

Guideline I: Regulations for climate friendly and energy efficient alternatives in the refrigeration, air conditioning and heat pump (RACHP) sector in the Ukraine

In the framework of the project “Capacity Building for the Innovative Application of Energy-Efficient and Climate-Friendly RACHP Technologies in Ukraine”

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List of Abbreviations

AC	Air Conditioner
CEN	Committee for Standardisation (EU)
CFC	Chlorofluorocarbons
CO ₂	Carbon Dioxide
COP	Coefficient of Performance
EED	Energy Efficiency Directive
EER	Energy Efficiency Ratio
EPBD	Energy Performance of Buildings Directive (EU)
EPREL	European Product Database for Energy Labelling
GHG	Greenhouse Gases
GIZ	Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
GWP	Global Warming Potential
HC	Hydrocarbons
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HFO	Hydrofluoroolefins
IFC	International Finance Corporation
INDC	Intended Nationally Determined Contribution
ISO	International Organization for Standardization
LEDS	Low Emission Development Strategy (Ukraine)
LULUCF	Land use, land-use change and forestry
MAP	Market Incentive Programme (in Germany)
MENR	Ministry of Ecology and Natural Resources Ukraine
MEPS	Minimum Energy Performance Standards
MP	Montreal Protocol
NDC	Nationally Determined Contribution
NECP	National Energy and Climate Plans (EU)
NEEAP	National Energy Efficiency Action Plan (EU)
NZEB	Nearly Zero Energy Buildings
NH ₃	Ammonia
ODP	Ozone-Depleting Potential
ODS	Ozone-Depleting Substances
OECD	Organisation for Economic Co-operation and Development
PFC	Perfluorinated Compounds
RACHP	Refrigeration, Air Conditioning and Heat Pump
RES	Renewable Energy Sources

SEER	Seasonal Energy Efficiency Ratio
PU RAU	Public Union “Refrigerating Association of Ukraine”
TPES	Total Primary Energy Supply
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United National Environment Program

1 Introduction

Climate change is the long-term alteration of temperatures and typical climate patterns. The cause of current climate change is mainly due to the release of greenhouse gases (GHGs) in the atmosphere. Manmade gases such as chlorofluorocarbons (CFC)s, hydrochlorofluorocarbons (HCFC)s, and hydrofluorocarbons (HFC)s – to be used as refrigerants in various applications - are potent GHGs and have a significant impact on climate change. Their global warming potential (GWP)¹ can be thousands of times higher than the GWP of carbon dioxide (CO₂). HCFCs and CFCs are also potent ozone depleting substances (ODSs).

As a signatory country to the Montreal Protocol, its Kigali Amendment and to the Paris Agreement, Ukraine is obliged to phase out ODS and limit the use of substances with a high GWP. Hence, the government is facing the need to update its national regulations to allow for a transition to alternative, more climate friendly technologies.

In the refrigeration, air conditioning and heat pump (RACHP) sector alternative technologies using natural refrigerants and hydrofluoroolefins (HFO)s with a low GWP are commercially available, cost-competitive in many applications and provide better energy performance, with lower life cost, compared to high GWP technologies.

As a neighbouring country to the European Union, the Ukraine has an interest to align its energy and climate change policies with the European regulatory framework as declared in the Association Agreement with EU, which became part of National Legislation in September 2014. In the RACHP sector this applies, among others, for Regulation (EU) No. 517/2014 on fluorinated gases (the “F-gas Regulation”) to control emissions from fluorinated greenhouse gases (f-gases) and Directive 2009/125/EC on establishing requirements such as minimum energy performance standards for energy-related products.

This guideline provides an overview of the most relevant regulations in Europe and recommendations on adopting an enabling framework for climate friendly refrigerants in the Ukraine.

This guideline is part of a series of **three consecutive** guidelines **prepared** for Ukrainian decision makers to promote climate friendly and energy efficient RACHP appliances in the country:

Guideline I: The regulatory framework for climate friendly and energy efficient alternatives in the refrigeration, air conditioning and heat pump (RACHP) sector in the Ukraine

Guideline II: Safety standards and regulations for manufacturers and operators of refrigeration, air conditioning and heat pump (RACHP) equipment in the Ukraine

Guideline III: Training, qualification and certification for the introduction of climate-friendly cooling and heating technologies in Ukraine

2 Aim of this guideline

This guideline is prepared to guide Ukrainian decision makers and important RACHP sector stakeholders in the process of adopting changes to its current legislative and regulatory framework in line with the implementation of the country’s international agreements (Montreal Protocol and Paris Agreement) and

¹ GWP is expressed as the ratio of the amount of heat trapped by a certain mass of the gas in question to the amount trapped by a similar mass of CO₂.

taking into consideration the European regulatory framework with the overall objective to pave the way for low GWP alternatives in the RACHP sector.

This guideline is aimed at decision makers from governmental organizations, associations, think tanks and other institutions which are involved in the policy making - and awareness raising process towards climate friendly alternatives to F-gases. For this reason, it includes information on:

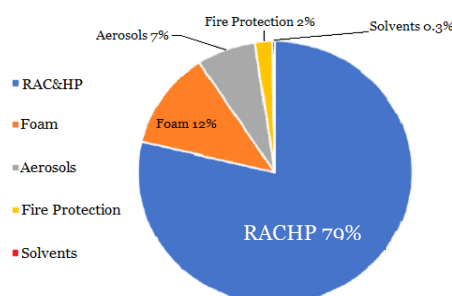
- The impact of the RACHP sector on the climate.
- On relevant international climate related agreements.
- European regulations on f-gases and MEPS and labels, etc.; and
- Ukrainian regulation currently in place (or in progress).

3 The RACHP sector and its climate relevance

As a consequence of the Montreal Protocol's² obligation on countries to phase-out the production and consumption of ODS, fluorinated gases (f-gases) have entered the refrigerants market and are been used as replacement in the RACHP sector. F-gases are hydrocarbon derivatives containing fluorine. There are different types of f-gases with a broad range of applications³. This guideline focuses on HFCs used as refrigerants. While f-gases do not deplete the ozone layer, most f-gases are powerful GHGs with an exceptionally high GWP. HFCs, used as refrigerants, are emitted during manufacturing, operation, servicing, and from the disposal of RACHP equipment and refrigerant cylinders and containers.

Figure 1 illustrates the global use of HFCs in the main five sectors, clearly showing that the RACHP sector constitutes the largest share.

Figure 1: Use of HFCs in the top five sectors (2012)



Source: own compilation and data from UNEP (2015)⁴

HFCs contribute to about two percent to total GHG emissions in Annex I countries to the UNFCCC.⁵

In addition to such direct emissions resulting from the use of refrigerants in RACHP appliances, the RACHP sector also contributes to climate change through emissions resulting from the use of fossil fuels needed to power RACHP appliances (indirect emissions).

For instance, final energy use for space cooling in buildings worldwide more than tripled between 1990 and 2016. In 2016 cooling accounted for approximately 18.5 percent of total electricity use in buildings,

² The Montreal Protocol on Substances that Deplete the Ozone Layer is the multilateral environmental agreement that regulates the production and consumption of nearly 100 man-made chemicals referred to as ozone depleting substances (ODS). See: <https://www.unenvironment.org/ozonaction/who-we-are/about-montreal-protocol> (25.02.2020)

³ including: HFCs used as/in refrigerants, foams, insulation, fire extinguisher, aerosols, solvents; Perfluorinated compounds (PFC)s: Aluminum-, PCB-, semiconductor-, ...production; Sulphur hexafluoride (SF₆): Switchgears, al-cleaning, high-voltage capacitors, shoe soles

⁴ UNEP (2015): Fact Sheet 2 Overview of HFC Market Sectors.

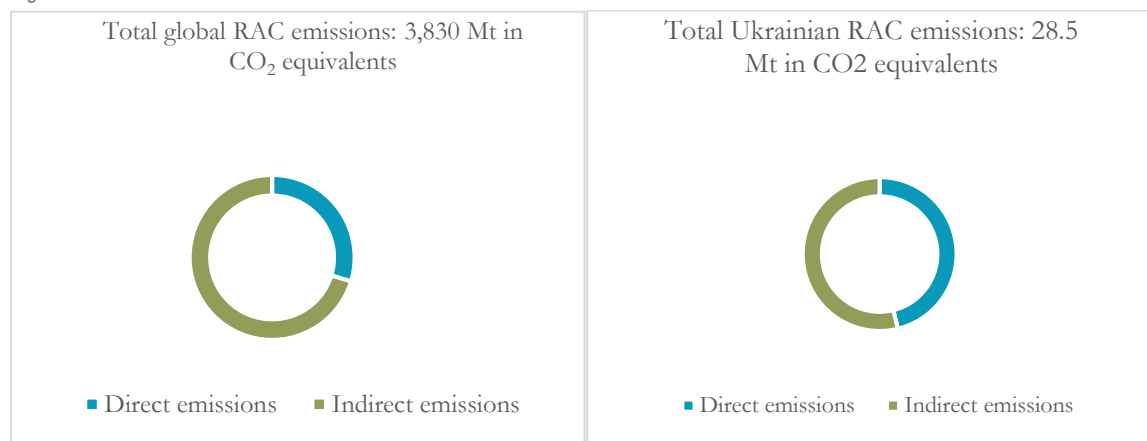
https://ozone.unep.org/sites/ozone/files/Meeting_Documents/HFCs/FS_2_Overview_of_HFC_Markets_Oct_2015.pdf

⁵ UNFCCC (2020): Query results for — Parties: Annex I and Ukraine — Years: Base year and Last Inventory Year (2017) — Category: Total GHG emissions without LULUCF — Unit: kt CO₂ equivalent. https://di.unfccc.int/comparison_by_gas

resulting in significant GHG emissions. The share of cooling in total energy-related emissions from buildings was estimated to amount to 12 percent.⁶

In Figure 2 below emissions in the refrigeration and air conditioning sector (excluding heat pumps) are visualized. The Green Cooling Initiative estimated the total emissions from this sector to amount to 3,830 Mt CO₂ equivalents in 2016 globally, 30 percent of those referring to direct and 70 percent to indirect emissions. In Ukraine total emissions from these product groups made up about 28.5 Mt CO₂ equivalents; the share of direct and indirect emissions is roughly equal (54% for indirect versus 46% for direct emissions).⁷

