EPEE F-GAS INDUSTRY ROUNDTABLE

26 Nov 2018
**Agenda**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>12.00 – 13.00</td>
<td>Registration of participants - Lunch</td>
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<tr>
<td>13.00 – 13.10</td>
<td>Introduction by Andrea Voigt, EPEE</td>
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<td>13.10 – 13.30</td>
<td>Evolution of HFC prices</td>
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<td></td>
<td><em>Julia Kleinschmidt, Öko-Recherche</em></td>
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<td>13.30 – 14.10</td>
<td>EPEE Gapometer update</td>
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<td><em>Ray Gluckman</em></td>
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<td>14.10 – 14.20</td>
<td>Update on an ongoing collaboration: the AREA, ASERCOM, EFCTC &amp; EPEE F-gas communications campaign</td>
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<td><em>Andrea Voigt, EPEE</em></td>
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<td>14.20 – 14.45</td>
<td>Q&amp;A/debate</td>
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<td>14.45 – 15.05</td>
<td>Update from DG CLIMA, European Commission, on illegal trade of refrigerants</td>
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<td><em>Arno Kaschl, Bente Tranholm-Schwarz</em></td>
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<td>15.05 – 15.25</td>
<td>An action plan against illegal trade of refrigerants</td>
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<td><em>Olivier Janin, AREA; Sébastien Gallet, EFCTC; Andrea Voigt, EPEE</em></td>
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<td>15.25 – 15:50</td>
<td>Q&amp;A/debate</td>
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<td>15.50 – 16.00</td>
<td>Closing remarks</td>
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Welcome
Andrea Voigt, EPEE
Evolution of HFC prices

Julia Kleinschmidt, Öko-Recherche
Development of HFC prices

EPEE F-gas Roundtable

26 November 2018
EPEE offices, Brussels

Julia Kleinschmidt
Öko-Recherche GmbH
Frankfurt am Main, Germany
Agenda

► About the HFC price monitoring analysis
► Price developments in 2018
► Short summary and outlook
About the HFC price monitoring analysis (I)

► **Aim:** Monitoring the price effects of the HFC phase-down at different levels of the supply chain

- Commissioned by DG CLIMA, started in mid-2016
- Takes into account results from a previous project (2015-2016)
- CITEPA (France) as project partner
- Close cooperation with national (ATF, BWP, VDKF, SNEFFCA) and EU associations (AREA, ASERCOM, EPEE, Eurovent)
- Quarterly reports to DG CLIMA
- Companies receive an excerpt from the last price monitoring report (with a three months delay)
About the HFC price monitoring analysis (II)

- 60 – 70 companies from RACHP sectors, different EU Member States and all levels of the supply chain
- Companies provide purchase and/or selling price data for refrigerants (HFCs and alternatives) and quota authorisations for the previous quarter
- End-users not included
- Assessment of price development for the entire supply chain and each supply chain level
Price developments in 2018 (I)

- R404A reached its price peak at the beginning of the year
- Price decreases of R410A and R134a after both have seen strong price rises
- Price increases have been completely passed on the end-users
- Lower GWP alternatives have shown rather moderate price increases
- Natural refrigerants still available at low prices
- Prices of quota authorisations vary from 25 to 40 €/t CO₂e
Price developments in 2018 (II)

Price development of R134a (GWP 1430) at all levels of the supply chain (price index, 2014 = 100 %)

- Gas producers (selling price)
- Gas distributors (purchase price)
- OEMs (purchase price)
- Service companies (purchase price)
- Service companies (selling price) = end-user price
Price developments in 2018 (III)

Development of purchase prices of R404A, R410A, R407C and R134a at OEM level (price index, 2014 = 100 %)
Price developments in 2018 (IV)

Development of purchase prices of various alternative refrigerants at service company level (price index, Q2/2017 = 100 %)
Development of abatement costs

