Refrigerants, Efficiency and Beyond: Sustainable Heating and Cooling Has Many Faces

By Andrea Voigt, Director General EPEE

MOP32, 24 November 2020

Instructions to participants

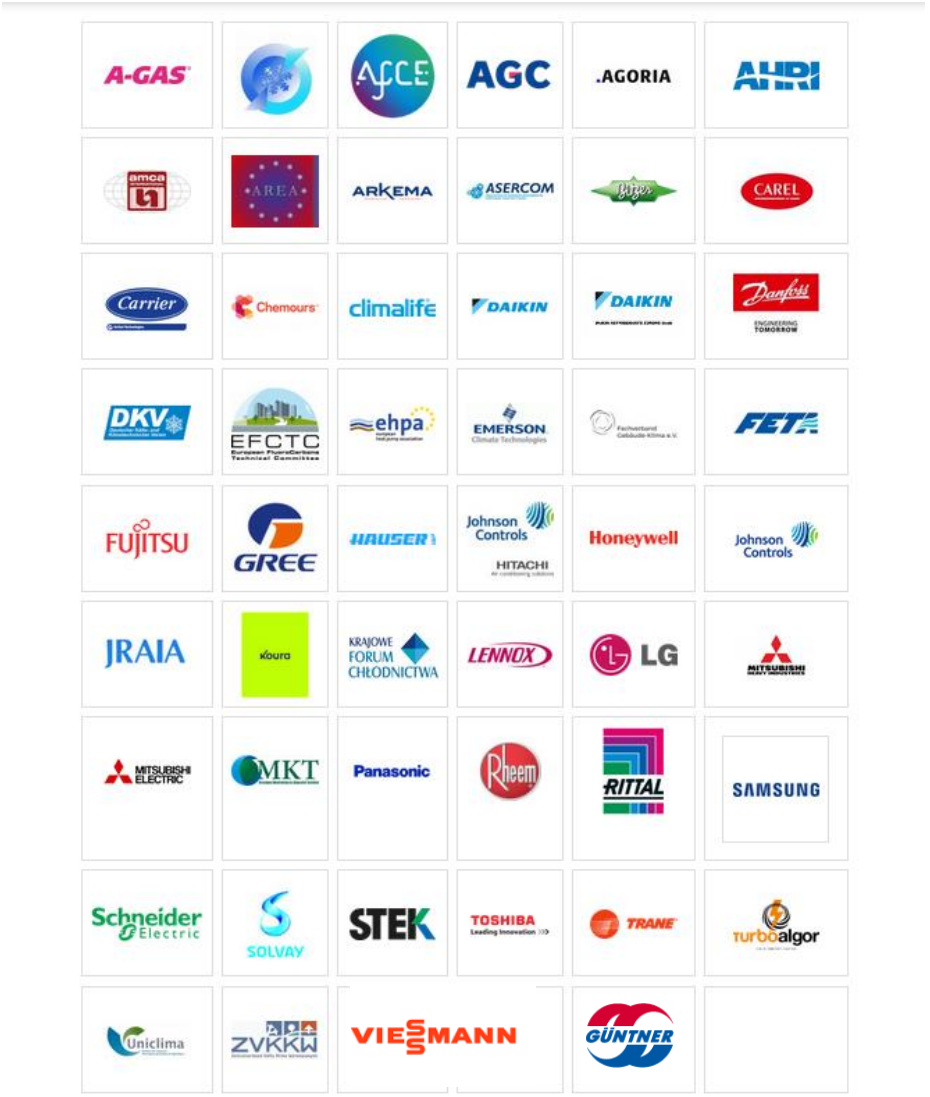
- ❑ All participants should remain in mute mode if not speaking
- ❑ A Q&A session will take place after the two presentations
- ❑ Participants can either submit their questions through the chat or click on the “raise your hand” button
- ❑ If time doesn’t allow to cover all questions, please send them through the chat and we will do our best to come back to you via email after the event

Timing (EAT)	PROGRAMME	
12.00 – 12.05	Welcome	Andrea Voigt, EPEE Director General
12.05 – 12.20	The Many Faces of Sustainable Heating and Cooling	Andrea Voigt, EPEE Director General
12.20 – 12.40	Reducing Greenhouse Gas Emissions from Refrigeration, Air-Conditioning and Heat Pumps	Ray Gluckman, Gluckman Consulting
12.40 – 12.55	Q&A session	Andrea Voigt, EPEE Director General
12.55 – 13.00	Closing remarks	Andrea Voigt, EPEE Director General

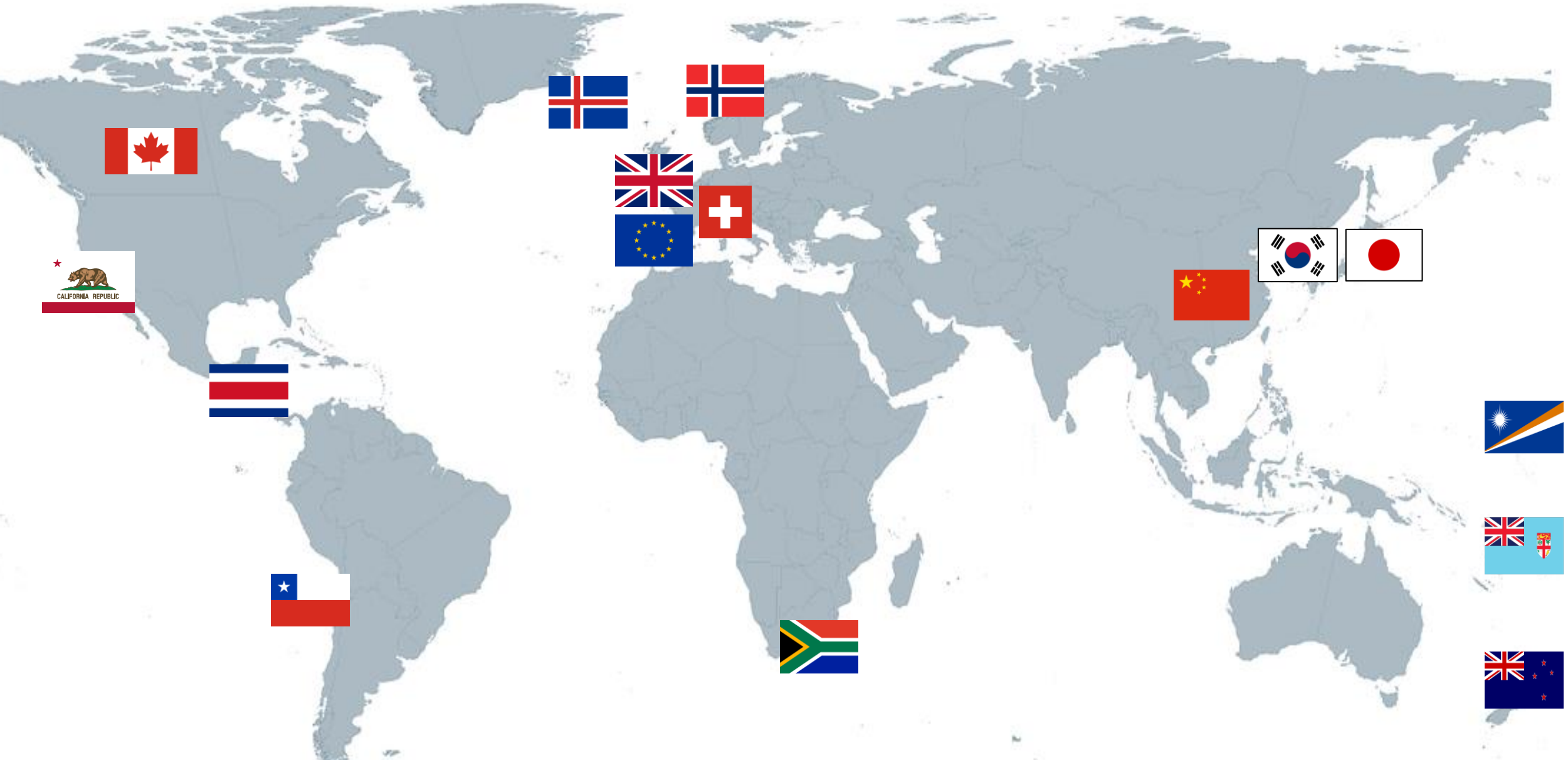
Who is EPEE? The full value chain. A true voice.