Figure 2: Share of direct and indirect emissions in total RAC emissions



Source: own compilation based on Green Cooling Initiative (2020)

According to data from the United Nations Framework Convention on Climate Change (UNFCCC) current GHG emissions in the Ukraine comprise about 321 Mt of CO₂ equivalents (2017), which is about 7 percent of that of the European Union's GHGs and only slightly less than that of Spain.⁸ Refrigeration and air conditioning is therefore responsible for approximately 9 percent of these total emissions in the Ukraine.⁹

⁶ IEA (2018): The Future of Cooling Opportunities for energy-efficient air conditioning. <https://webstore.iea.org/download/direct/1036>

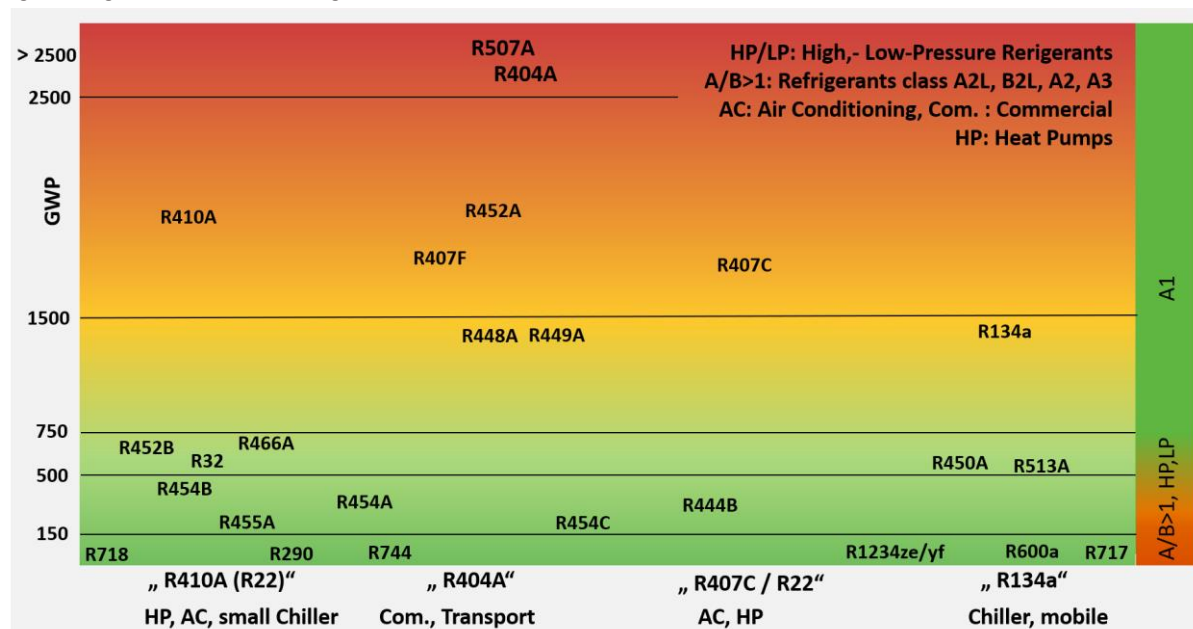
⁷ Green Cooling Initiative (2020): Total emissions of cooling sector. <https://www.green-cooling-initiative.org/country-data/> (03.01.2020)

⁸ UNFCCC (2020): GHG total without LULUCF, in CO₂ equivalent, time series Annex I https://di.unfccc.int/time_series (03.01.2020)

⁹ This figure is only a rough estimation, since the measurement approach of the Green Cooling Initiative (which is bottom-up based, for different appliance groups) deviates from UNFCCC reporting (which is top-down) and comparisons have to be done carefully. According to UNFCCC statistics HFCs in Ukraine account for approximately 1 Mt of CO₂ equivalents – 3.5 percent of overall GHG emissions. UNFCCC (2020): Total of HFCs, in CO₂ equivalent, time series Annex I https://di.unfccc.int/time_series (03.01.2020)

Figure 3 illustrates the GWP of different refrigerants used for different applications (heat pumps, air conditioners (AC), commercial refrigeration, chiller) in the RACHP sector. The GWP of commonly used synthetic f-gases (R404A, R410A, R134a) is from 1400 up to above 4000 times higher than that of CO₂.

Figure 3: F-gases and alternative refrigerants



Source: Timm (2019)¹⁰

As outlined as well in that Figure, those refrigerants with a low GWP such as the hydrocarbon (HC) R-290 (propane), ammonia (NH₃) R-717 or Carbon Dioxide (CO₂) R-744 show specific characteristics with regards to flammability, toxicity and pressure. Particularly HCs such as R-290 needs to be handled properly: classified as an A3 (highly flammable) refrigerant in international safety standards, R-290 comes with charge limit restrictions and other safety caveats that have been addressed in a number of international and regional safety regulations and standards. For a more in-depth description of the safety specifics of low GWP alternatives, please refer to Guideline II on safety regulations and standards and Guideline III on training, qualification, and certification for the RACHP sector in Ukraine.

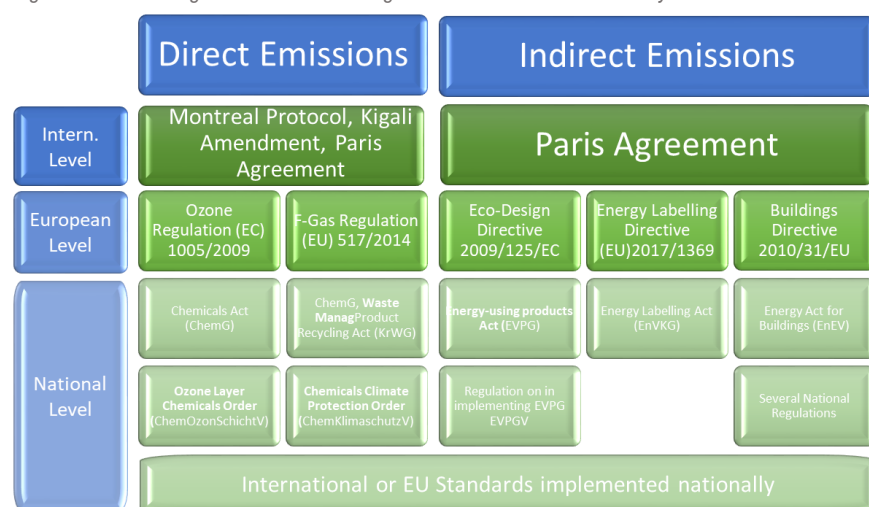
This Guideline, and the following sections are to provide an overview of regulations that have been established in Europe in order to promote the adoption of climate friendly RACHP equipment, using highly efficient appliances that contain low-to zero GWP refrigerants.

4 Regulatory framework for climate friendly and energy efficient alternatives in the RACHP sector

Policies today are more than ever influenced by political decisions at international and regional level. The following Figure provides an overview of the relevant policy framework at global, regional (in this case European) and national level with regards to the RACHP sector. It has been exemplarily illustrated for Germany. Direct and indirect emissions in the sector are addressed by different regulations.

¹⁰ Timm, E. (2019): Environmental Regulation and alternative technologies in heating and refrigeration (presentation). Workshop in Kyiv, Dnipro, Odessa 3.-6. September 2019. ETSuS Kulmbach.

Figure 4: Multi-level governance concerning the RACHP sector in Germany¹¹



Source: own compilation

The following paragraphs introduce the most important multilateral agreements and regulations at European (regional) level that aim at curbing direct and indirect emissions of the RACHP sector by launching alternative refrigerants and increasing energy efficiency of the appliances.

4.1 International Agreements

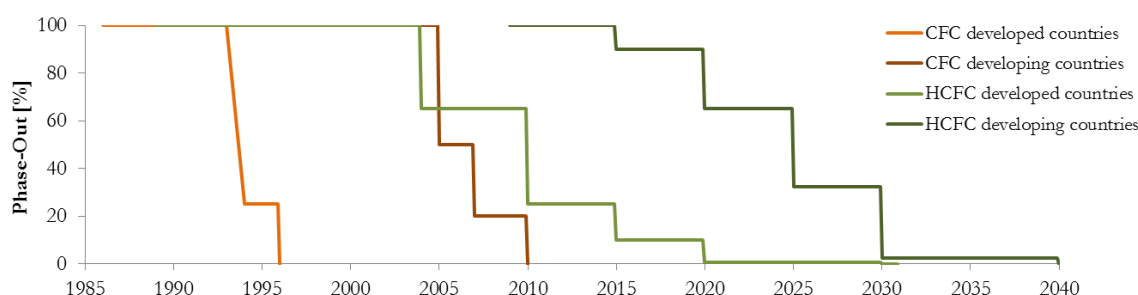
There are two international treaties that have an impact on emissions in the RACHP sector and implications on national regulations: the Montreal Protocol's Kigali Amendment and the Paris Agreement:

4.1.1 Montreal Protocol

The Montreal Protocol on substances that deplete the ozone layer is the multilateral environmental agreement that regulates the production and consumption of almost 100 ODS (among them HCFCs and CFCs). The Montreal Protocol was adopted in 1987, and since then been ratified by all 197 UN Member States.

The Montreal Protocol imposes binding, time-targeted and measurable commitments on its members in order to phase down the consumption and production of the different ODS in a step-wise manner, with different timetables for developed and developing countries (referred to as “Article 5 countries”) as outlined in Figure 5. Other responsibilities comprise the control of ODS trade, annual reporting of data, national licensing systems to control ODS imports and exports, and other matters. Ukraine became a party to the Protocol on September 20th, 1988).