Prices expressed in €/t CO₂e in Q2/2018

<table>
<thead>
<tr>
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<th>in €/t CO₂e</th>
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<tbody>
<tr>
<td>Gas producers (selling price)</td>
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<tr>
<td>R134a</td>
<td>15.91</td>
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<tr>
<td>R410A</td>
<td>13.71</td>
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<tr>
<td>R404A</td>
<td>6.88</td>
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<tr>
<td>OEMs (purchase price)</td>
<td></td>
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<tr>
<td>R134a</td>
<td>23.08</td>
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<tr>
<td>R410A</td>
<td>23.65</td>
</tr>
<tr>
<td>R404A</td>
<td>13.74</td>
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<tr>
<td>Service companies (purchase price)</td>
<td></td>
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<tr>
<td>R134a</td>
<td>23.30</td>
</tr>
<tr>
<td>R410A</td>
<td>24.17</td>
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<tr>
<td>R404A</td>
<td>16.99</td>
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*Study carried out for UBA in 2015

- Prices still within the expected range (Forecast 2030* 35 €/t CO₂e, EU Roadmap 2050 50 €/t CO₂e)
- Widening gap between R404A and R134a/R410A → recent price increases of R134a/R410A much stronger than for R404A when considering the GWP
- Current price of ETS allowances ~ 20 €/t CO₂ (for comparison)
- Price range 35 to 50 €/t CO₂e for alternatives with GWP ~ 650 (at service company level)
Short summary and outlook

• According to some companies, different aspects might have affected refrigerant prices (e.g. stockpiling in previous years, increased care in handling refrigerants, illegal trade)

• 2018 divided into two parts - flattering of price increases after strong price rises at the beginning of the year

• Prices decreases in the second half of the year

• Some companies expect “wave-like” price trends for the future (i.e. price increases at the beginning, falling prices towards the end of the year)
Thank you very much for your attention!

Julia Kleinschmidt
julia.kleinschmidt@oekorecherche.de

Öko-Recherche
Büro für Umweltforschung und -beratung GmbH
Münchener Str. 23
60329 Frankfurt/Main
GERMANY

www.oekorecherche.de
@OekoRecherche
EPEE Gapometer update
Ray Gluckman
EPEE Gapometer Project

Update

November 26th 2018
Agenda

- Reminder: EPEE Gapometer Roadmap
- Results of Market Research, 2017
- Progress Towards the 2018 Phase-Down Step
- New EPEE Model: EU and UNEP Article 5 Models
- Concluding Comments
Reminder:

EPEE Gapometer Roadmap
Gapometer Project Methodology

• Step 1: Develop Roadmap (2015)
  – based on previous modelling for EPEE in 2012

• Step 2: Monitor progress (2016 / 2017)
  – market research to monitor progress towards the key milestones identified in the Roadmap, i.e.:
    • rate of uptake of lower GWP alternatives for new equipment
    • actions related to supermarket systems
    • use of reclaimed and recycled HFCs
The challenges in 2018 and 2021

Intermediate Milestones

Estimate of 22 MT made in 2012

EPEE Model

Reported data in 2016: 19.6 MT (probably slightly low due to under-reporting)
The challenges in 2018 and 2021

Intermediate Milestones

The EPEE Roadmap illustrates one route to achieve these challenging cuts

**Baseline**
- 22 MT CO$_2$
- 183 MT CO$_2$

**2018**
- 44% cut
- -90 MT CO$_2$

**2021**
- 60% cut
- -123 MT CO$_2$

**Graph Details**
- EU HFC Quota
- Pre-charged imports

**Chart Labels**
- Million tonnes CO$_2$ equivalent
Roadmap Scenario: Contributions from Core Actions

- Cuts in MT CO₂

<table>
<thead>
<tr>
<th>Year</th>
<th>New Equipment</th>
<th>Existing Equipment</th>
<th>Reclaimed Refrigerant</th>
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<tbody>
<tr>
<td>Baseline</td>
<td></td>
<td>-36 (40%)</td>
<td>-36 (40%)</td>
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<tr>
<td>2018</td>
<td>-64 (52%)</td>
<td>-30 (33%)</td>
<td>-30 (33%)</td>
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<tr>
<td>2031</td>
<td>-39 (32%)</td>
<td>-24 (27%)</td>
<td>-24 (27%)</td>
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<td>-20 (16%)</td>
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<td>-20 (16%)</td>
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Market Research Results

2016 and 2017
MAC Directive - zero for cars from 2017

Largest sector for new equipment in 2012 (mostly R-410A)
Roadmap only assumed a small switch away from R-410A by 2018.