EPEE represents the manufacturers of refrigeration, air-conditioning and heat pump technologies

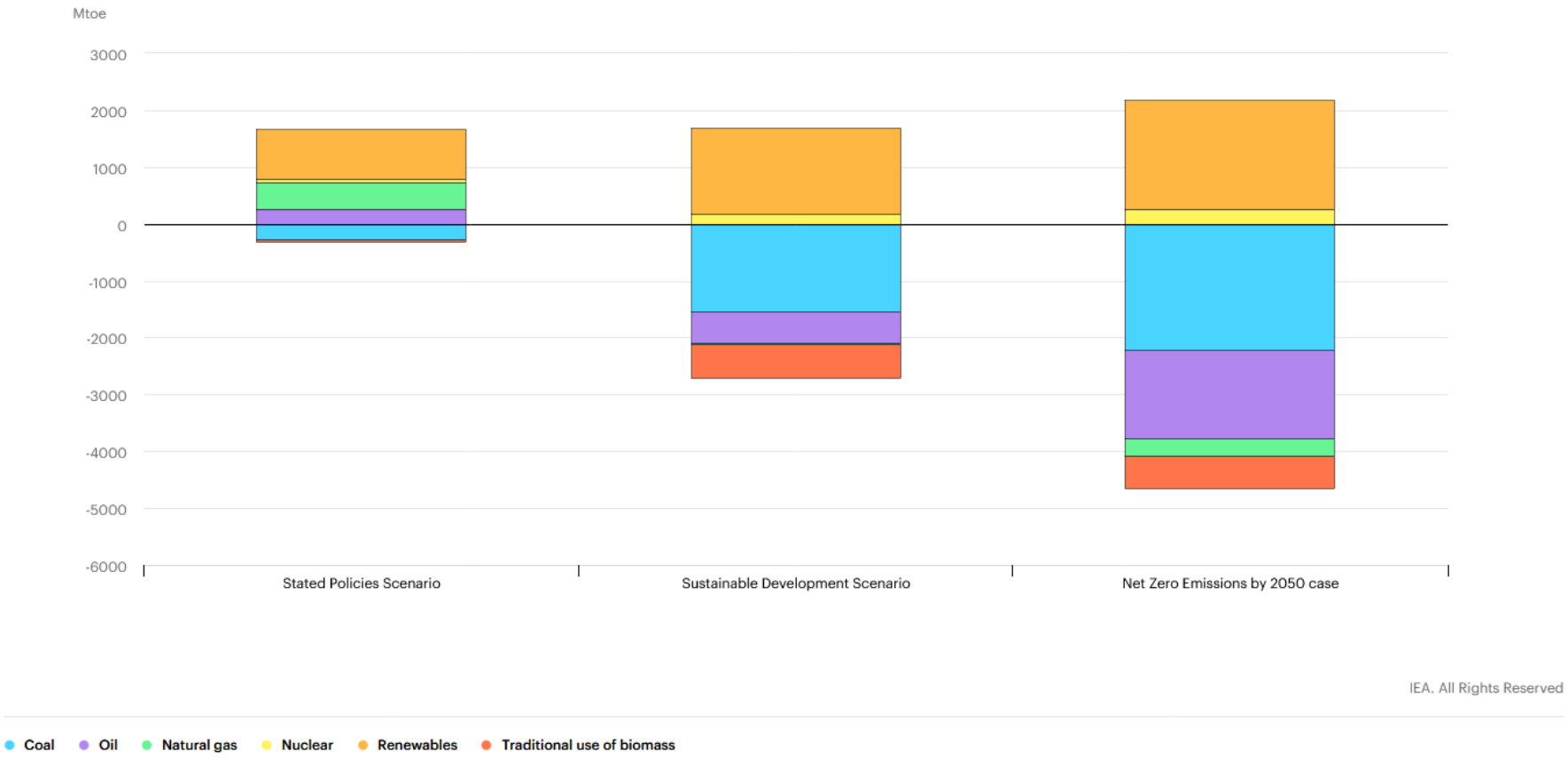
- Founded in 2000, headquartered in Brussels, Belgium
- Committed to promoting sustainable heating and cooling technologies
- Small – medium – large size companies
- Members from three continents: Europe, Asia, North America
- Over 200,000 direct employees, over €30bn turnover, production throughout Europe
- More about sustainable heating and cooling technologies here: www.countoncooling.eu



Carbon Neutrality: already a goal of several major economies



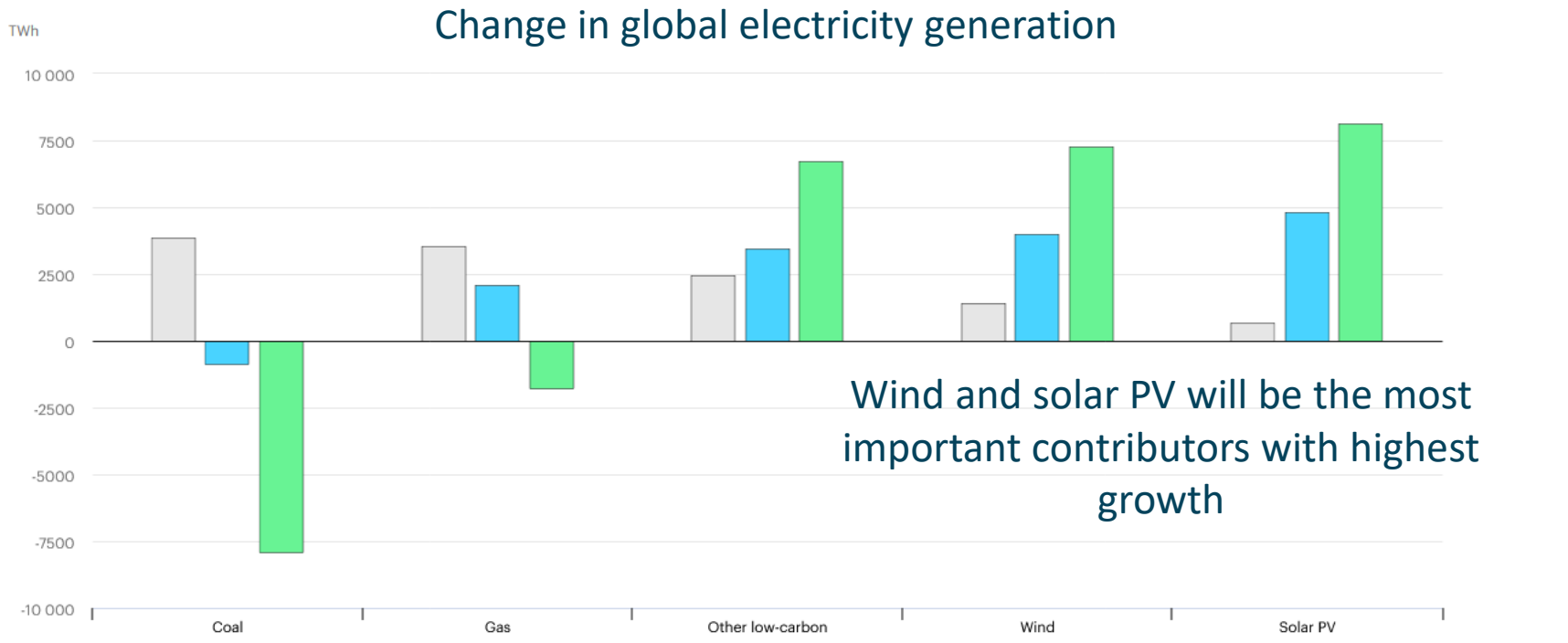
Reducing the energy demand will be essential



Dramatically increasing the share of renewables implies a strong need for systemic efficiency and reducing energy demand:

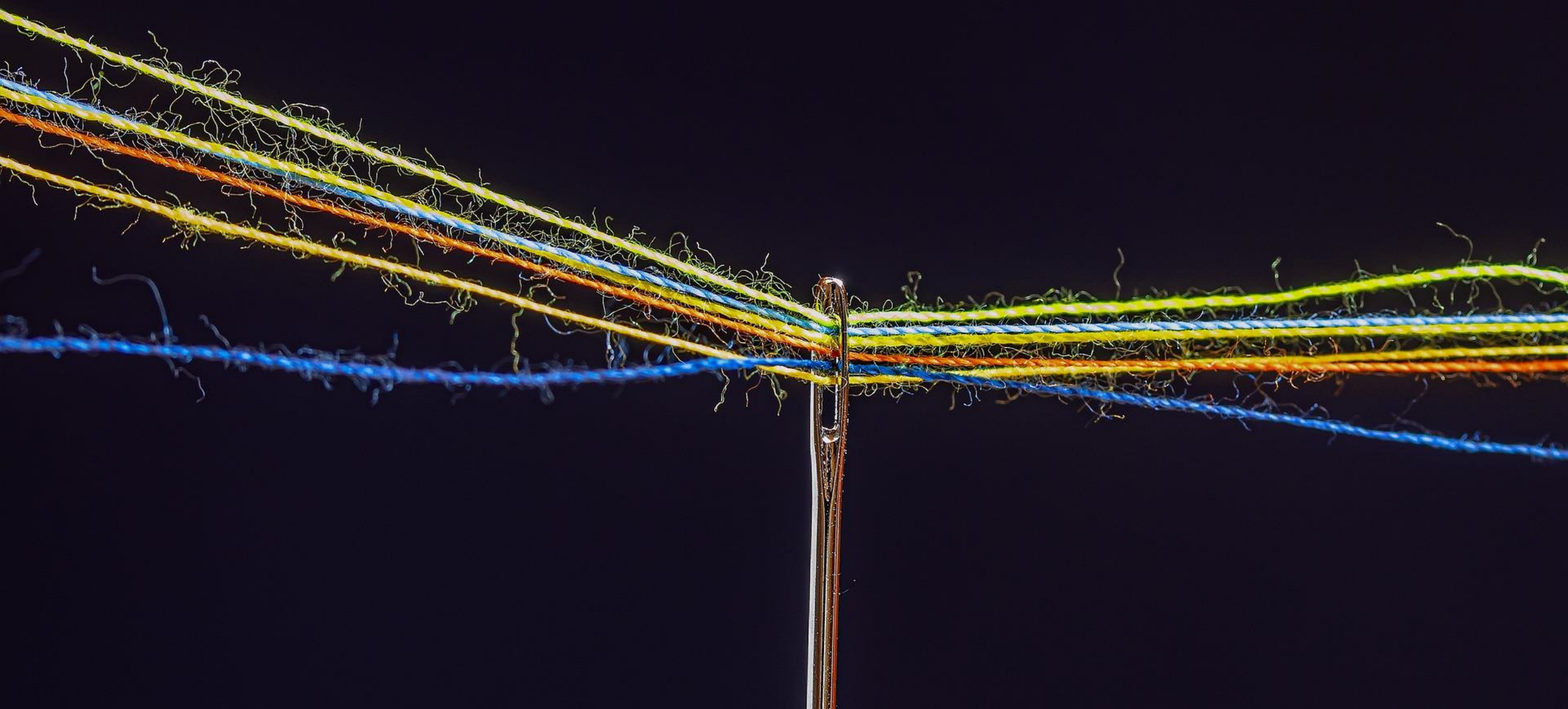
- Energy Efficiency First priniciple
- Electrification of end uses such as heating
- An integrated approach to heating and cooling
- Waste heat recovery from cooling
- Controls and monitoring
- Behavioural change…

Along with greening the power mix



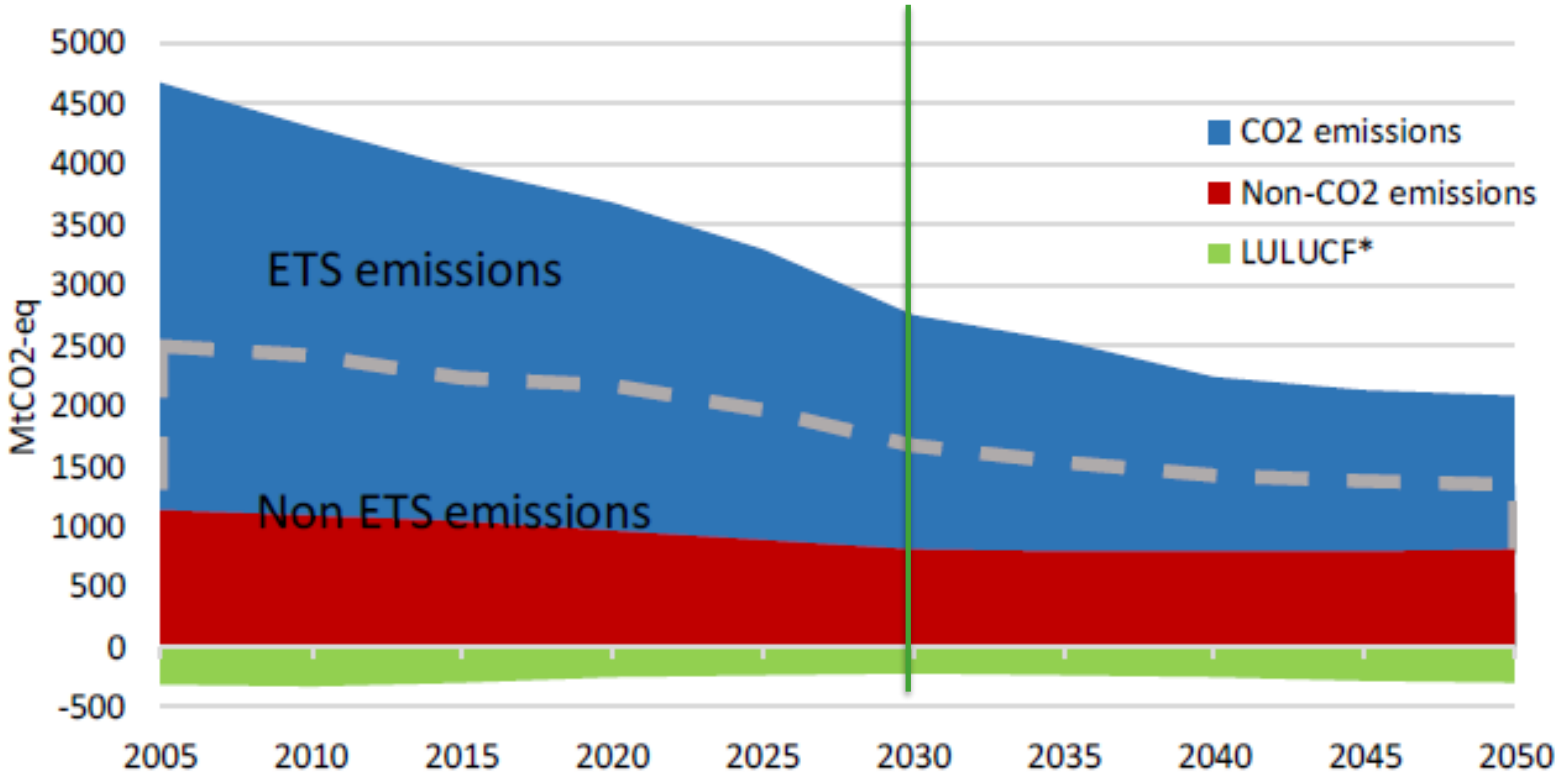
Greening the power mix calls for high demand side flexiblity and storage solutions