Figure 5: Montreal Protocol Phase-Out Schedules



Source: own compilation

¹¹ It should be noted that HFCs as direct emissions are also covered by the Paris Agreement, although the consumption of HFCs are now mainly regulated under the Kigali Amendment to the Montreal Protocol

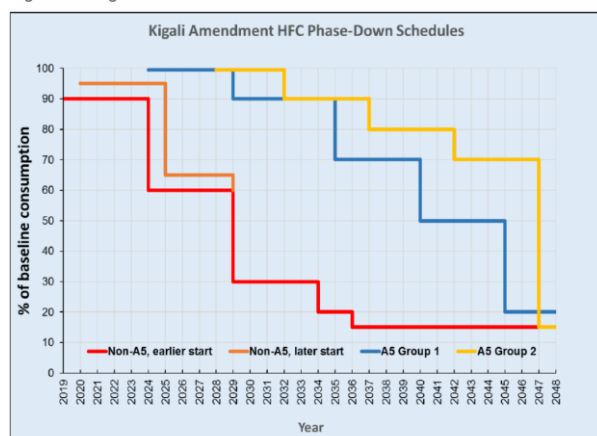
4.1.2 Kigali Amendment

The Kigali Amendment to the Montreal Protocol adds the phase-down of the production and consumption of HFCs to the existing controls of ODS under the MP. It was agreed by all 197 Parties in 2016 and entered into force on 1 January 2019. This international agreement sees that developed countries (Non-A5 countries) take the lead on phasing down HFCs, while developing countries (A5 countries) are allowed to have a delayed start, as shown in

Figure 6: The Ukraine belongs to non-A5 earlier start countries; its phase down path is illustrated in red.

- Non-A5 earlier start (2019): developed countries (including, e.g. the European Union, the United States, but also the Ukraine)
- Non-A5 later start (2020): Belarus, the Russian Federation, Kazakhstan, Tajikistan, Uzbekistan
- A5 group 1 (2024): most developing countries according Montreal Protocol (147 Parties)
- A5 Group 2 (2028): Bahrain, India, Iran, Iraq, Kuwait, Oman, Pakistan, Qatar, Saudi Arabia, UAE

Figure 6: Kigali Amendment HFC Phase-Down Schedules



Source: UNEP/OzonAction (2019)¹²

4.1.3 Paris Agreement

The Paris Agreement from 2015 is part of the United Nations Framework Convention on Climate Change (UNFCCC) and has been ratified by 185 nations. The agreement aims at keeping the global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

The Paris Agreement requires all Parties to develop and put forward nationally determined contributions (NDCs) that describe their efforts to combat climate change and to strengthen these efforts in the years ahead. Parties are obliged to report regularly on their emissions and on their implementation efforts.

The 2019 review of countries' NDCs and their national implementation by the New Climate Institute and Climate Analytics revealed that the current pledges and targets, however, are insufficient to reach the Agreement's goal.¹³ At the 25th Conference of the Parties (COP) that took place in December 2019 in Madrid, numerous countries announced that they intend to strengthen their NDCs in 2020. The delegates agreed that by the COP26 all parties should submit revised commitments for the next decade and a long-term strategy by 2050.

¹² UNEP/OzonAction (2019): HFC Baselines and Phase-down Timetable. OzonAction Kigali Fact Sheet 5. <https://www.unenvironment.org/ozonaction/resources/factsheet/ozonaction-kigali-fact-sheet-5-hfc-baselines-and-phase-down-timetable> (2019-07-29)

¹³ New Climate Institute/Climate Analytics (2019): Warming Projections Global Update, December 2019. Climate Action Tracker, <https://climateactiontracker.org/publications/governments-still-not-acting-on-climate-crisis/> (03.01.2020)

With regard to the RACHP sector, the Paris Agreement covers both direct emissions from HFCs and the indirect emissions through the use of energy related indirect emissions. The phase-down on the consumption of HFCs is regulated, as mentioned above, under the Kigali Amendment.

4.2 EU regulations

With regards to the limitation of direct GHG emissions in the RACHP sector Regulation (EU) No 517/2014 of the European Parliament and the Council of 16 April 2014 on fluorinated greenhouse gases is the most important policy instrument in the European Union. Indirect emissions in the RACHP sector are addressed particularly by the Ecodesign Directive 2009/125/EC of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products and the Energy Labelling Regulation (EU) 2017/1369 of 4 July 2017 setting a framework for energy labeling. All three policies supplemented by a few other EU regulations supporting the development of a climate friendly RACHP sector will be presented in the following paragraphs.

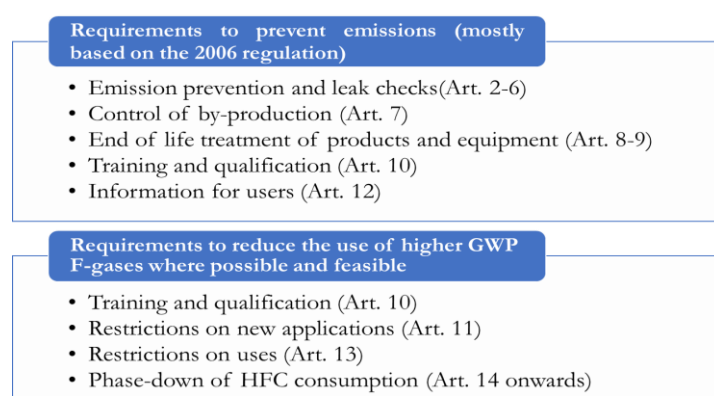
4.2.1 Addressing direct emissions: the EU F-Gas Regulation

The EU's F-gas legislation was among the world's first actions to phase down HFCs in favor of low-GWP alternatives – two years ahead of the Kigali Amendment. The F-Gas Regulation, or “Regulation of the European Parliament and of the Council on fluorinated gases and repealing Regulation (EC) No 842/2006” is an EU legislative instrument which is directly applicable in all EU member states. In 2014 the regulation was revised; the new version “(EU) No 517/2014” fully replaces the 2006 F-Gas Regulation as of January 2015.

Although the new rules maintain the principles of the 2006 Regulation, the 2014 version goes much further as it introduces an “EU HFC phase-down” mechanism to ensure emission reductions from fluorinated GHGs to help achieve the Union's climate targets. Regulation (EU) No 517/2014 aims to decrease the EU's CO₂ equivalent F-gas emissions by 79 percent by 2030. By the help of the “EU HFC phase-down” mechanism the total quantities of HFCs expressed in CO₂ equivalent that companies may import or produce in the EU (i.e. “place on the market for the first time”), are reduced gradually until 2030. It is realized through the allocation of quotas by the European Commission to producers and importers of bulk HFCs¹⁴.

Figure 7 summarizes the most important requirements of the regulation outlining some additional obligations of the new regulation:

Figure 7: Content of the F-Gas Regulation



Source: EPEE (2014)¹⁵

¹⁴ Bulk HFCs are HFCs which have not been integrated into any equipment, typically contained in bottles or containers.

¹⁵ EPEE (2014): The New F-Gas Regulation. https://www.epeglobal.org/wp-content/uploads/EPEE_F-GAS_FAQS_ENGLISH_8678.pdf

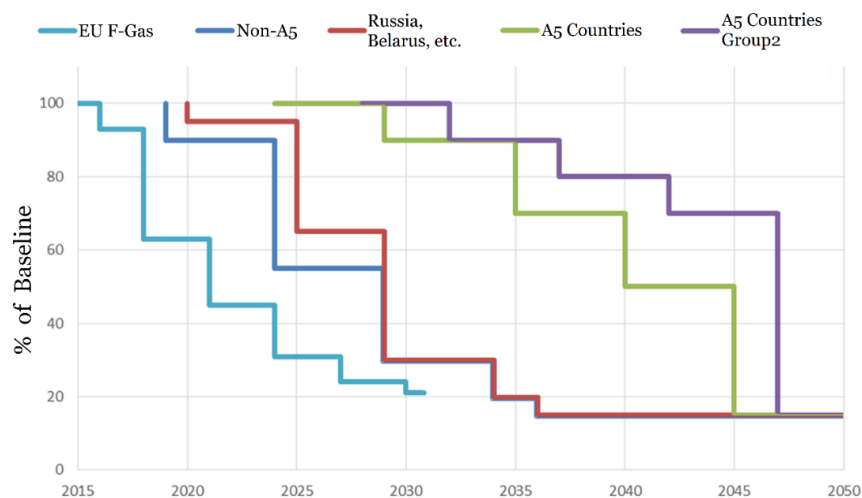
In particular, the scope of the revised regulation was extended to include:

- A list of F-gases supplemented with other fluorinated substances that currently includes: 19 HFCs, 7 PFCs, SF₆, 5 unsaturated HFCs, 33 fluorinated ethers and fluorinated alcohols and 4 other PFCs;
- A HFC phase-down schedule and system of allocation of HFC annual quota for placing on the market of HFCs by producers and importers as well as of transfer of quota and of authorization for using quota by importers of RACHP equipment pre-charged with HFCs;
- A system of registration of undertakings;
- Requirements regarding equipment leakage checking, record keeping and reporting on F-gases, labeling of F-gas containers as well as products and equipment containing F-gases and certification of technicians and companies conducting certain activities involving F-gases;
- Bans on use of certain F-gases;
- Bans on placing on the market products and equipment containing certain F-gases or whose functioning relies upon certain F-gases.

The table in Annex I provides an overview of each Article in the new F-Gas Regulation.

Figure 8 highlights the ambitious phase down schedule for HFCs of the F-Gas Regulation compared to those of the Kigali Amendment. The F-Gas Regulation aims at a reduction of 37 percent of F-Gases by the end of 2020 already.