2017 forecast: progress will be faster than Roadmap in 2018.
2017 forecast: progress will be slower than Roadmap in 2018

Similar 2017 forecast for chillers i.e. slow progress
Key supermarket actions

• new equipment:
  – 2017 survey already showed good progress
  – virtually zero R-404A in new equipment

• leak reduction:
  – 2017 survey showed good progress
  – but many supermarkets did not send leakage data

• retrofills:
  – 2017 survey showed significant gap compared to Roadmap
  – i.e. not enough action
Actual Progress Towards the 2018 Phase-Down Step
How are we doing in 2018?

• Q4 of 2017 saw massive price rises
  – possible indicator of supply shortages in 2018, given the massive cut in supply
    • 44% below baseline (including pre-charged equipment)
• EPEE research in 2017 showed “gaps” compared to Roadmap
  – another indicator of possible shortfall of supply in 2018
• but, by Q4 of 2018, market seems to be coping
  – what has changed?
Possible reasons for unexpected drop in HFC demand

• faster uptake of low GWP refrigerants in new equipment
• leak reduction – in response to high prices
• faster rate of R-404A retrofits, especially by supermarkets
• improved rate of reclaim and recycling
• little demand for authorisations
  – due to 2015 / 2016 “pre-purchase”
• some bulk HFC stock-piling in 2017
• illegal imports of bulk HFCs
The Market is Rapidly Changing

- Chillventa 2016
  - still R-404A on display; little evidence of low GWP refrigerants
- Chillventa 2018
  - massive change; many stands highlighting low GWP technologies
- 2017 price rises
  - stimulated much activity:
    - new equipment refrigerant choices
    - retrofits
    - creates commercial viability for reclaim / recycle
- unfortunately, price rises also lead to opportunities for criminals!
Roadmap Data

• we can see areas where good progress is being made

• new equipment options
  – big changes in 2018

• retrofits
  – many supermarkets becoming “self-sufficient” in R-404A

• reclaim / recycle
  – much more activity than in 2016
Use of R-410A in < 3kg splits much lower than 65% forecast in 2017 (or 80% in Roadmap)
Use of R-410A in 3 kg to 6 kg also less than Roadmap forecast of 80%
Conclusions regarding new equipment in 2018

- 2016 and 2017 research shows some “gaps” between Roadmap assumptions and responder predictions
- but actual performance in 2018 is better
- small split AC < 3kg: very large proportion using HFC-32
- DX air-conditioning in 3 to 12 kg range: rapidly moving to HFC-32
- air-conditioning water chillers: lots of HFO models now available
- large commercial refrigeration: no R-404A; lots of CO₂ and HCs
  - also encouraging signs for medium sized equipment (CO₂, HCs and A2Ls)
- MACs in cars and vans: zero HFC-134a from 2017
  - but, later start than in Roadmap: creating more servicing needs
Supermarket Self-Sufficiency (1)

- supermarkets: about 75% of R-404A demand in 2012
- 2018: zero requirement for new equipment
- many have invested in leak reduction – leaks probably now average 10% to 12%
- many have begun retrofit programmes in 2017 / 2018
  – retrofits starting later than Roadmap, but still effective
- big supermarket companies becoming self-sufficient:
  – obtaining their own R-404A from retirements and retrofits
  – usually working with big wholesalers and repackers
Supermarket Self-Sufficiency (2)

Year 1:
Bank of R-404A equipment
100 tonnes

- Retire 5% of plants: obtain 5 tonnes
- Retrofit 10% of plants: obtain 10 tonnes
- 15 tonnes available for top-up (15%)

Year 2:
Bank of R-404A equipment
85 tonnes

- Retire 5% of plants: obtain 4.2 tonnes
- Retrofit 10% of plants: obtain 8.5 tonnes
- 12.7 tonnes available for top-up (15%)