IN EUROPE, THE GREEN DEAL CONNECTS THE DOTS



Current efforts will not achieve carbon neutrality by 2050

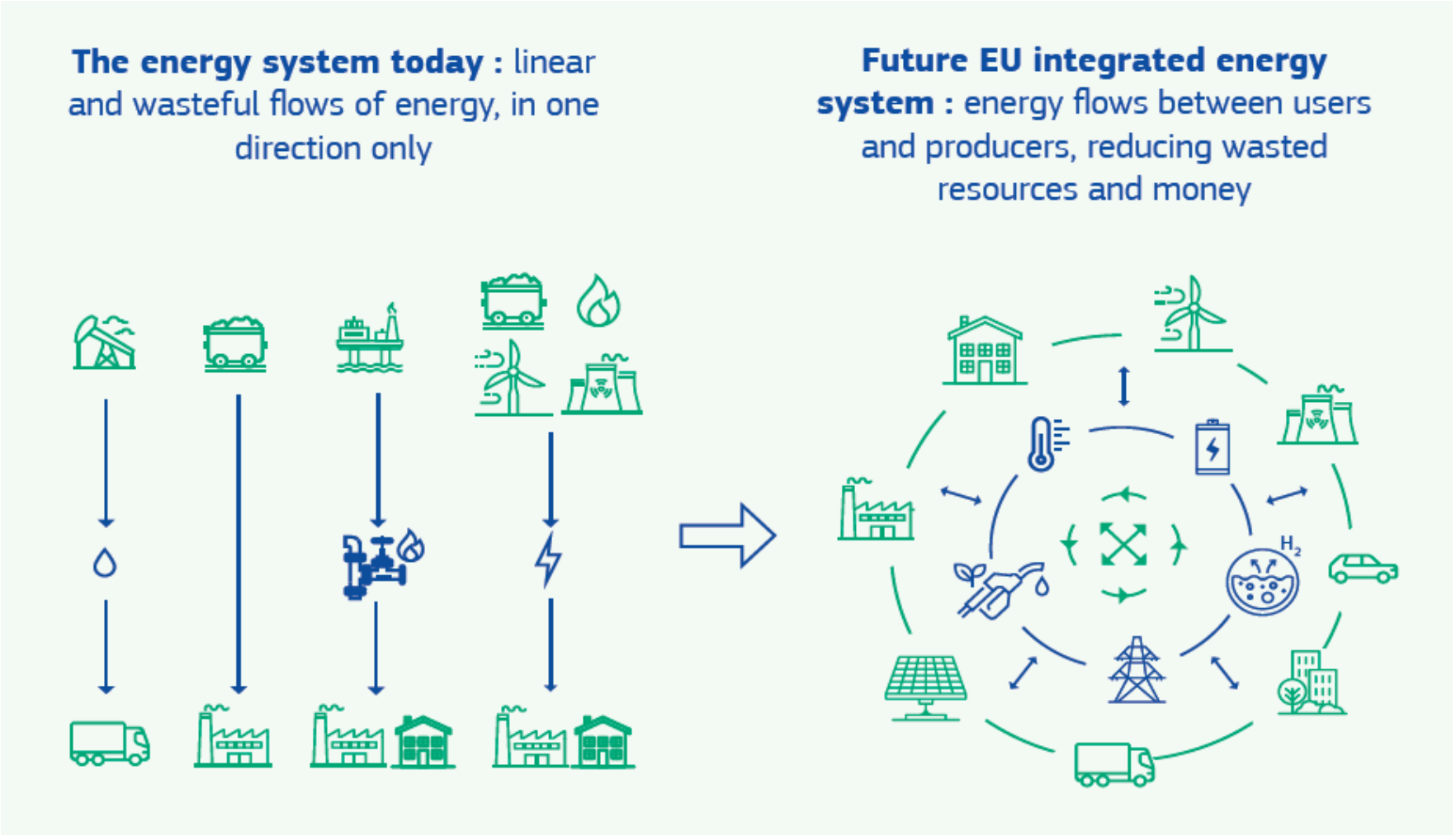
Proposed increase of the target from 40% to 55% emission reduction



- By 2030, emissions will reduce **by > 44%** vs. 1990
- But without additional climate and energy legislation, emissions **will stabilise** post 2040
- **To achieve carbon neutrality by 2050, the European Commission proposes to increase the reduction target to 55% by 2030**

European Commission, Sept 2020: 2030 Climate Target Plan, Impact Assessment

Energy System Integration



1. A more efficient and circular system where **waste energy** is captured and re-used

2. A cleaner power system with more **direct electrification** of end use sectors such as industry, heating of buildings and transport

3. A **cleaner fuel system** for hard to electrify sectors such as heavy industry or transport

Focus on buildings: The Renovation Wave

Buildings account for :

40% of energy consumed

36% of energy-related greenhouse gas emissions

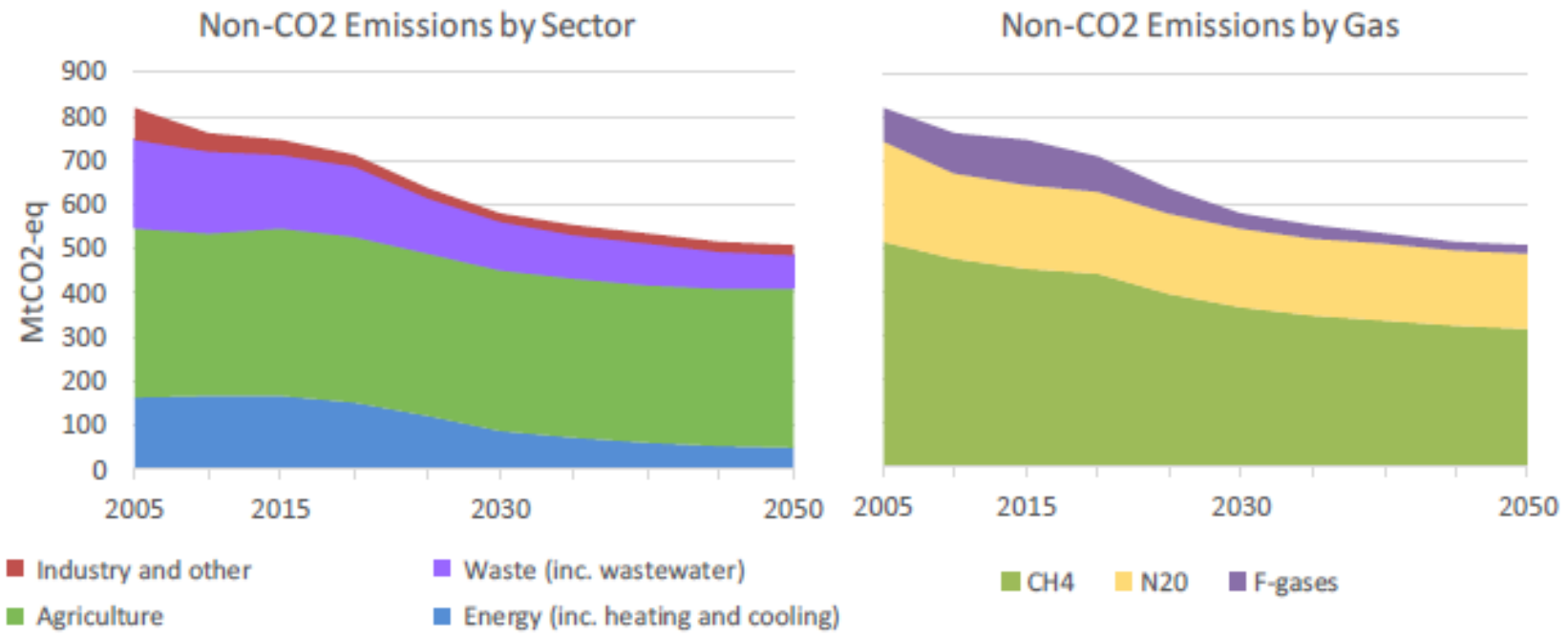
Renovation Wave Priorities

Tackling **energy poverty** and **worst-performing buildings**

Renovation of **public buildings** such as schools, hospitals and public administrations

Decarbonisation of **heating** and **cooling**

What role for F-Gases?