Figure 8: EU F-Gas regulation compared to Kigali Amendment phase-down schedules

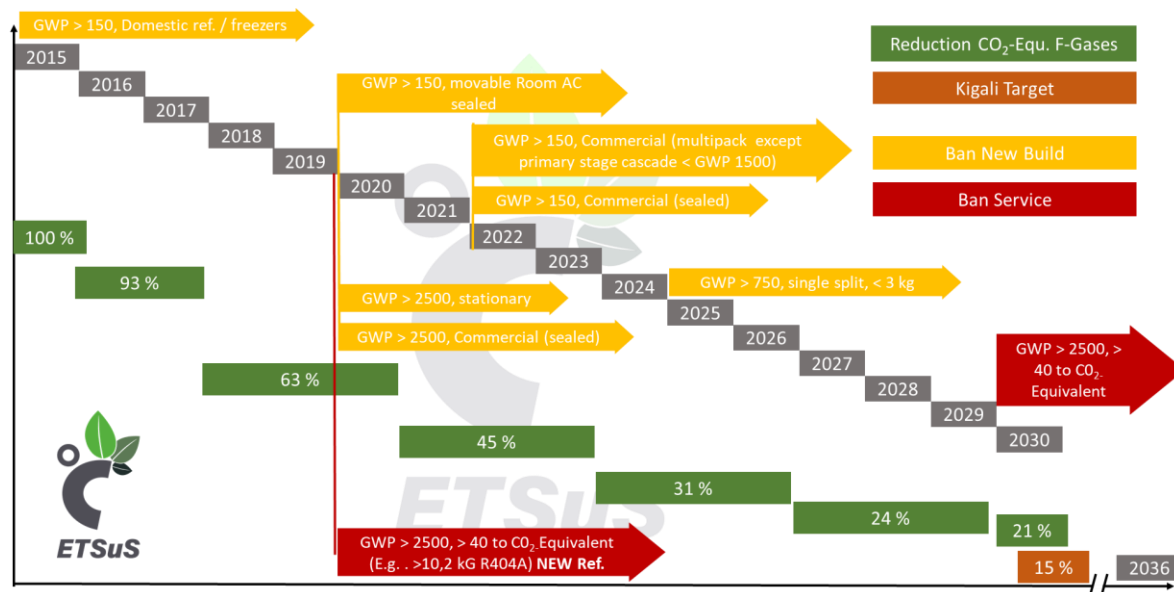


Source: own compilation

The milestones of the F-Gas Regulation are summarized on a timeline in Figure 9. As explained the regulation imposes bans on different HFC-containing equipment/product groups, which contain both: bans on placing on the market of certain products and equipment, containing high GWP f-gases, and bans on the use of high GWP F-gases in existing equipment.

For instance, since 2015 the regulation prohibits domestic refrigeration and freezer producers and importers to place products containing HFCs with a GWP larger than 150 on the market. From 2020 onwards there is a similar ban for movable room ACs (sealed) that cannot longer contain HFCs with a GWP larger than 150 as well as for HFCs in stationary and commercial refrigerators with GWPs larger than 2500.

Figure 9: Current EU F-gas regulation with most important milestones¹⁶



Source: Timm (2019)¹⁷

In order to control the annual HFC limit, the F-Gas Regulation established a quota system. Since 2015 companies need quota to legally place bulk HFCs on the market and the Commission allocates quotas to enterprises for free on an annual basis. Quotas are expressed in CO₂ equivalents. The higher the GWP of a refrigerant, the higher the amount of CO₂ equivalent for a given number of kilograms and the higher the quota required.

According to the F-Gas Regulation, the quotas are allocated based on two methodologies:

- on the basis of "grandfathering", based on the activities of each EU bulk HFC¹⁸ producer and importer in the past, provided that reported data is available (for incumbent undertakings).
- from a reserve on the basis of annual company declarations stating their anticipated need for (additional) quota. For this purpose, an "F-gas Portal & HFC Licensing System" was established.

Quotas allocated to incumbent undertakings based on grandfathering can be transferred to other undertakings, while quotas from the reserve cannot be transferred.

The F-gas Regulation requires that pre-charged RACHP equipment containing HFCs that is placed on the market must be accounted for within the quota system from 1 January 2017. Importers of HFC equipment need authorisations from quota-holders to use the latter's quota for their imports. Authorisations must be entered online in the F-gas Portal & HFC Licensing System. Registration in the Portal is mandatory for companies to receive a quota or an authorisation.¹⁹

Article 19 of Regulation (EC) No 517/2014 requires that production, import, including gases in equipment, export of bulk gases, feedstock use and destruction of the substances listed in Annexes I or II

¹⁶ Colour code: "New build" in yellow refers to producers/distributors that are prohibited to place new products on the market by the respective dates; "Ban service" in red refers to operators that are prohibited to use the refrigerants by the given dates (from 2030 onwards this includes a ban for "refilling")

¹⁷ Timm, E. (2019): Environmental Regulation and alternative technologies in heating and refrigeration (presentation). Workshop in Kyiv, Dnipro, Odessa 3.-6. September 2019. ETSuS Kulmbach.

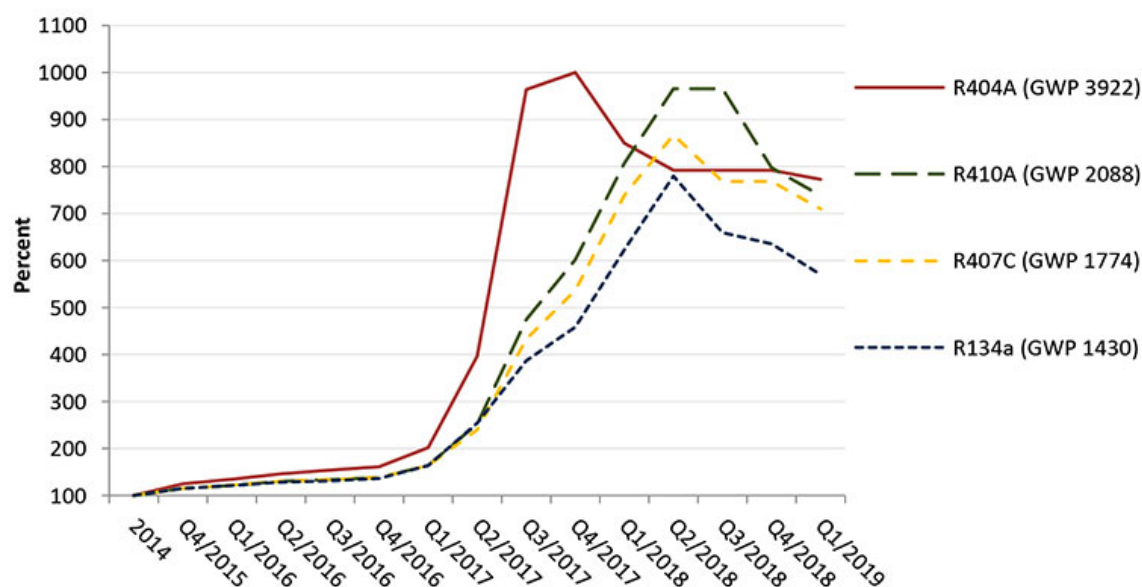
¹⁸ Quotas and (quota) authorisations are not needed for imports of less than 100t of CO₂ equivalent of HFC per year (in equipment or as bulk gas).

¹⁹ Further information can be found here: https://ec.europa.eu/clima/policies/f-gas/reporting_en

in the Regulation are reported annually before 31 March, for the previous calendar year. The reporting requirements depend on the role of the reporting company in the market.²⁰

The following chart visualizes the effect of the quota set by the EU's F-Gas Regulation. Since the first quotas were set for HFCs prices increased rapidly, particularly those for R404A, R410A and R407C. Since each quota holder can consume a certain amount of CO₂-equivalent, he can sell more tons of refrigerant with low GWP than with high GWP. This simple equation leads to significant price increases for higher GWP refrigerants.

Figure 10: The quota effect: price increase by refrigerant in Europe (in percent)



Source: Öko-Recherche (2019)²¹

To support the implementation of the F-Gas regulation, different Implementing Acts were issued, including Regulation (EU) No 2017/1375 of 25/07/2017 that determines the format and means for submitting the report, the Regulation (EC) 1516/2007 on leakage checking procedures or Regulation (EU) 2015/2067 on the certification of technicians and companies.

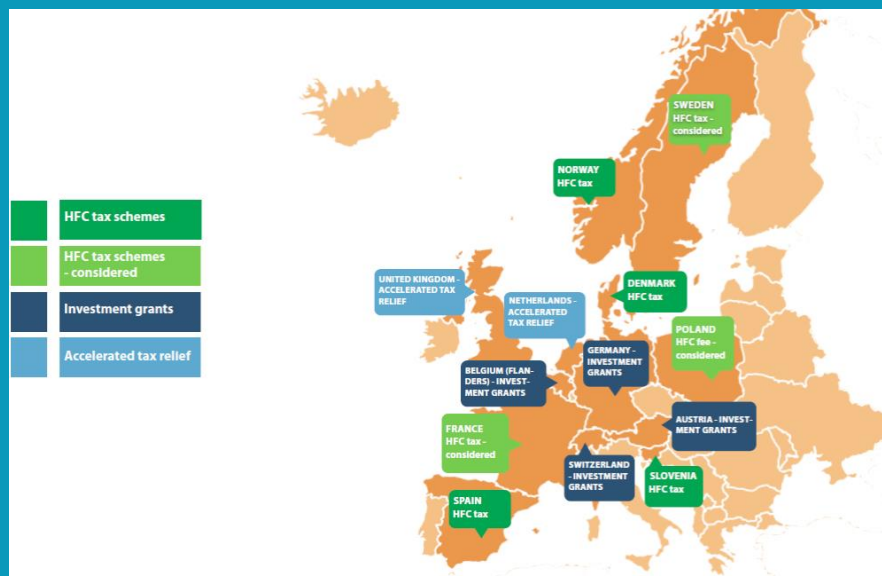
Requirements regarding the qualification and certification of personnel are described in more detail in Guideline III on training, qualification and certification for the introduction of climate-friendly cooling and heating technologies in Ukraine. Box 1 provides an overview about national support policies helping countries to implement the phase down requirements in the F-Gas regulation.

²⁰ More information can be found here: <https://bdr.eionet.europa.eu/help/fgases>

²¹ Öko-Recherche (2019) at: Cooling Post (2019): HFC refrigerant prices continue to fall, 17 Jul 2019, <https://www.coolingpost.com/world-news/hfc-refrigerant-prices-continue-to-fall/> (24.02.2020)

Box 2: National policies to support the fulfilment of the F-Gas regulation

In order to achieve the phase-down of HFCs as stipulated in the F-Gas regulation several countries in Europe have adopted national support policies, ranging from HFC tax and refund schemes based on the polluter-pays-principle to support schemes encouraging investment in climate friendly technologies (investment grants or accelerated or enhanced depreciation). The following picture provides an overview of the support schemes in different EU countries established in 2013. In the meantime other countries, including France and Poland have adopted an HFC tax.



Source: Shecco (2013)²²

4.2.2 Addressing indirect emissions: MEPS, Labels & Buildings' regulations

There are several pieces of legislation set up in the EU to diminish the indirect emissions from RACHP equipment, including the Ecodesign Directive 2009/125/EC and the Energy Labelling Regulation (EU) 2017/1369, etc. which are briefly described in the following chapters.