Programme can be supported via:

a) retirement or retrofit of leakiest plants – improving average leak rate
b) using previously stockpiled virgin or reclaimed R-404A
Stockpiles of virgin HFCs

- use of stockpiled HFCs ease the pressure on quotas in 2018
- two periods when stockpiles created
  - in 2014, before quota system
  - in 2017, during “panic buying” as prices rose sharply
- 2014: good evidence from EEA annual report
  - around 30,000 tonnes of HFCs stockpiled
  - some used in 2015 – 16 (keeping HFC prices low)
  - some kept in reserve for big cut in 2018
- 2017: high demand fuelled price rises – some was stockpiled
  - harder to quantify, but estimated to have been significant
Routes to Refrigerant Re-use

• recycled refrigerant
  – *reuse of a recovered gas following a basic cleaning process*
  – can be done with limited facilities e.g. recovery machines used by RAC contractors
  – but, no guarantee of refrigerant quality when re-used

• reclaimed refrigerant
  – *reprocessing of a recovered gas to match the performance of a virgin substance, taking into account its intended use*
  – must include chemical analysis to ensure refrigerant quality

• 2 sub-options for reclaim
  – recovered gas **unmixed**, (e.g. only R-404A)
    • reprocessing relatively simple
  – recovered gas **mixed**: (e.g. R-404A and R-410A)
    • requires sophisticated distillation facilities to separate components and re-combine as required
Sources of Refrigerant for Re-use

- from equipment reaching end-of-life
  - mandatory requirement in F-Gas Regulation to recover gas
  - retiring equipment is a significant source of recovered gas

- from equipment being retrofitted
  - key aspect of R-404A retrofits is to ensure that old gas recovery is maximised and the gas is re-used
  - easy to avoid gas mixing in retrofit programmes

- what happened to old gas historically?
  - some was illegally vented
  - some was accidently vented during recovery
  - much was sent for incineration
  - some was re-used
Conclusions regarding re-use of refrigerant

- Roadmap shows requirement for significant use of reclaimed / recycled refrigerant in 2018 (24 MT CO2)
- Rapid growth in available reclaim infrastructure
- High price of R-404A provides strong incentive for recovery / re-use
- Difficult to assess quantities being reclaimed
  - Capacity for reclaim >5,000 tonnes per year
  - Supermarkets (major user of R-4040A) have managed programmes
- Level of recycling very hard to quantify
  - 200,000 F-Gas qualified technicians in EU
  - If each engineer recycled just 5kg per year: 1,000 tonnes!
  - High gas prices incentivise recycling
  - But, reclaim should be encouraged as the preferred route
Reported Authorisations

• authorisations issued (from Commission report):
  – 2015: 17.2 MT CO2
  – 2016: 19.9 MT CO2
  – 2017: data not yet published

• none used for pre-charged equipment (PCE) imports prior to 2017

• annual requirement was ~ 20 MT CO2
  – mostly R-410A in small split air-conditioning
  – but this will fall significantly as R-410A replaced by HFC-32

• sufficient authorisations sold in 2015/2016 to supply most PCE requirements in both 2017 and 2018
  – “eases” pressure on phase-down in 2018
  – by around 20 MT CO2
  – 22% of the required cut of 90 MT CO2
Progress in 2018

Illegal imports

no data easily available!
Modelling of HFC Use and Emissions for EU and for Article 5 Countries
Current Modelling Work

- **UNEP Phase 1: Kuwait and Bahrain**
  - models completed

- **UNEP Phase 2: 8 countries, to be completed Q2 2019**
  - Africa: Senegal, Gabon, Mali
  - Central America: Dominican Republic, Guatemala, Honduras
  - Bosnia
  - Sri Lanka

- **new EU model for EPEE**
  - to be completed Q1 2019
New EPEE Model of EU HFC Consumption

• easy to use and robust interface
  – readily usable by EPEE members
  – multi-lingual capability

• wide variety of output formats
  – to explore the data of greatest interest

• easy to modify input assumptions
  – to create new forecasts of future HFC demand