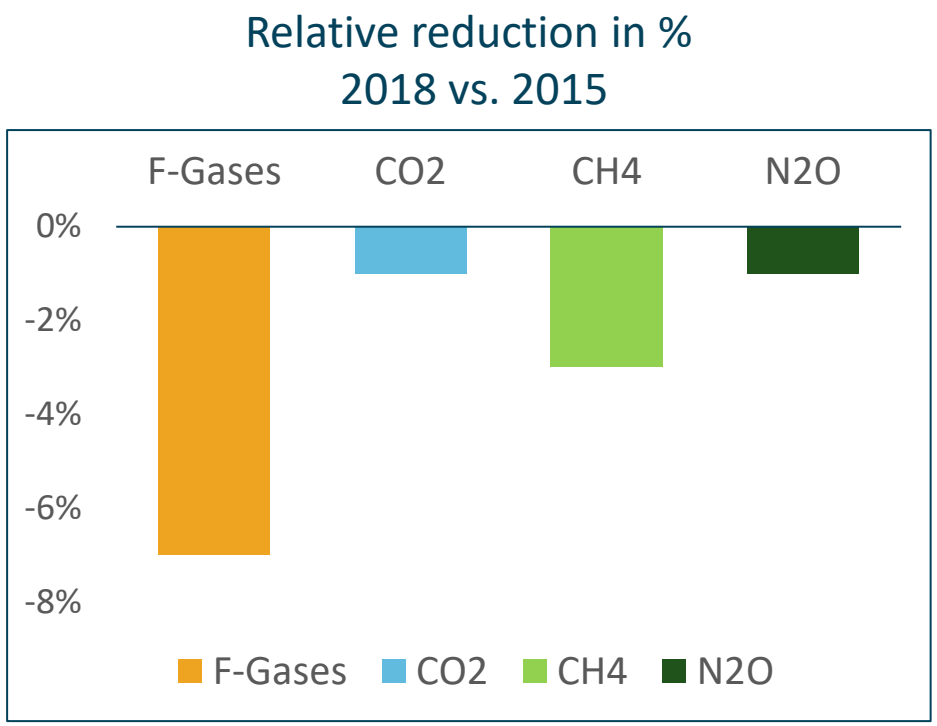


Much lower reduction potential than CO2
CH4 is the most critical gas to be reduced

- **Reduction potential** for non-CO2 emissions much more limited than for CO2
- **Only F-Gases** will reduce drastically **by 65%** between 2015 and 2030
- **Agriculture** remains the biggest emitter with very little reduction (7%)

European Commission, Sept 2020: 2030 Climate Target Plan, Impact Assessment

The F-Gas Regulation works!



F-Gases achieved highest relative emission reductions (in CO2-eq) since 2015

- Since 2015, F-Gas emissions have started to fall as a result of the EU's F-Gas Regulation + MAC Directive. **By 2030, the European Commission expects 65% F-Gas emission reductions compared to 2014**.

- The F-Gas Regulation foresees a review process which has started very recently. **Major steps include:**
  1. Evaluation of the effectiveness of the Regulation
  2. Elaboration of a draft proposal by the European Commission
  3. The European Parliament, the European Council and the European Commission need to agree on a final revised version.

- **First round of stakehodler feedback:** >20 Industry associations agree that the focus needs to be on **better enforcement and implementation, illegal trade, alignment with Kigali, training and certification for non-fluorinated refrigerants, safety and energy efficiency.**

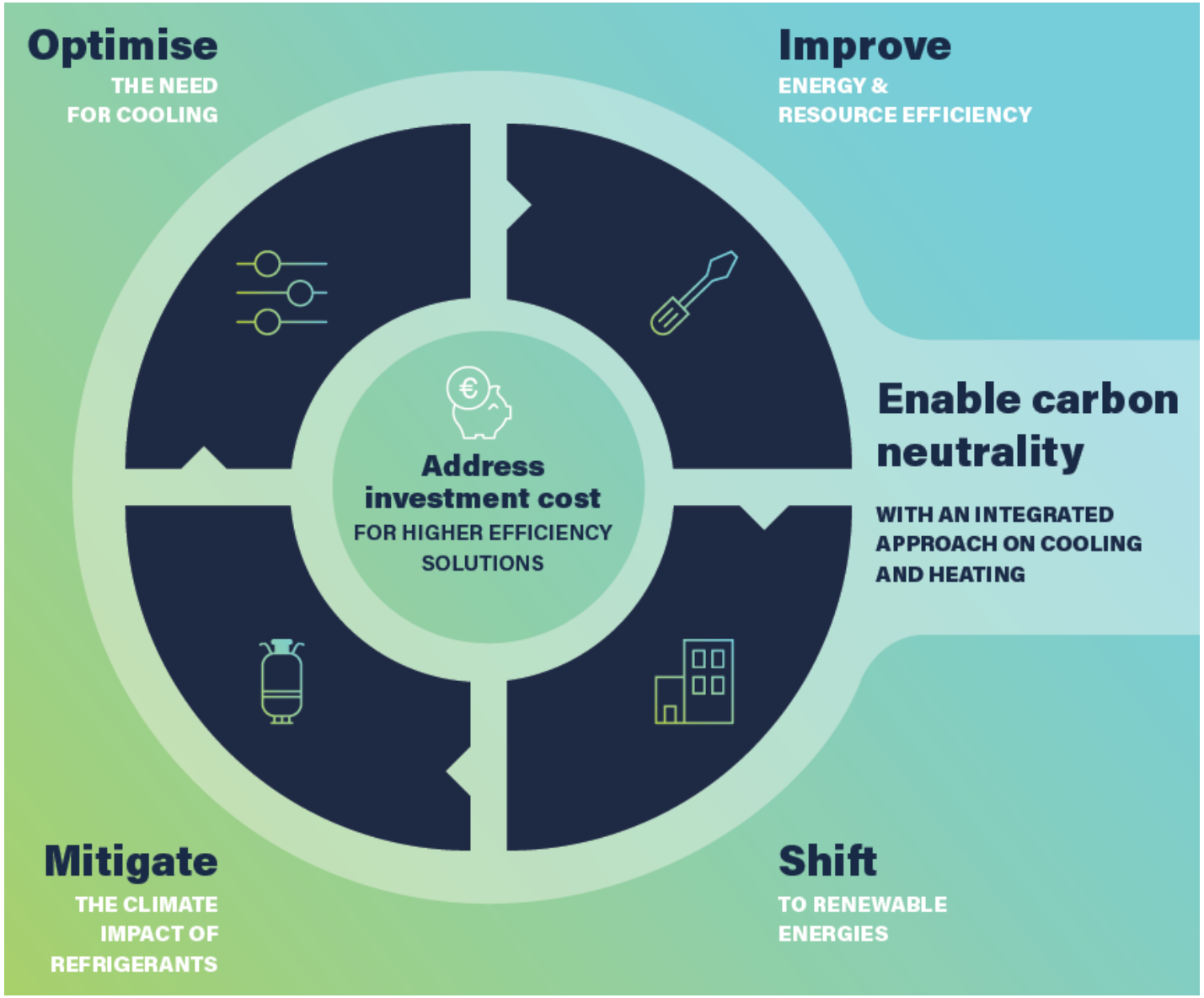
https://www.eea.europa.eu/themes/climate/eu-greenhouse-gas-inventory

Photo: https://ozone.unep.org/news

111 Parties have already ratified the Kigali Amendment

If you have not done so yet, don‘t wait any longer!