Box 3 indicates to the different legal acts in the EU and their implications for members states.

Box 3: European legal instruments: directives versus regulations

The two main EU framework policy tools differ in their choice of legal act:

A **Directive** is a legal act of the EU that requires member states to achieve a specified result without dictating the means of achieving that result. Each State is requested to transpose the EU legal act first into national law. That leaves countries with a certain leeway on the exact rules to be adopted. Its benefit is that it acknowledges that member states have different legal systems and processes, and that they should be free to choose their own wording rather than the EU standard language.

A **Regulation**, on the contrary, is self-executing, meaning it is directly applicable across the EU and becomes immediately enforceable in all member states simultaneously. It is binding in all its clauses and does not require any implementing measures. Its main advantage lies in the unambiguity of legal rules that are the same for each member states. In addition, Implementing Regulations or Delegated Acts can be issued for both, directives and regulations, in order to set specific rules.

²² Shecco (2013): GUIDE+: HFC taxes & fiscal incentives for natural refrigerants in Europe, <http://publications.shecco.com/publications/view/guidehftaxesandfiscalincentivesforrineurope>

4.2.2.1 The Ecodesign Directive

The EU Ecodesign Directive 2009/125/EC²³ aims at minimizing GHG emissions of energy-related products from a life cycle perspective, from the development phase through the recycling / disposal phase. Its main focus, however, is on the product's use phase by prescribing minimum energy performance standards (MEPS). The directive sets a framework for performance criteria which manufacturers must meet in order to legally bring their product to the market. This eliminates the least performing products from the market, significantly contributing to the EU's energy efficiency objective. The Ecodesign Directive is implemented through product-specific regulations, directly applicable in all EU countries and supplemented by harmonised European standards that contain the technical specifications.²⁴

As of February 2020, ecodesign requirements for 31 product groups apply.²⁵ MEPS follow a fixed time schedule. A special regulation per product group²⁶ applies. Manufacturers can demonstrate compliance by applying the approved EU harmonized standards and testing methods²⁷.

The following table provides an overview of the different applications of the EU Ecodesign Directive and the EU Energy Efficiency Labelling Regulation as regards to RACHP products.

Table 1: Affected product groups by the Ecodesign Directive relevant for the RACHP sector

Product group	Ecodesign Directive	Energy Labelling Regulation
Air conditioners	(EU) No 206/2012 Harmonised standards: 2012/C 172/01, 2014/C 110/01 and 2018/C 092/03	(EU) No 626/2011 Harmonised standards: 2014/C 110/01 and 2018/C 092/03
Air heating products, cooling products, high temperature process chillers and fan coil units	(EU) 2016/2281	N/A
Water heaters, hot water storage tanks and packages of water heater and solar device	(EU) No 814/2013	(EU) No 812/2013
Professional refrigerated storage cabinets	(EU) 2015/1095	(EU) 2015/1094
Household refrigerating appliances	(EC) No 643/2009 Harmonised standards: 2014/C 22/03	(EU) No 1060/2010 Harmonised standards: 2014/C 22/03
Space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device	(EU) No 813/2013	(EU) No 811/2013
Refrigerating appliances with a direct sales function	(EU) 2019/2024 – in application from 1 March 2021	(EU) 2019/2018 – in application from 1 March 2021

Source: European Commission (2020)²⁸

²³ “DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products” <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32009L0125>

²⁴ A list of harmonised standards for ecodesign and labelling can be found here: https://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/ecodesign_en

²⁵ https://ec.europa.eu/info/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/energy-label-and-ecodesign/energy-efficient-products_en

²⁶ Product groups regulated: https://ec.europa.eu/growth/industry/sustainability/ecodesign/product-groups_en

²⁷ An overview of harmonized standards used by the Ecodesign Directive and the Energy Labelling Directive can be found here: https://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/ecodesign_en

²⁸ <https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficient-products/list-regulations-product-groups-energy-efficient-products> (26.02.2020)

Providing one example, Commission Regulation (EU) No 206/2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for air conditioners and comfort fans stipulates the following MEPS for different types of air conditioners (see **Table 2**).

Table 2: Requirements for minimum energy efficiency in ACs

	Requirements for minimum energy efficiency					
	Air conditioners, except double and single duct air conditioners		Double duct air conditioners		Single duct air conditioners	
	SEER	SCOP (heating season: Average)	EER _{rated}	COP _{rated}	EER _{rated}	COP _{rated}
If GWP of refrigerant > 150 for < 6 kW	4,60	3,80	2,60	2,60	2,60	2,04
If GWP of refrigerant ≤ 150 for < 6 kW	4,14	3,42	2,34	2,34	2,34	1,84
If GWP of refrigerant > 150 for 6-12 kW	4,30	3,80	2,60	2,60	2,60	2,04
If GWP of refrigerant ≤ 150 for 6-12 kW	3,87	3,42	2,34	2,34	2,34	1,84

Source: (EU) No 206/2012 Annex I, 2. Table 6

The Coefficient of Performance (COP_{rated}) is the ratio of heating capacity provided (output, in kW) to the amount of work required for heating (input, in kW), when providing heating at standard rating conditions²⁹. The COP usually exceeds 1 (a 100% efficiency would be a COP of 1). The Energy Efficiency Ratio (EER) is identical to COP and defined as the ratio of cooling capacity provided to the power input required (some standards use COP and some EER as the base indicator). Both consider a single temperature measuring point. The Seasonal Energy Efficiency Ratio (SEER) or the Seasonal Coefficient of Performance (SCOP) considers the performance of the unit at different temperature conditions within a country.

The development and implementation of MEPS is a lengthy process. In the European Union, as a first step a preparatory study is conducted, including in-depth market, regulatory and technology assessments. The study comprises a mapping of a representative number of products in the market, an analysis of their energy efficiency and price, and a comparison to international products. The data is collected directly from manufacturers which derive them from standardised performance testing³⁰ and discussed in a broader stakeholder consultation process. Once all the data has been collected (and climatic class conversions have been executed wherever necessary), a modelling exercise would be carried out to determine energy performance classes³¹ and develop a set of scenarios (incl. a mandatory implementation timeline) that will be submitted for consultation with the stakeholder group. Such a study lasts at least two years.

The regulations usually require a review by the Commission after a fixed timeframe (e.g. five years) from the date of the entry into force. Ecodesign requirements are introduced gradually in order to provide a sufficient timeframe for manufacturers to re-design products. A timeline for the gradual increase of MEPS is included in the regulations.

National market surveillance authorities verify whether products sold in the EU follow the requirements laid out in ecodesign and energy labelling regulations. EU countries must ensure effective surveillance of their markets, by guaranteeing that products placed on the market are marked, documented and

²⁹ “Standard rating conditions” means the combination of indoor (T_{in}) and outdoor temperatures (T_j) that describe the operating conditions while establishing the sound power level.

³⁰ For ACs for example, the following performance testing standards are used: ISO 5151, ISO 13253, EN 14511, EN 14825.

³¹ Energy performance classes are the statistical equivalent of percentiles

monitored; market surveillance authorities got the necessary powers, resources and knowledge to perform their functions; procedures were established for following up complaints and monitoring accidents; and market surveillance programmes are reviewed and periodically updated.³²

4.2.2.2 Energy Labelling Regulation

As a complementary tool, the EU Energy Labelling Regulation (EU) 2017/1369³³ sets mandatory labelling requirements for currently 14 product groups. It hence drives a move towards high efficiency products by rescaling the label in line with technological progress at regular intervals. Its main communication efforts go towards consumers that are encouraged to choose products in the highest range of the energy efficiency label.

Regulation (EU) 2017/1369 replaces a previous Directive (2010/30/EU), hence making it directly applicable in national law (see difference between Directive and Regulation as outlined in **Box 3**).

Before 2017, products were labelled on a scale of A+++ (most efficient) to D (least efficient). As a major shortcoming of the scheme, products available today are already piling up in the top classes (A+ to A+++), undermining the scheme's effectiveness and incentive mechanism. Studies have shown that the labels from A+ to A+++ are less efficient when it comes to convincing the consumer to buy efficient refrigerators).³⁴

Under the new Energy Labelling Regulation (2017) products will be labelled using a simpler A to G scale (excluding any “+” additions) together with introducing a rescale trigger mechanism guaranteeing the effectiveness of the label. Rescaling will take place once the population of the highest class of the label exceeds 30 percent or that of the two highest classes combined exceeds 50 percent of the market. The two top classes are practically empty the first years to encourage technological progress. The recommended rescale time in the EU is 10 years.

Figure 11 visualises the market shares for domestic refrigerators for different label classes in 2015 and the ideal distribution according to intentions of the new regulation.

Figure 11: EU Energy Label market shares for domestic refrigerators, 2015; and (b) ideal distribution of products within a certain product group after rescaling



Source: ECOS (2017)³⁵

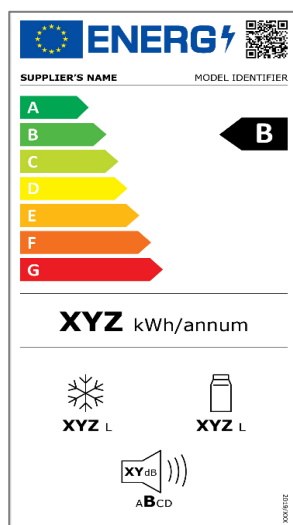
³² For more information see: https://ec.europa.eu/growth/single-market/goods/building-blocks/market-surveillance/organisation_en (09.01.2020)

³³ “Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU”

³⁴ European Commission (2019): COMMISSION DELEGATED REGULATION (EU) .../...of 11.3.2019 supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of refrigerating appliances and repealing Commission Delegated Regulation (EU) No1060/2010. <https://ec.europa.eu/transparency/regdoc/rep/3/2019/EN/C-2019-1806-F1-EN-MAIN-PART-1.PDF>

³⁵ ECOS (2017): The revised Energy Labelling Regulation http://ecostandard.org/wp-content/uploads/ECOS-Analysis_New-Energy-Label-Regulation_Final.pdf

Figure 12: New EU Energy Label design for household refrigerators (from March 2021)



