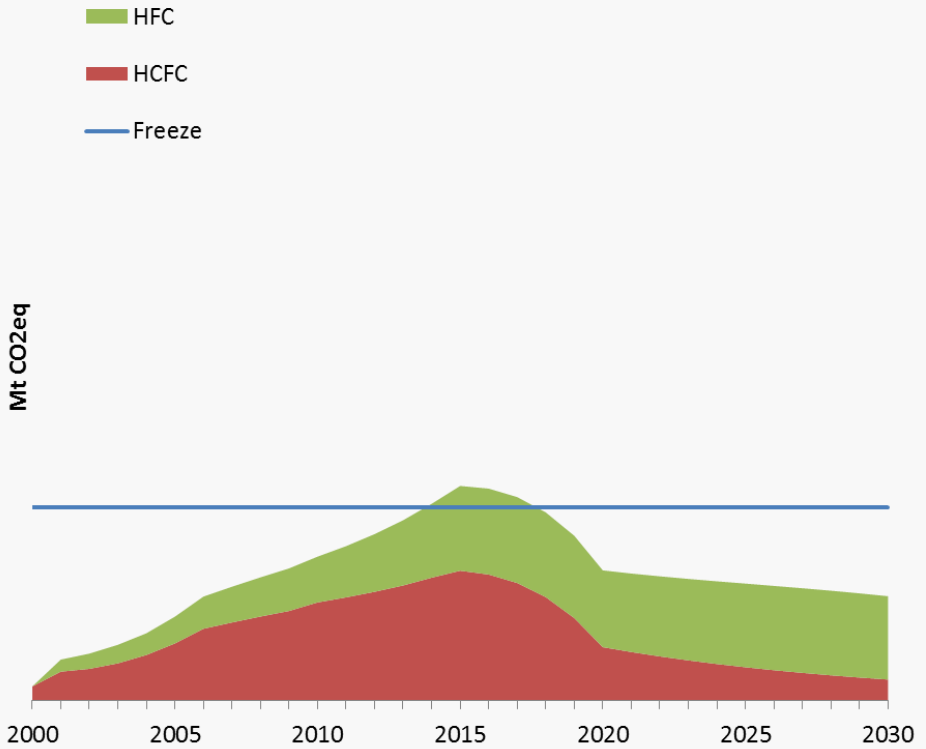
Subsector		Substance	BAU	MIT
			by 2020	by 2020
Unitary air conditioning	Self-contained air conditioners	HCFC-22	0%	0%
		HFC-32	0%	10%
		HFC-407C	48%	0%
		HFC-410A	48%	0%
		HC-290	4%	90%
	Split residential air conditioners	HCFC-22	0%	0%
		HFC-32	20%	25%
		HFC-410A	80%	0%
		HC-290	0%	75%
	Commercial ducted split	HCFC-22	0%	0%
		HFC-32	0%	65%
		HFC-407C	50%	0%
		HFC-410A	50%	0%
		HC-290	0%	25%
		R744	0%	10%
	Multi-splits	HCFC-22	0%	0%
		HFC-32	0%	40%
		HFC-407C	50%	0%
		HFC-410A	50%	0%
		HC-290	0%	50%
		R744	0%	10%

Case study 1 results

BAU:



MIT:



Case study 1 results

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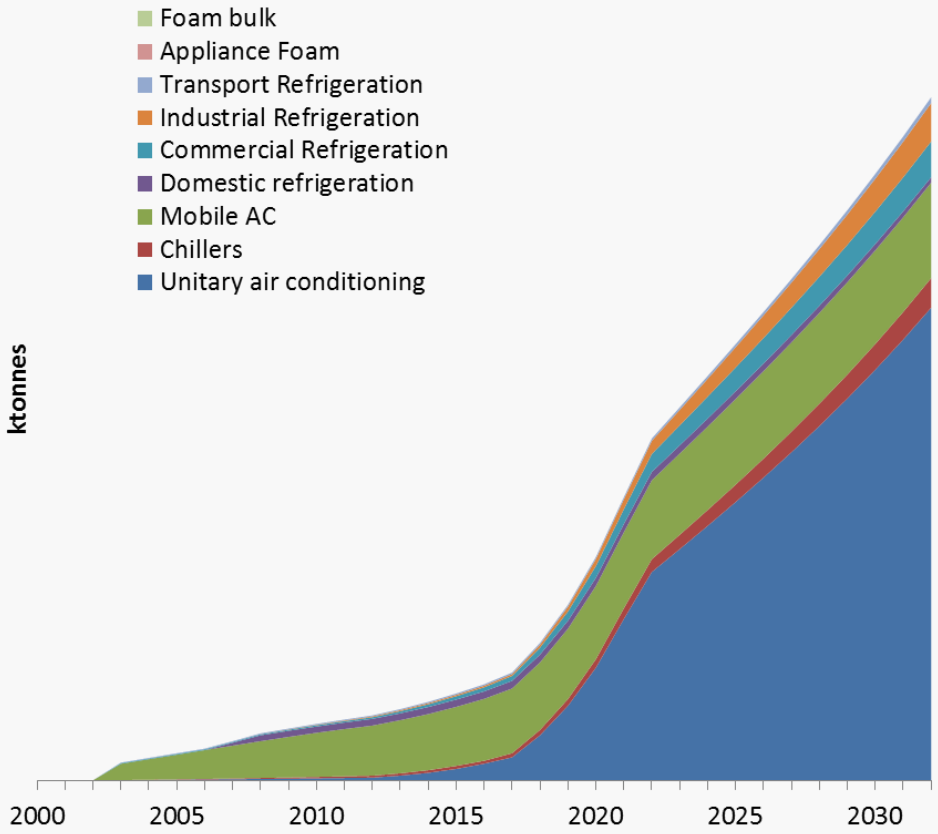

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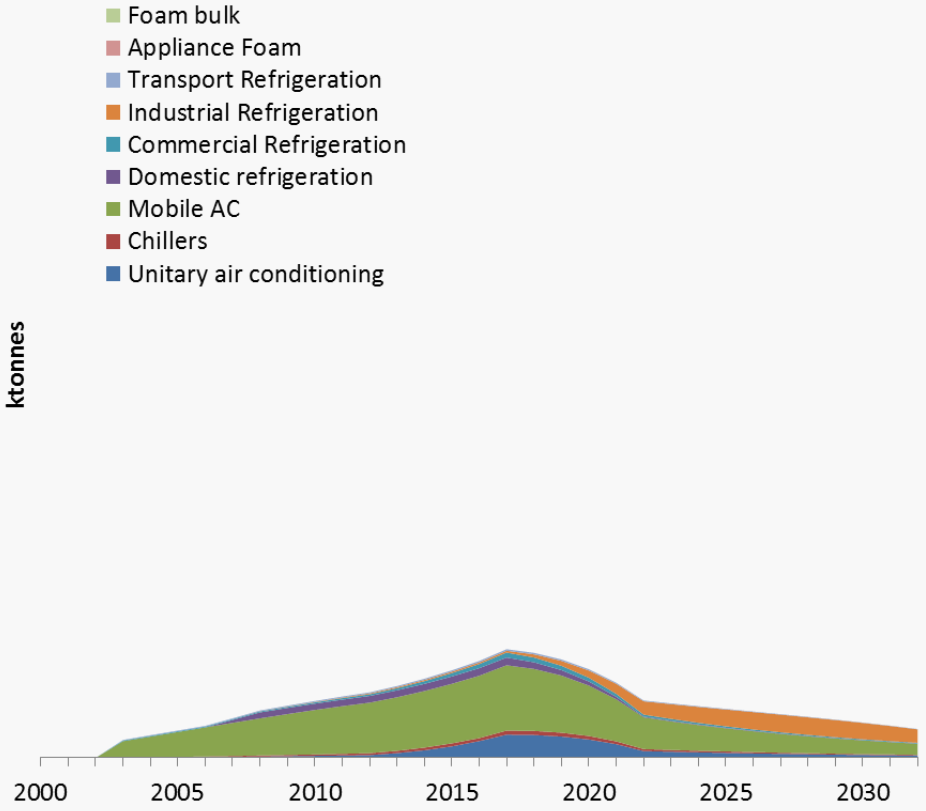