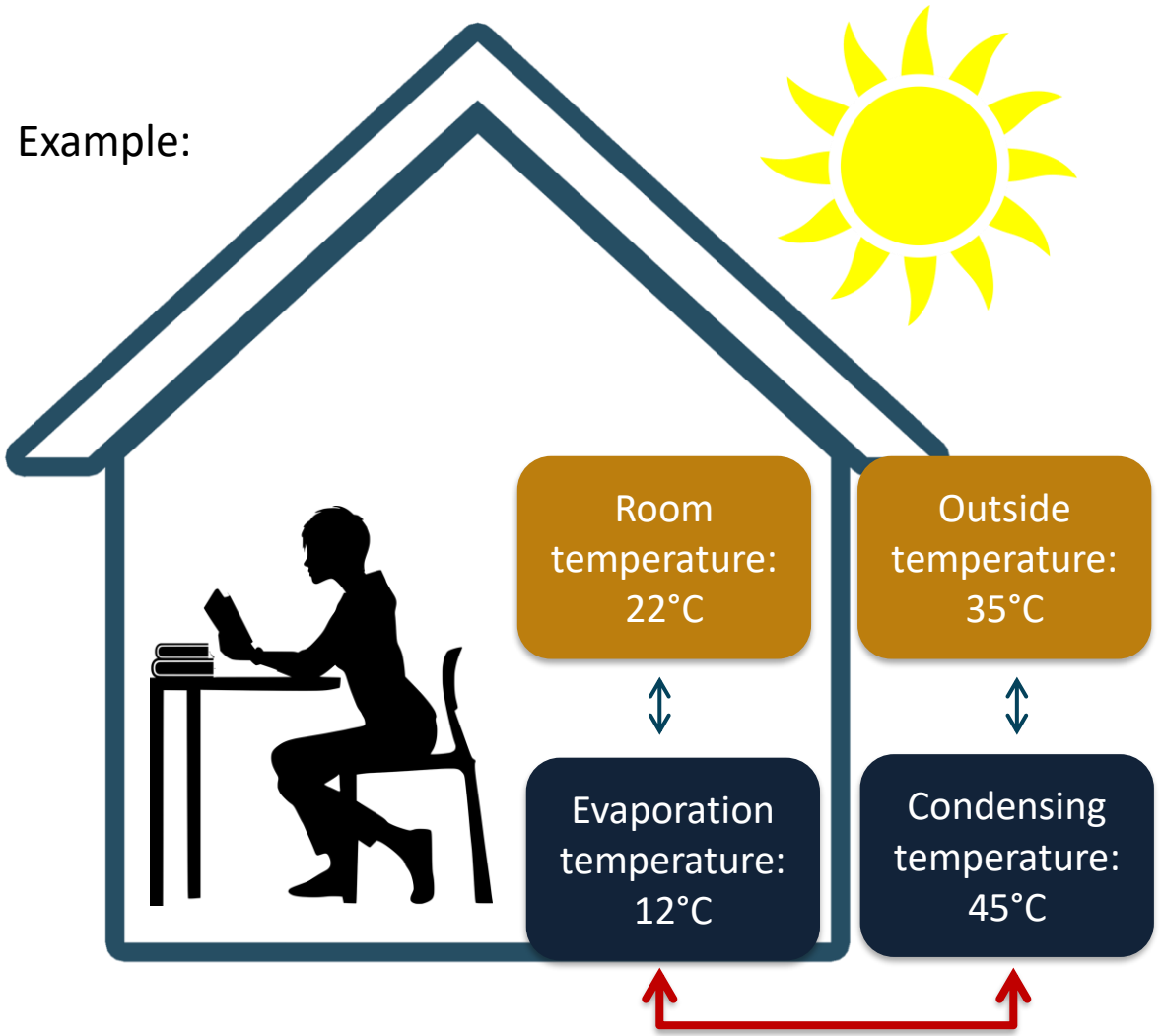
EPEE‘s approach to sustainable heating and cooling



For more information on EPEE‘s 5 step approach, pls check out www.countoncooling.eu

Understanding the basics of cooling efficiency

Example:



The higher the difference (temperature lift), the more energy will be consumed

What is the role of the temperature lift?

At the cold evaporation side, heat is removed (e.g. from a room to cool it down). At the hot condensing side, heat is released, i.e. to the outside air.

➔ The difference between these two temperature levels is called the **temperature lift**.

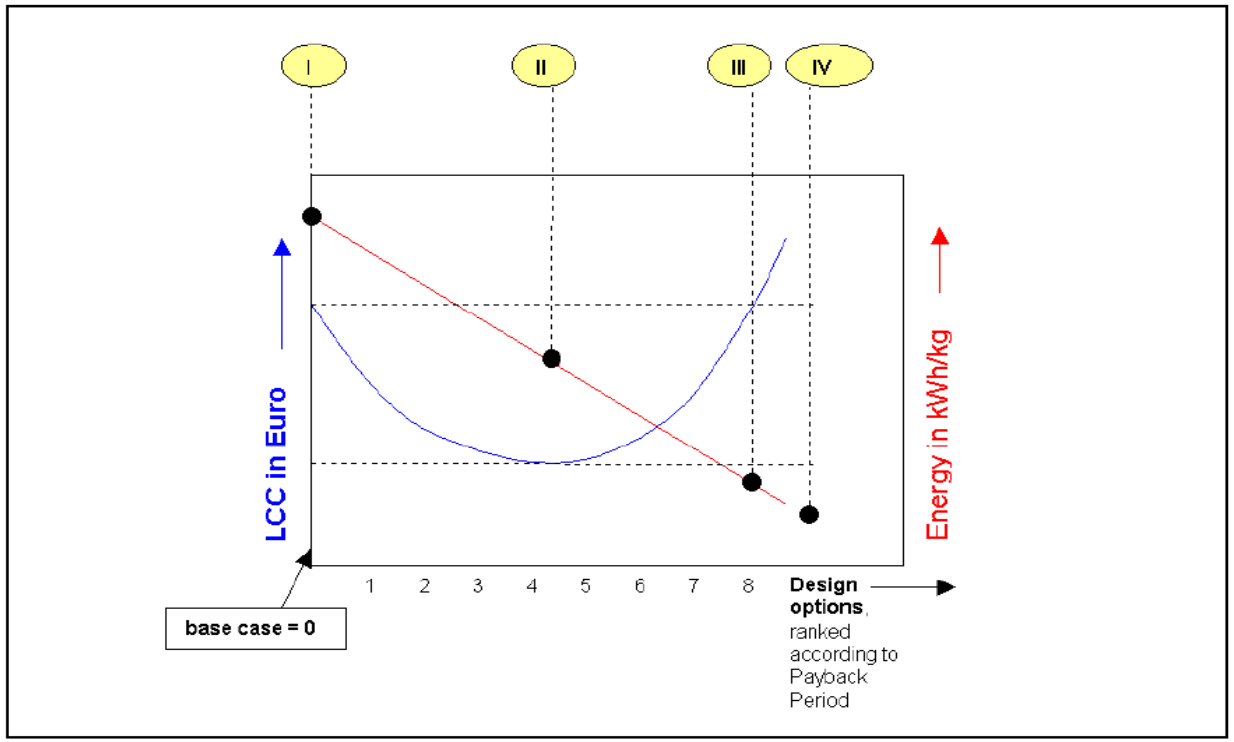
➔ The effort required to overcome that difference determines the efficiency of the process.

➔ High efficiency means that the temperature lift in the refrigeration cycle is as small as possible

What influences directly the temperature lift?

- The outside and inside temperature levels
- The desired room temperature (set-point)
- The design and sizing of the equipment
- Service, maintenance, correct refrigerant charge
- Monitoring and control …

Product design and MEPS: how is it done in Europe?



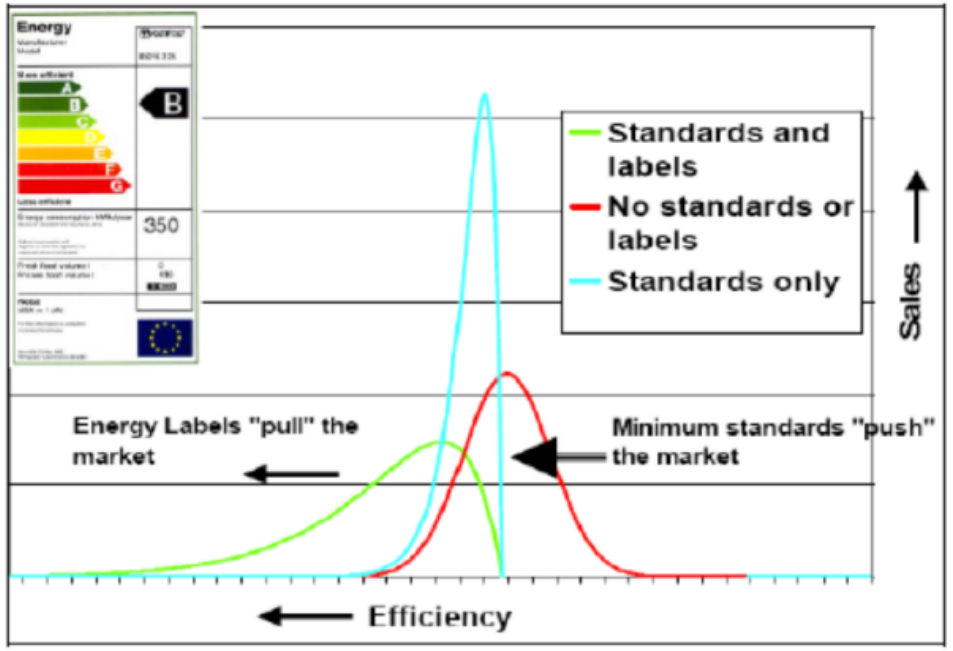
Archetype LCC curve: I = Base Case; II = LCC, III = no financial loss (break-even point); IV = BAT point