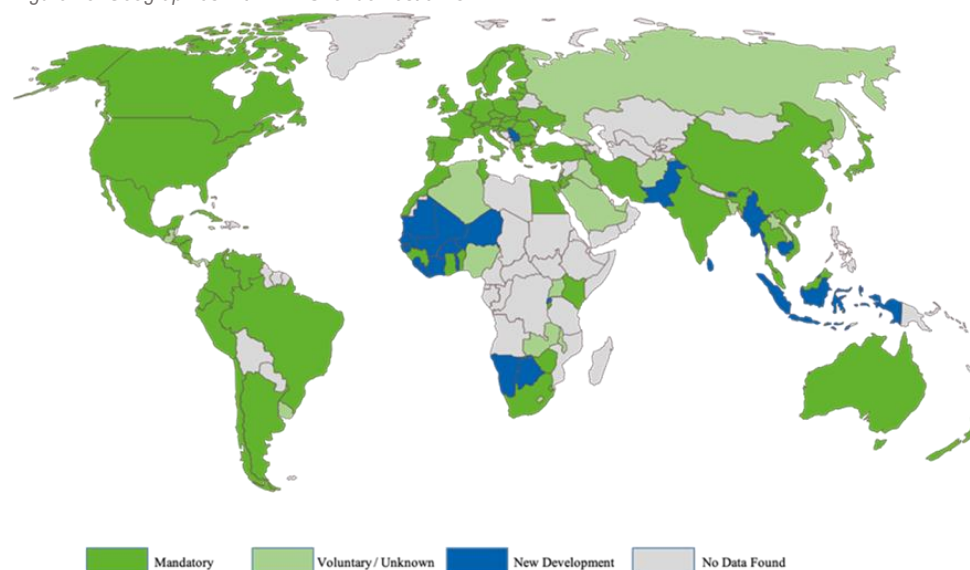
Today, the Energy Label is recognized by 85 percent of consumers in the EU. As a general rule, labels must be clearly shown on each appliance or next to it at the point of sale. Each label needs to be accompanied by a product information sheet with more details. It shows absolute energy consumption in kWh/year or kWh/cycle for most product groups. Additional product-specific information, such as noise level in dB, volumetric capacity, or water consumption also shows on some labels (see Figure 12).

In March 2019, the European Commission adopted the new Energy Labels for six product groups (among them household refrigerators and a new labelling product group for refrigerating appliances with a direct sales function used in shops and vending machines), making the new labels visible for European consumers in physical and online stores as of March 2021. As a new element in those labels, a QR code will enable consumers get additional information through the European Product Database for Energy Labelling (EPREL) that is currently being built.³⁶

An analysis conducted in 2014³⁷ showed that a growing number of countries outside the EU had also adopted the European energy labelling programme, including Russia, Turkey and South Africa.

Figure 13 provides an overview about those countries with mandatory and voluntary energy performance standards for domestic air conditioners, including those countries in which MEPS are under development.

Figure 13: Geographies with MEPS for domestic AC



Source: TEAP/UNEP (2019)³⁸

³⁶ For more information on the new labels, see: https://ec.europa.eu/info/news/clearer-and-simple-energy-labels-will-help-consumers-save-money-and-contribute-energy-unions-objectives-2019-mar-11_en and the Technical Memo at: [http://europa.eu/rapid/press-release MEMO-19-1596_en.htm](http://europa.eu/rapid/press-release_MEMO-19-1596_en.htm)

³⁷ The study can be found at: https://ec.europa.eu/energy/sites/ener/files/documents/201404_ieel_third_jurisdictions.pdf

³⁸ TEAP/UNEP (2019): Volume 4: Decision XXX/5 Task Force Report on Cost and Availability of Low-GWP Technologies/Equipment that Maintain/Enhance Energy Efficiency. https://eta-publications.lbl.gov/sites/default/files/teap_may-2019_task_force_report_on_energy_efficiency.pdf

4.2.2.3 *European Directive on the Energy Performance of Buildings (EPBD)*

The EPBD (2010/31/EU) was partly designed to meet the 20 percent target for energy efficiency improvements under the 2020 climate and energy package. In 2018, the EPBD was revised (2018/844/EU). The new directive comprises various policies and supportive measures to enhance the energy performance of buildings in EU member states in new and existing buildings. The goal is that only nearly zero energy buildings (NZEB) will be built after 2020. Public buildings must already meet the lowest energy building standard by the end of 2018.

The Directive also stipulates that EU countries must establish long-term renovation strategies, aiming at decarbonising the national building stocks by 2050, with indicative milestones for 2030, 2040 and 2050. The strategies should contribute (among others) to the promotion of smart technologies such as building automation and control systems, e-mobility, air quality and ventilation, the issuance of energy performance certificates as well as the establishment of inspection schemes for heating and air conditioning systems. Moreover, EU countries must implement cost-optimal minimum energy performance requirements for new buildings, for the major renovation of existing buildings, and for the replacement or retrofit of building elements (heating and cooling systems, roofs, walls and so on) and national financial measures to improve the energy efficiency of buildings.

Besides actions on the building envelope, a decarbonisation of the building stock requires actions on the main consumption sources in buildings, such as space cooling, space heating and water heating. For this reason, the EPBD has a significant impact on the deployment of efficient heat and air-conditioning systems.

As supportive instruments, the European Commission established the energy performance of buildings standards (EPB standards)³⁹, managed by the European Committee for Standardisation (CEN) and published a series of recommendations ((EU) 2019/786 and (EU) 2019/1019)⁴⁰ on both the building renovation and building modernisation aspects of the new rules.

4.2.2.4 *Renewable Energy Directive (RES Directive)*

The EU Directive on the Promotion of the Use of Energy from Renewable Sources has been in force since June 25, 2009 (2009/28/EC). It stipulated in a legally binding manner that by 2020 at least 20 percent of gross final energy consumption in Europe must come from renewable sources - the heat pump is recognized as renewable energy with the three heat sources earth, water and air. The target at European level was to be achieved through the attainment of individual national targets.

In December 2018, the revised renewable energy directive 2018/2001/EU entered into force, as part of the “Clean energy for all Europeans” package⁴¹. The directive establishes a new binding renewable energy target for the EU for 2030 of at least 32%.

In addition, EU countries adopted a new Governance regulation (EU)2018/1999, which is (together with the RES Directive, the EPBD and the Energy Efficiency Directive part of the Clean energy for all Europeans package). According to this directive EU countries are required to draft 10-year National Energy & Climate Plans (NECPs) for 2021-2030, showing how they will meet the new 2030 targets for renewable energy and for energy efficiency.

In response to the RES Directive, various support schemes were put in place by Member States to increase the deployment of renewable energy sources, such as feed-in tariffs, feed-in premiums, auction/tender systems, quotas, tax credits and grants. With regards to heating and cooling, in Denmark, for example, there are several taxes on the production, supply and use of energy sources for heating purposes.

³⁹ <https://epb.center/>

⁴⁰ <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1557992239852&uri=CELEX:32019H0786> and <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019H1019>

⁴¹ <https://ec.europa.eu/energy/en/topics/energy-strategy/clean-energy-all-europeans> (24.02.2020)

Renewable energy sources are exempt from these tax obligations. In France, the generation of heat through renewable energy plants is promoted through two systems of energy subsidies, two tax regulation mechanisms as well as through the granting of a zero percent-interest loan. In Germany, the Market Incentive Programme (MAP) provides investment support (soft loans and/or grants) for heat produced from solar, biomass and geothermal energy.⁴²

4.2.2.5 Energy Efficiency Directive (EED)

The 2012 Energy Efficiency Directive (2012/27/EU) includes a set of binding measures with the original aim to help the EU reach its 20 percent energy efficiency target by 2020. A number of important measures have been adopted impacting the RACHP sector, including

- an annual energy savings obligation,
- energy efficient renovations to at least 3 percent per year for public buildings,
- national long-term renovation strategies for the building stock in each EU country,
- mandatory energy efficiency certificates for buildings,
- the preparation of national energy efficiency action plans (NEEAPs) every three years,
- minimum energy efficiency standards and labelling for a variety of products (energy label and ecodesign, see above),
- the rollout of smart meters for electricity and gas, mandatory energy audits for large companies, and
- improved information for consumers of energy in buildings.

In 2018, the new EED (EU) 2018/2002 was adopted to update the previous policy framework (that lasted until 2020) to 2030 and beyond. The directive contains the energy efficiency target for 2030 of at least 32.5 percent, to be achieved collectively across the EU, against the 2007 modelling projections for 2030 (an upward revision in 2023 is possible). In addition, EU countries will have to achieve new energy savings of 0.8 percent each year of final energy consumption for the 2021-2030 period.

New important elements of the directive include the obligation for improved information on the metering and billing of thermal energy for consumers, transparent rules on the allocation of the cost of heating, cooling and hot water consumption in multi-apartment and multi-purpose buildings, and an updated primary energy factor (PEF) for electricity generation of 2.1 (down from the current 2.5), applicable for the calculation of energy savings in primary energy terms using a bottom-up approach based on final energy consumption.⁴³ A lower PEF provides incentives for systems that consume electricity to generate heat such as heat pumps.

The European Commission has developed guidance notes to support EU countries to transpose fully the different elements of the 2018 amending directive into national law.⁴⁴

5 Regulatory framework in the Ukraine

Ukraine has committed to the multilateral climate agreements and taken efforts to implement supportive framework conditions to ensure compliance with these agreements. The following paragraphs provide a brief description of the most relevant policies and regulations of the country with regards to the reduction of GHG emissions in the RACHP sector.

⁴² For a description of the support schemes in EU member states promoting heat pumps, see: <http://www.res-legal.eu/search-by-country/>

⁴³ This is just a guiding figure. It is up to member states to determine the right PEF for their calculations according to the countries' individual circumstances (electricity mix).