• can compare forecasts to:
  – current EU phase-down schedule
  – Kigali phase-down schedule
  – can easily be updated to assess any new proposals from Commission
Following slides are for an anonymous “Country X”

Equivalent data for EU model will be available in a few weeks time
HFC Consumption in kT CO2
For 5 different “policy” scenarios

and 3 different “growth” scenarios
Can switch to other output types e.g. “by gas-type”
Same data looks very different if we switch units to tonnes.
Now we can see the use of ultra-low GWP HFOs and non-fluorocarbons
Can filter to individual market sectors or sub-sectors e.g. car air-conditioning
Displayed by individual gas
Consumption data split by main market sector
Can display many different types of output e.g.
- Gas consumption
- Gas emissions
- Gas in systems
- Number of systems

Each “output type” can be split into sub-types e.g.
- Consumption for:
  - Factory manufacture
  - On-site filling of new systems
  - Top-up of leakage
many other views and outputs
- individual years can be displayed with pie charts
- all data can be viewed as tables
- all tables and graphs can easily be exported e.g. to PowerPoint

“Compliance View” shows progress to Regulations
- historic consumption
- baseline and phase-down steps
- effectiveness of different future scenarios

“Input Viewer” displays all input assumptions used in model
Compliance View for an Article 5 Group 2 Country

Regulation: HFC Phase Down
Country Group: Article 5 Group 2
Economic Growth: Mid

HCFCs
HFCs

Reported data
Model – history
Model – forecast
Model – phase-down

Gluckman Consulting
specialists in refrigeration and climate change
All screens can be easily translated into another language e.g. Spanish.
Concluding Comments
Achieving 2018 Phase-Down

- challenging cut in 2018 seems to have been achieved
- very high prices in Q3 / Q4 2017 were key signal to market
- activity in various areas has increased rapidly e.g.:
  - faster uptake of HFC-32 in new split air-conditioning
  - retrofills and refrigerant re-use in supermarkets
  - more refrigerant reclaim and recycling
- stockpiles from 2014 and 2017 are helping in 2018
- authorisations sold in 2015 – 2017 also helping
- however, significant concern about illegal imports
Contact Details

Ray Gluckman
Gluckman Consulting

e-mail: ray@gluckmanconsulting.com

Tel: +44 1932 866344

Information Sheets about EU F-Gas Regulation:
www.gluckmanconsulting.com/f-gas-information-sheets/

Fact Sheets about low GWP alternatives to HFCs:
www.gluckmanconsulting.com/low-gwp-alternatives-to-hfcs/

Fact Sheets about Kigali Amendment:
www.gluckmanconsulting.com/kigali-amendment/
Communications campaign on F-Gases
Andrea Voigt, EPEE
EPEE Gapometer: Identify and act on priorities

1. Information campaign to stop installing R-404A / R-507A

Stay in business: Stop installing R-404A/R-507A!
Brochure & Video

Translations available in: German, French, Spanish, Italian, Polish, Romanian, Slovakian, Czech, Dutch, Greek, Norwegian, Portuguese, Croat, Danish, Estonian, Finnish, Hungarian, Maltese, Latvian, Slovene, Bulgarian, Lithuanian.

Remaining EU languages to come
EPEE Gapometer: Identify and act on priorities

2. Information campaign on flammable refrigerants

Grow your business: Get ready for flammable refrigerants!

Translations ongoing
New EPEE communication material (1)

EPEE FAQ on HFOs and HCFOs
New EPEE communication material (2)

EPEE 7 Lessons Learned from the EU F-Gas Regulation

Launched at Montreal Protocol Meeting in Quito on 7th Nov
Q&A/Debate
Update from DG CLIMA, European Commission, on illegal trade of refrigerants

Arno Kaschl
An action plan against illegal trade of refrigerants

Olivier Janin, AREA; Sébastien Gallet, EFCTC; Andrea Voigt, EPEE
In a nutshell

• Press release to the trade press
• Letter to national associations
• Reaching out to EIA (survey)
• AREA survey
• Reaching out to Member States
• Cooperation with DG CLIMA
• Engagement with other relevant DGs
Q&A/Debate