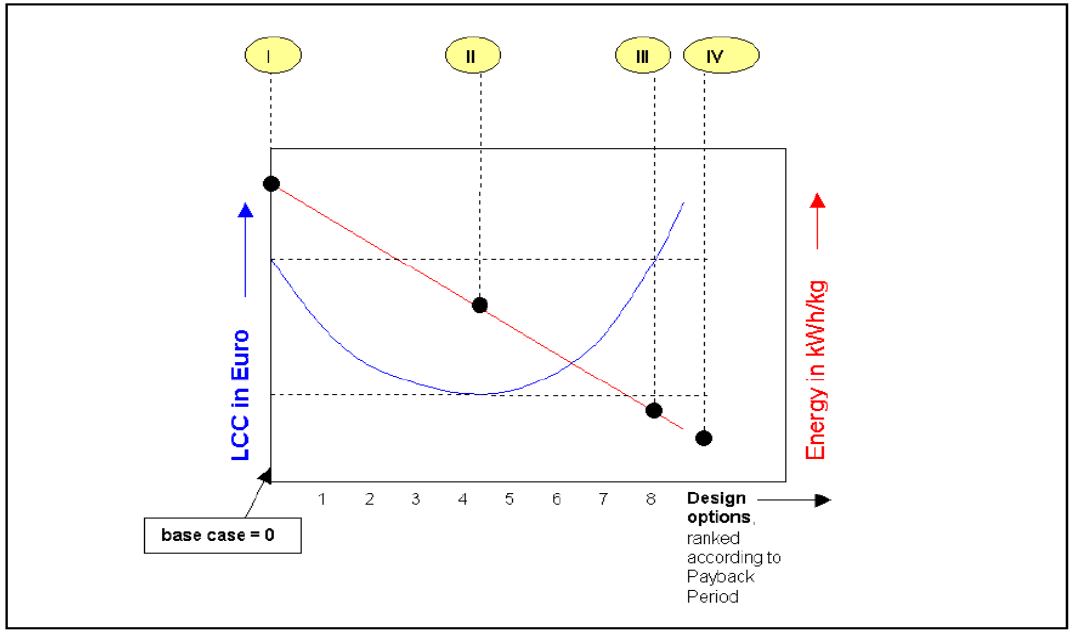
MEPS are important measures but represent only one part of the puzzle

- **Minimum efficiency performance standards (MEPS)** are a well-known tool to reduce energy consumption of products.
- Lessons-learned from the EU Ecodesign Directive demonstrate that **Least Life Cycle Cost considerations** always needs to be part of the equation to ensure successful market transformation:
  - ➔ MEPS to be set at the point where the energy savings are highest and the increase of the purchase cost is lowest, i.e. at the lowest total cost of ownership (point II on the graph)
- **A transparent, inclusive and well-structured** stakeholder process and stringent enforcement rules are essential success factors

Source: COWI, VHK: Methodology for Ecodesign of Energy-related Products, MEErP 2011, Methodology Report, Part 1: Methods

Energy Labels can further stimulate the market uptake of efficient products



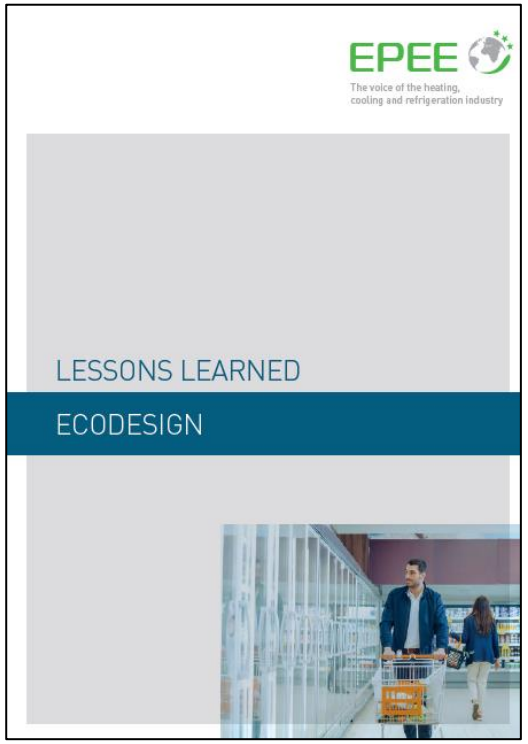


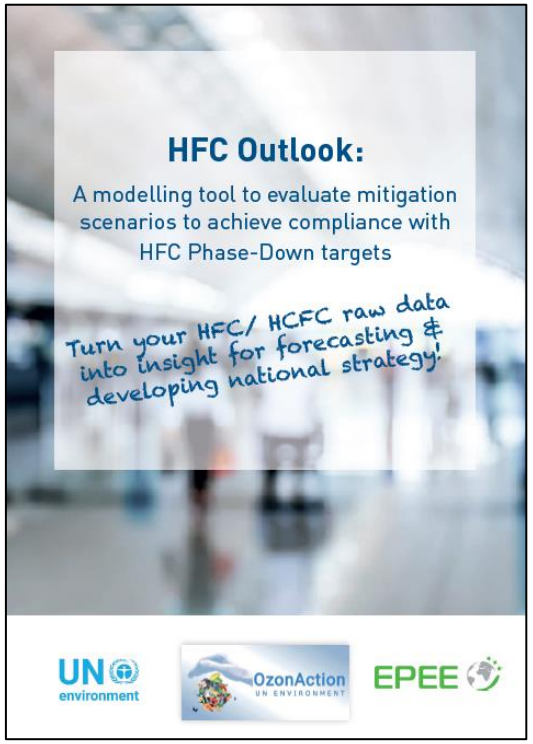
Archetype LCC curve: I = Base Case; II = LCC, III = no financial loss (break-even point); IV = BAT point

- MEPS set minimum standards to eliminate the least efficient products from the market
- Energy Labels can pull the market further towards the most efficient technologies

- The „BAT“ point (IV) shows what is technically feasible with the best performing products and can serve as an indicator for energy labels
- As there is no ROI for consumers, energy labels need to be combined with additional incentives

Get in touch and find out more!





www.countoncooling.eu

www.epeeglobal.org

CountOn Cooling

EPEE

Reducing Greenhouse Gas Emissions from Refrigeration, Air-Conditioning and Heat Pumps

By Ray Gluckman, Gluckman Consulting

MOP32, 24 November 2020

Presentation Contents

- types of GHG emission from refrigeration, air-conditioning and heat pumps
- core actions to reduce refrigerant emissions
- core actions to reduce energy emissions

Types of GHG Emission

Direct Emissions

refrigerant emissions through equipment lifecycle

Key drivers:

- GWP of refrigerant
- Rate of leakage during operation
- Emissions at end-of-life

Indirect Emissions

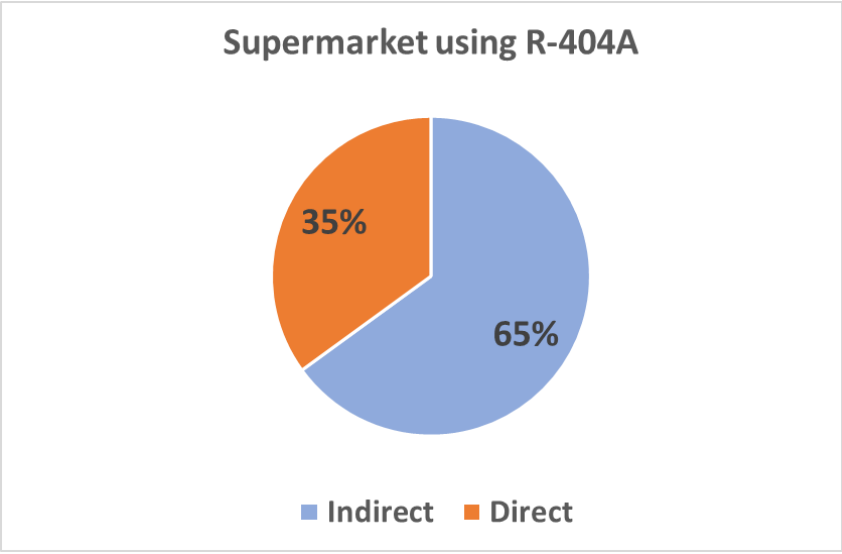
CO_2 from energy used to operate equipment