⁴⁴ <https://ec.europa.eu/energy/en/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive> (25.02.2020)

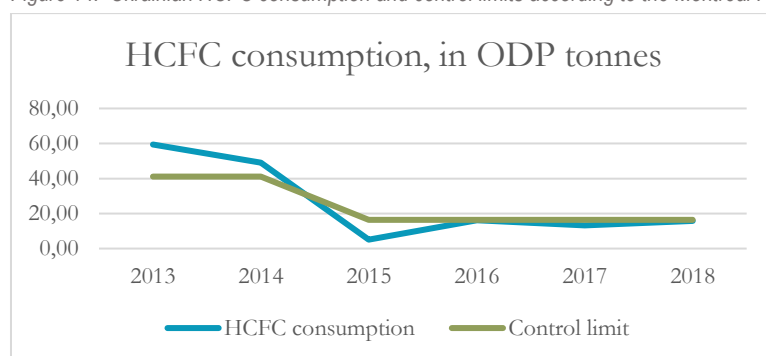
5.1 Addressing direct emissions of the RACHP sector

As a Party to the Montreal Protocol under Article 2, Ukraine was obliged to completely phase out HCFCs by 01. January 2020 with the following compliance schedule.⁴⁵ A decrease of its consumption to:

- 86.90 ODP-tonnes in 2013;
- 51.30 ODP-tonnes in 2014;
- 16.42 ODP-tonnes in 2015, 2016, 2017, 2018 and 2019;
- Zero by 1 January 2020, save for consumption restricted to the servicing of refrigeration and air-conditioning equipment between the period 2020 and 2030 as prescribed in the Protocol.

According to UNEP's Ozone Secretariat's data, the Ukraine met its targets since 2013 until 2018 (latest data available) as outlined in Figure 14. Consumption is calculated as production plus imports minus exports.

Figure 14: Ukrainian HCFC consumption and control limits according to the Montreal Protocol



Source: UNEP 2020⁴⁶

As a “non-A5 earlier start” country under the Kigali Amendment, the Ukraine’s HFC phase down path is laid out in the following table:

Table 3: Kigali Amendment – reductions for “non-A5 earlier start” countries

Reduction targets	Time period
-10%	2019-2024
-30%	2024-2029
-30%	2029-2034
-10%	2034-2036
-5%	2036-.....
-85%	Total reduction*

Source: own compilation based on Kigali Amendment *compared to the baseline (the average HFC consumption in the years 2011-2013 plus 15% of the historical HCFC baseline)

According to this schedule, the first significant phase down steps must be achieved by 2024 (minus 10%), as compared to the baseline. The Ukraine, however, has not yet ratified the Kigali Amendment.

In December 2019 the Verkhovna Rada (Ukrainian Parliament/Supreme Council) approved the Law No. 0874 "On the regulation of economic activity with ozone-depleting substances and fluorinated greenhouse gases"⁴⁷. The law regulates the existing market of imported ODS and fluorinated gases. The regulation

⁴⁵ https://ozone.unep.org/treaties/montreal-protocol/meetings/twenty-fourth-meeting-parties/decisions/decision-xxiv18-non?source=decisions_by_article_topic_relation&args%5B0%5D=137&parent=2261&nextParent=2262

⁴⁶ UNEP (2020): <https://ozone.unep.org/countries/profile/ukr> (07.01.2020)

⁴⁷ <https://zakon.rada.gov.ua/laws/main/376-IX> (20.02.2020)

focuses on imports as production of ODS does not exist in Ukraine. The Law will enter into force on 27 June 2020. It is aligned to the EU F-Gas Regulation and contains the following provisions:

- a distribution of responsibilities for its implementation;
- establishment of a central registry;
- reporting obligations for various market actors (mainly importers and operators) (activities of last five years and future intended placing);
- other duties of operators: training, leak checks, marking;
- prohibition of the production of controlled substances in Ukraine;
- rules regarding the import, export and placing on the market of controlled substances, goods and equipment “the import of ozone-depleting substances as well as of fluorinated greenhouse gases referred to in paragraph 1 of Annex 2 to this Law shall be subject to the receipt of a share within the annual national quota for the import of controlled substances”;
- rules regarding the recovery and disposal of controlled substances;
- training of technicians and certification of technicians and companies;
- labelling and marking; and
- a ban for ODS.

It is regulated that the definition and allocation of quota must enter into force three years after the law enters into force, which is in line with the country’s phase-down requirements according to the Kigali Amendment. The Cabinet of Ministers of Ukraine shall, within six months from the day the Law enters into force to ensure the adoption of new and conformity of existing normative legal acts provided for by the Law.

The Government also agreed (proposed by the Ministry of Ecology and Natural Resources) a pilot project on the introduction of electronic auctions on the distribution of shares of the annual national quota on the import of ODS to comply with the Montreal Protocol’s restrictions.⁴⁸

5.2 Addressing indirect emissions of the RACHP sector

5.2.1 The Paris Agreement

Ukraine is an Annex I Party (developed countries) to the UNFCCC since 1997 and has been an active participant in negotiation processes. Ukraine ratified the Paris Agreement in September 2016. In its Intended Nationally Determined Contributions (INDC) submitted in 2015, Ukraine declared it will not exceed 60 percent of the 1990 GHG emissions level in 2030 (excluding LULUCF⁴⁹)⁵⁰. Given the fact that the post-Soviet Union heavy industry collapsed after 1990, the carbon emissions fell in parallel. On this background the emission target is not considered as sufficiently ambitious and it is expected that the Ukraine overachieves its INDC based on its current policies.

Figure 15 illustrates the development of Ukraine’s GHG emissions since 1990. 2017 total emissions amounted to 320.63 million tons of CO₂-equivalent (without LULUF). Total emissions have been falling since 1990 by approximately 66 percent. Energy and carbon intensity of Ukraine's GDP remains high in comparison to OECD countries⁵¹. Most emissions are caused by the energy sector, followed by industry, agriculture and waste.

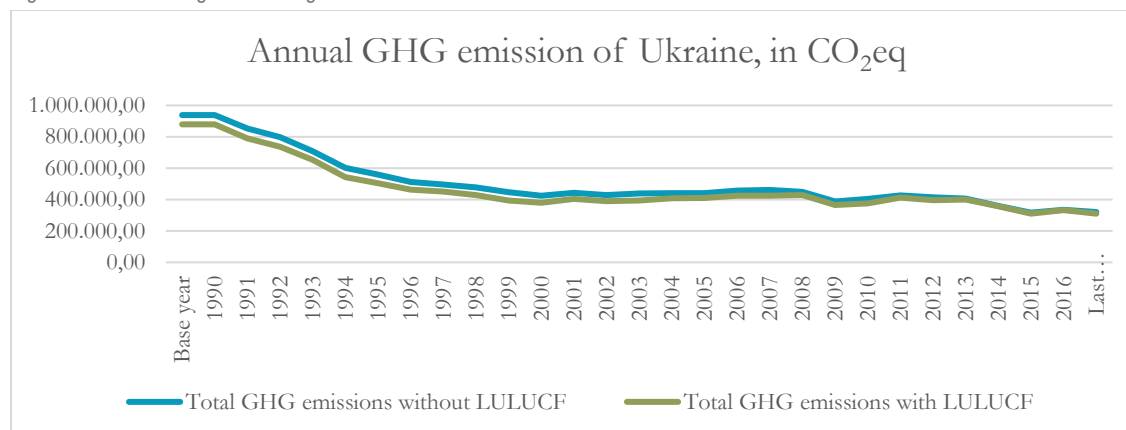
⁴⁸ <https://www.kmu.gov.ua/en/news/minprirodi-verhovna-rada-shvalila-za-osnovu-zakonoproekt-yakij-peredbachaye-stvorenniya-v-ukrayini-yedinogo-reyestru-importeriv-ozonorujivnih-rechovin> (20.02.2020)

⁴⁹ Land use, land-use change and forestry (LULUCF)

⁵⁰ <https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Ukraine%20First/Ukraine%20First%20NDC.pdf> (20.02.2020)

⁵¹ Carbon intensity of Ukraine's GDP is 2.4 times higher than that of the OECD countries and 3.3 higher than that of 28 EU member states. https://unfccc.int/sites/default/files/resource/Ukraine_LEDs_en.pdf (20.02.2020)

Figure 15: Ukraine's greenhouse gas emissions from 1990 to 2017



Source: own compilation based on UNFCCC GHG Data Interface (20.02.2020)

The government has indicated that it intends to revise its NDC “after the restoration of its territorial integrity and state sovereignty as well as after the approval of post-2020 socio-economic development strategies with account of investment mobilization.”⁵²

5.2.2 The 2050 Low Emission Development Strategy (LEDS)

In the past, GHG mitigation policies on energy efficiency and renewable energy were made separately and not well integrated in Ukraine. Most concrete and recent plans on both mitigation strategies (energy efficiency and renewable energy) have been made in the 2050 Low Emission Development Strategy (LEDS)⁵³, which was published in 2018. In the framework of the strategy modelling results have shown that in 2050 the GHG emissions in the energy sector and industrial processes sector can be reduced to the level of 31-34 percent of 1990, provided that the envisaged low carbon policy framework of Ukraine is implemented. The LEDS sets the global warming target of 2 degrees Celsius (Paris Agreement) as the reference value for its defined goals.

The strategy sets out a broad range of measures in different sectors. For example, it stipulates an improvement of minimum requirements for energy consuming products and an eco-design labelling, in order to give priority to products with the highest energy saving potential.