Case study 2 results

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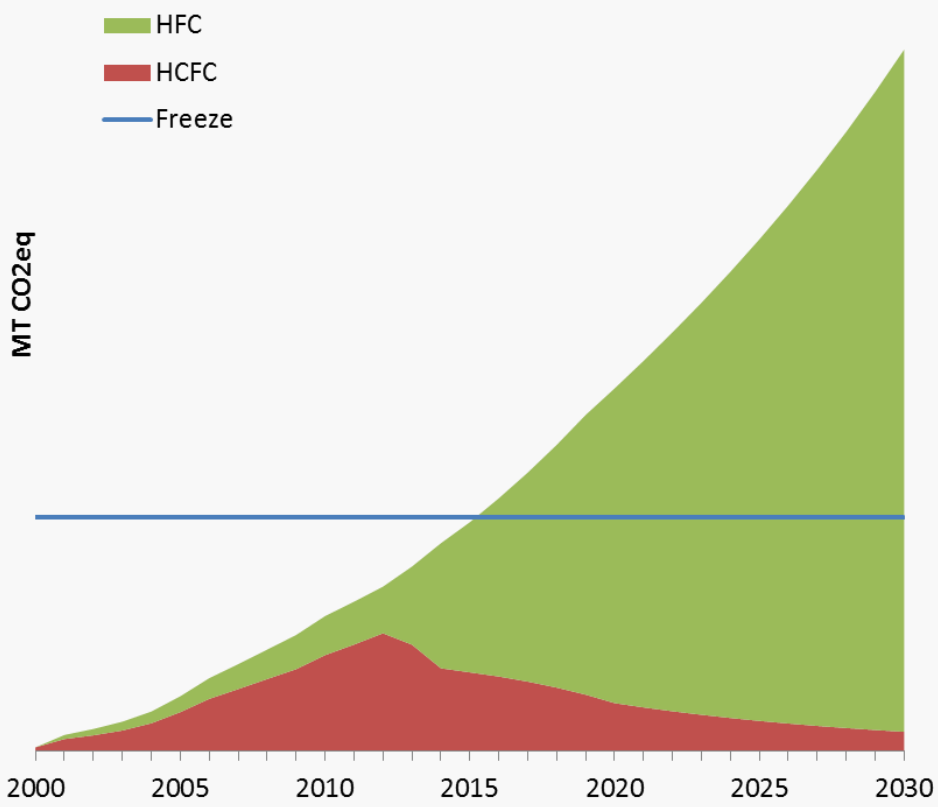