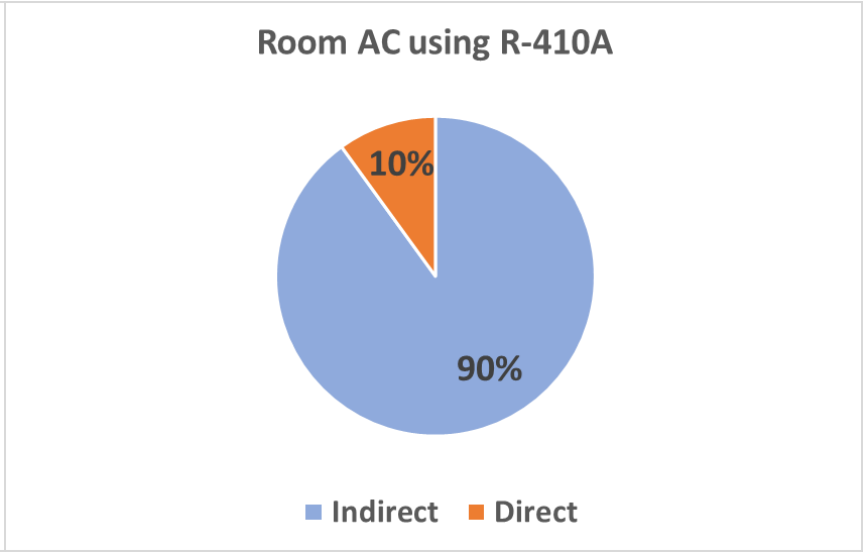
Key drivers:

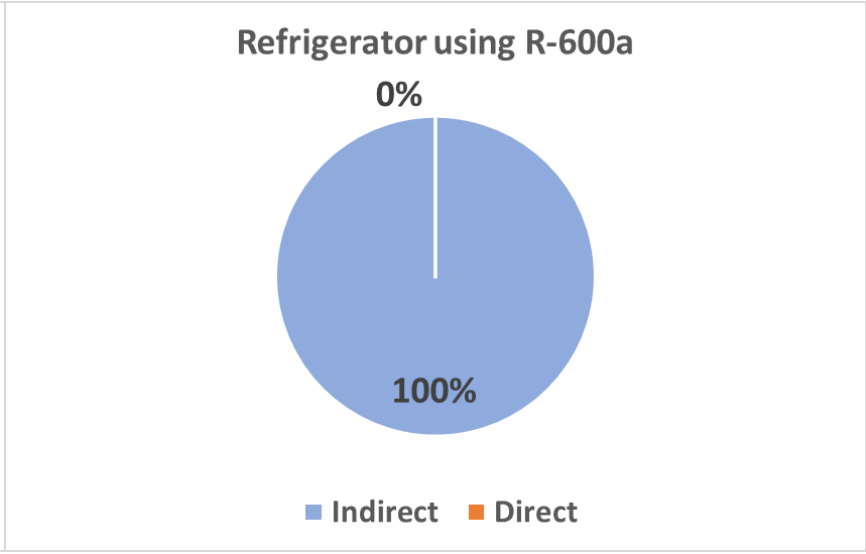
- Size of heat load
- Efficiency of new equipment
- Effectiveness of maintenance
- Operating hours
- Control settings (e.g. temperature setpoint)
- Energy source carbon factor

Split of Direct and Indirect Emissions

- depends on many factors, e.g.:
  - type of equipment, refrigerant GWP, hours of use and energy source carbon factor
- indirect energy related emissions are dominant







Strategies for Reducing GHG Emissions

- many different opportunities to reduce emissions
- useful to consider a structured approach based on “core actions”
- to achieve maximum emission reduction potential
  - consider both direct and indirect emissions together
- it is important to make a broad assessment of cooling (or heating) requirements
  - e.g. can I optimise the need for cooling? (saves both direct and indirect emissions)
- it is also important to coordinate efforts with energy supply sector
  - it is often cheaper to improve efficiency than to supply new low carbon electricity

"Core Actions" to Reduce Direct Refrigerant Emissions

1. Actions for <u>new</u> equipment

- use lower GWP alternatives
- design for less refrigerant charge and low leakage

Use of lower GWP refrigerants in new equipment is a crucial long-term strategy

2. Actions for <u>existing</u> equipment

- leak prevention
- retrofit with low GWP alternatives

Leak prevention and refrigerant retrofit can deliver early emission reductions

3. Use of reclaimed refrigerant

- recovered from equipment at end-of-life
- recovered during retrofit of existing equipment

Gas recovery from old equipment reaching end-of-life significantly reduces emissions

"Core Actions" to Reduce Indirect Energy Emissions (1)

- indirect emissions are already dominant
  - they will become more dominant as lower GWP refrigerants are widely adopted
- delivering large cuts in indirect emissions is a more complex and challenging task than reducing direct emissions of HFCs
- there are more core actions to consider
- end-user behaviour has more impact on emissions
  - e.g. choice of temperature settings and hours of use for AC
- responsibility for implementing actions involves wider spectrum of actors

"Core Actions" to Reduce Indirect Energy Emissions (2)

1) Optimise the cooling or heating demand

2) Purchase high efficiency new equipment

3) Operate and maintain equipment to maximise efficiency

4) Utilise a low carbon energy supply supply

5) Utilise load shifting techniques

Core Action 1: Optimise the cooling or heating demand

- always assess and understand the load e.g.:
  - how does load vary daily and seasonally?
  - at what temperature is cooling required?
- use that information to optimise the demand
- eliminate or reduce loads e.g.:
  - doors on display cases; better building insulation and shading
- maximise temperature of cooling e.g.:
  - data centres: operate at higher temperature with “free cooling”

Core Action 2: Purchase high efficiency new equipment

- many design decisions affect energy efficiency
- what type of system is best?
  - e.g. in a large apartment building, are small room air-conditioners appropriate?
    - is an alternative option such as a water chiller for the whole building more efficient?
    - can several buildings be linked via a district cooling system?
- will the equipment be efficient across the whole annual operating envelop?
  - e.g. is compressor part-load control efficient?
- has the temperature lift been minimised?
  - e.g. are evaporator and condenser of optimum size

Core Action 3: Operate and maintain equipment to maximise efficiency

- it is common to find systems using an extra 20% to 30% energy through:
- poor installation
  - e.g. badly located condenser
- poor control
  - e.g. incorrect temperature control settings
- poor maintenance
  - e.g. fouled heat exchangers
- to avoid these problems, use good measurement and performance monitoring

Core Action 4: Utilise a low carbon energy supply supply

- electricity grid carbon factors vary geographically, dependent on fuel sources
- examples of national grid factors:
  - country with mainly coal generation 1.0 kg CO2 per kWh
  - country with mixed coal, oil, gas 0.6 kg CO2 per kWh
  - country with mainly hydro power 0.1 kg CO2 per kWh
- in most countries grid factors will fall over next 30 years
  - through deployment of wind, solar etc.
- to minimise investment required, improved RACHP efficiency is crucial

Core Action 5: Utilise load shifting techniques

- many RACHP applications are well-suited to load shifting
  - does not reduce indirect emissions
  - BUT, can reduce peak demand and reduce investments needed to supply power
- load shedding: switch off loads during peak period
  - e.g. large cold storage warehouses
- thermal storage: invest to allow load reduction during peak
  - e.g. ice bank storage

Concluding Comments

- Kigali Amendment will drive global HFC phase-down
  - reducing direct GHG emissions
- Paris Agreement will encourage higher energy efficiency
  - reducing indirect GHG emissions
- important opportunity to coordinate efforts in both areas for RACHP
  - consider all types of emissions
  - make best design decisions for new equipment (low GWP and high efficiency)
  - ensure good operation and maintenance
  - optimise investment in supply of low carbon electricity and demand for electricity

Conclusions

Sustainable heating and cooling:

- A win-win solution for the health of people and the planet!
- Efficiency is a much broader concept than only based on the product itself.
- Systemic efficiency will be a critical success factor to reduce energy demand, achieve the energy transition and ultimately the Paris Agreement
- Affordability remains an essential success factor, especially in times of crisis.
- Policy can be an important driver but needs to be grounded in reality, allowing the freedom for industry to innovate and adapt to new challenges
- Many technologies are readily available. Now they need to be deployed.

Let's make it happen!
#CountOnCooling

Questions?

a.voigt@epeeglobal.org
secretariat@epeeglobal.org
www.countoncooling.eu