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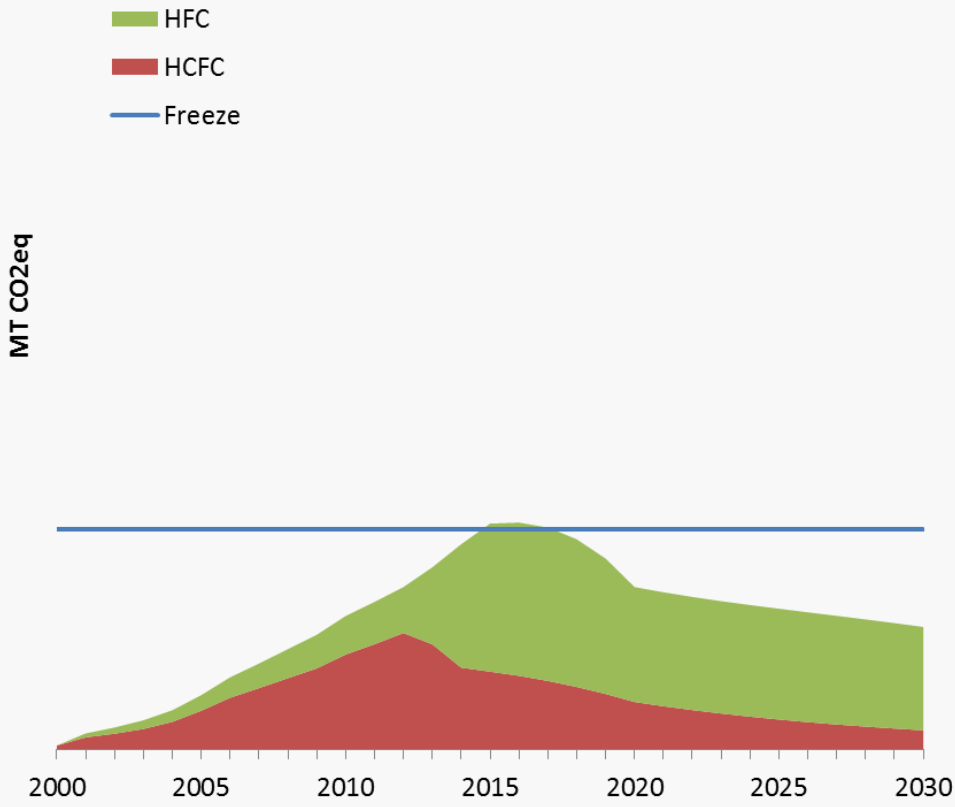

Case study 2 results

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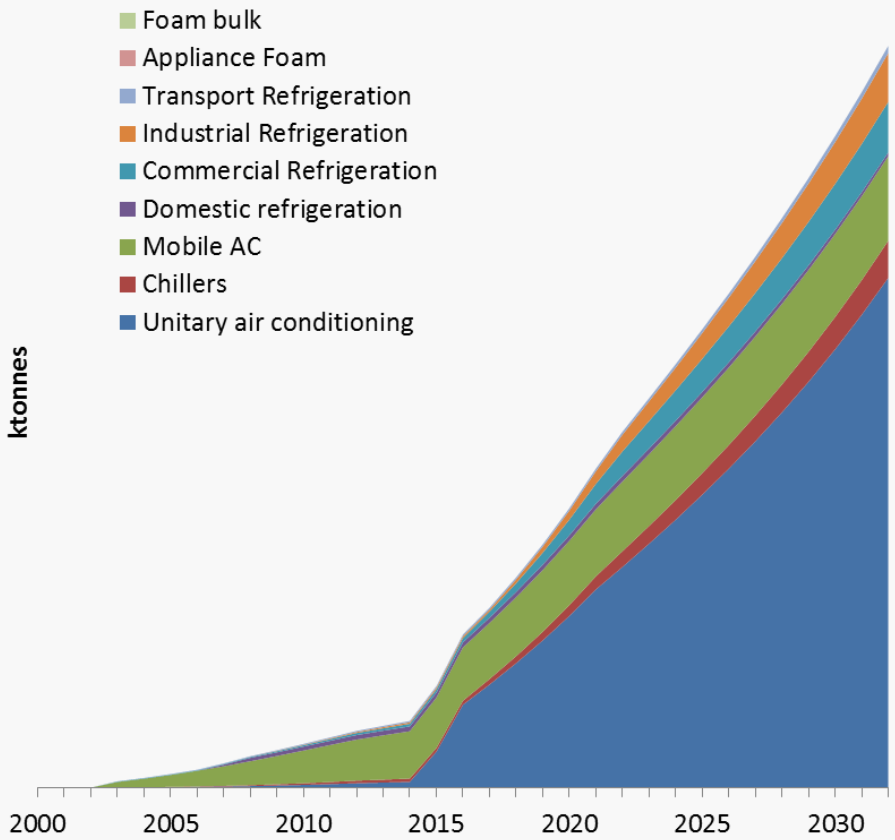
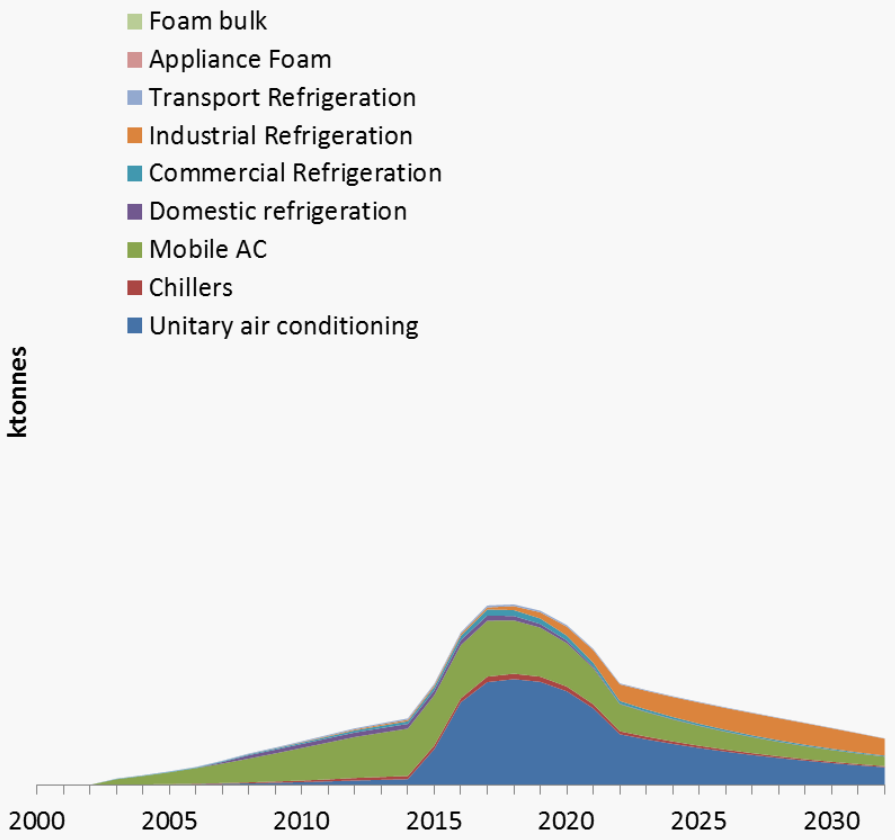


MIT:



Synthesis from case studies

- HCFC phase-out offers great opportunity to leap-frog HFCs
- Reaching 2019 freeze possible given aggressive investment in alternatives before 2020
- Unitary AC the most crucial sector; MAC, stand-alone com. and industrial ref. also important
- R32 can in most cases only play a minor role
- Cont'd investment in HFCs would prevent reaching freeze
- Data gathering needed to confirm results

90% HFCs can be prevented by low-GWP alternatives!

Specific challenge: High ambient temperatures

Equipment sector ↓ / Alternatives →		HC	Ammonia	HFO	R32/HFO blends
Private fridges		🟢	🔴	🔴	🔴
Commercial plug-ins		🟢	🔴	🟡	🔴
Condensing units	< 5kW	🟢	🔴	🟡	🟡
Condensing units	> 5 kW	🔴	🔴	🟡	🟡
Centralised system supermarket		🟢	🔴	🟡	🟡
Large industrial refrig.		🔴	🟢	🔴	🔴
AC plug-ins		🟢	🔴	🔴	🟡
AC Single split	< 7kW	🟢	🔴	🔴	🟡
AC Single/Multi split	> 7kW	🔴	🔴	🔴	🟢
AC cars		🔴	🔴	🟢	🔴
Displacement Chillers		🟢	🟢	🔴	🟡
Centrifugal Chillers		🔴	🔴	🟢	🔴

Source: Öko-Recherche et al., 2014

Thank you for your attention!

Questions…???

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More information:

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

General info on EU F-gas policy:
http://ec.europa.eu/clima/policies/f-gas/index_en.htm