5.2.3 Eco-design and Labelling regulations

The Association Agreement between the European Union and Ukraine requires Ukraine to transpose the European Eco-design Directive 2005/32/EC⁵⁴ and various implementing directives and regulations⁵⁵, within three years after entry into force of the agreement.⁵⁶ Ukraine adopted the framework regulation on Eco-design for energy-related products based on Directive 2009/125/EC, which is in force since April 6, 2019. Regulations for household refrigerators entered into force in September 2019⁵⁷. The technical

⁵² See Ukraine Country Summary. Climate Action Tracker. <https://climateactiontracker.org/countries/ukraine/> (09.01.2020)

⁵³ Ukraine 2050 Low Emission Development Strategy (LEDS) Kyiv 2017. https://unfccc.int/sites/default/files/resource/Ukraine_LEDS_en.pdf (20.02.2020)

⁵⁴ Former version of the current framework directive (Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products): Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products

⁵⁵ Amongst them is 96/57/EC Household electric refrigerators, freezers and combinations

⁵⁶ Annex XXVII to Chapter 1 of the Association Agreement “Energy cooperation, including nuclear issues” <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A22014A0529%2801%29> (20.02.2020)

⁵⁷ <https://zakon.rada.gov.ua/laws/show/158-2019-%D0%BF>

regulation for air conditioners was adopted in August 2019 and entered into force in February 2020.⁵⁸ The MEPS have been adopted analogue to the EU standards.⁵⁹

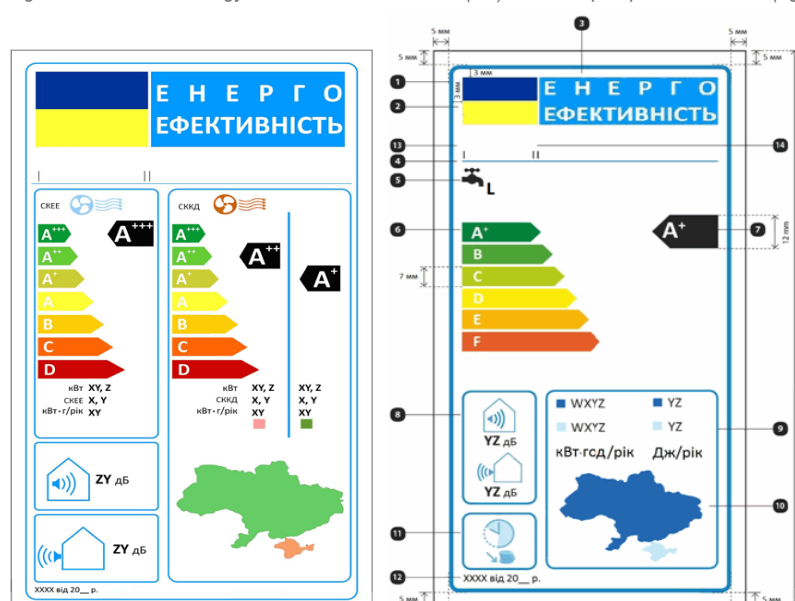
Table 4: Eco-design requirements for RACHP equipment in the Ukraine

Ukrainian Resolution/Order	Scope	Effective date	Relevant EU regulation
739 dated by August 2019	Electric mains-operated air conditioners with a rated capacity of $\leq 12\text{kW}$ for cooling, or heating	02.2020	No 206/2012 of 6 March 2012 implementing Directive 2009/125/EC
158 dated by February 2019⁶⁰	Electric mains-operated household refrigerating appliances with a storage volume up to 1500 liters	09.2019	No 643/2009 implementing Directive 2005/32/EC

Source: own compilation based on GMA⁶¹

Appliances subject to energy labeling requirements include household refrigerators and freezers⁶², water heaters⁶³, and most recently, air conditioners.⁶⁴ The adopted technical regulations are in line with the corresponding EU energy labeling regulations.

Figure 16: Ukrainian energy label for air conditioners (left) and heat pump water heaters (right)



Source: Technical regulations, see footnote 64 and 65

⁵⁸ See: <http://www.pravsky.com/ukraine-ecodesign-regulations-office-equipment-and-electronic-products> and <https://www.ul.com/news/energy-efficiency-and-ecodesign-new-technical-regulation-approved-ministry-ukraine> (20.02.2020)

⁵⁹ For the technical regulation on air conditioners see: <https://zakon.rada.gov.ua/laws/file/text/74/f486984n16.pdf> and <https://zakon.rada.gov.ua/laws/show/739-2019-%D0%BF>

⁶⁰ <https://zakon.rada.gov.ua/laws/show/158-2019-%D0%BF>

⁶¹ See: <https://www.gma.trade/single-post/Ukraine-Approves-Another-Series-of-Ecodesign-Technical-Regulations> (28.01.2020)

⁶² <https://zakon.rada.gov.ua/laws/show/107-2011-%D0%BF>

⁶³ <https://zakon.rada.gov.ua/laws/show/z0647-19>

⁶⁴ <https://zakon.rada.gov.ua/laws/show/360-2017-%D0%BF> (27.02.2020)

5.2.4 Building regulations

On June 22, 2017 the Verkhovna Rada passed the Law of Ukraine No 2118-VIII «On Energy Efficiency in Buildings» which aims to establish conditions to enable reduced energy consumption in buildings in accordance to Directive 2010/331/EU of the European Parliament and of the Council “On the energy performance of building” as a part to implementation of the ratified Treaty Establishing the Energy Community⁶⁵. The Law regulates the establishment of minimum performance requirements to energy efficiency in buildings, the introduction of energy certification and energy audits for buildings.

As a prerequisite Ukraine had to adopt other legislation to regulate the tenant and owner structure in the housing sector (among the approved laws On the Peculiarities for the Realization of a Right to Property in a Multi-Apartment Building, On Housing and Communal Services) and the possibility for energy accounting (the Law On Commercial Accounting of Thermal Energy and Water Supply).

In addition, the government set up the Energy Efficiency Fund (Law on Energy Efficiency Fund) to provide incentives aiming to increase energy efficiency mainly in the residential building sector and supports multi-apartment buildings' associations (condominiums) to implement energy-efficient activities through grants and integrated technical solutions, taking into account European best practices for energy-efficient building modernization.⁶⁶ The Fund complies with requirements of Directive 2012/27/EU of the European Parliament and of the Council as part of the implementation of the ratified Treaty Establishing the Energy Community and is implemented in collaboration with the International Finance Corporation - IFC, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and the United Nations Development Program (UNDP).

Moreover, the state construction codes SCN B.2.6-31:2016 «Heat insulation of buildings» were approved and include requirements to energy efficiency and thermo technical characteristics of the thermal insulation envelope for buildings and structures and their calculation procedure.

5.2.5 Renewable energy (heat pump) policies

The key renewable energy resources in Ukraine are so far biofuels, waste-to-energy and hydro power. The current renewable energy share constitutes about 4 percent of the total primary energy supply⁶⁷. In the Energy Strategy for Ukraine through 2035 (ESU), the total share of renewables in Total Primary Energy Supply (TPES) in 2035 is targeted at 25 percent. So far, Ukraine is behind this target. A major barrier are the highly subsidized gas prices⁶⁸ against which renewable energies are hardly competitive.

In 2017, Ukraine adopted the Law «On Alternative Energy Sources» (of 20 February 2003 No 555-IV, in the version of 11.06.2017), which determines legal, economic, environmental and organizational basis for the use of alternative energy sources and fosters their more extensive use in the fuel and energy sector.

Since 2016, heat pumps are legally classified as equipment that “uses renewable (alternative) energy sources”. “Thermal energy produced from heat pumps from aerothermal, hydrothermal or geothermal energy is considered to be produced from renewable energy sources, provided that the annual amount of heat production by such heat pump is greater than the amount of heat consumed for the production of electricity consumed by the heat pump, according to EU RES Directive 2009/28 / EC.⁶⁹ In 2018, the

⁶⁵ <https://www.energy-community.org/legal/treaty.html> (24.02.2020)

⁶⁶ See <https://www.kmu.gov.ua/en/news/fond-energoefektivnosti-prezentuvav-programu-modernizaciyi-zhitlovogo-fondu-ukrayini> ; <https://www.cms-lawnow.com/ealerts/2017/07/ukraine-a-milestone-law-on-the-energy-efficiency-of-buildings-adopted> and <https://zakon.rada.gov.ua/laws/show/2118-19> (24.02.2020)

⁶⁷ State Statistical Service of Ukraine, 2016 data

⁶⁸ See for example Oxford Institute for Energy Studies (2016): The Ukrainian residential gas sector: a market untapped. <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2016/07/The-Ukrainian-residential-gas-sector-a-market-untapped-NG-109.pdf>

⁶⁹ <https://www.unian.ua/economics/energetics/1601252-deputati-vidnesli-teplovi-nasosi-do-alternativnih-dzherel-energiji.html> (24.04.2020)

government approved a method for calculating the energy share, produced by heat pumps from renewable sources (03/12/2018 № 52).⁷⁰

6 Summary and recommendations

GHG emissions in the RACHP sector result from the release of f-gases used as refrigerants for cooling purposes in the appliances (direct emissions) and the fossil fuel combustion for electricity generation to power the appliances (indirect emissions). The GWP of commonly used f-gases is of 1400 up to above 4000 times higher than that of CO₂, indicating the significant climate mitigation potential of the sector.

In Ukraine, total emissions from RACHP sector accounted for roughly nine percent of total GHG emissions in the country.

This Guideline provides an overview of the regulatory framework at international and regional (European) level aiming to promote the adoption of climate friendly RACHP equipment in either way: by addressing indirect emissions of the sector (supporting highly energy efficient appliances) or direct emissions (by the market uptake of low-to zero GWP refrigerants).

The **driver at the international level are two multilateral treaties** that have a significant impact on RACHP sector emissions and implications on regional and national regulations: **the Montreal Protocol's Kigali Amendment** and **the Paris Agreement**. While the Kigali Amendment specifically regulates the global phase-down of the production and consumption of HFCs over the next 30 years, the Paris Agreement's scope is overarching. It requires (among other measures) all parties to develop and implement NDCs that describe their efforts to combat climate change in line with the global target to limit the temperature increase this century to not more than 1.5 degrees Celsius above pre-industrial levels.

Ukraine has taken efforts to adopt supportive framework conditions compliant with these agreements. Especially since 2017, the country has issued **a series of laws that promote a decarbonization of its economy, aligned to European legislation** on the basis of the Association Agreement between Ukraine and the EU and as part of the implementation of the ratified Treaty Establishing the Energy Community.

With the **“Law on ozone-depleting substances and fluorinated greenhouse gases” of Ukraine** the government started to prepare the phase down of high GWP HFCs. The law is based on the European F-gas regulation (EU) No 517/2014 and contains similar, if not the same provisions, including rules on a central registry and licensing system and rules for the import, export and placing on the market of controlled substances, goods and equipment. The implementation of the law remains yet to be seen. The envisaged licensing system enabling the quota allocation has to be developed first, based on reporting of the market participants. Under the Kigali Amendment (which Ukraine has not yet ratified) the first phase-down step for HFCs would need to be achieved by 2024. The law enters into force in June 2020. The necessary measures under the law with regards to a registry, quota and licensing system should be swiftly implemented to ensure compliance with the international treaty. It is recommended that the Ukraine builds on the experiences, rules, and tools under the EU F-Gas Regulation.

Moreover, in order to achieve the phase-down of HFCs as stipulated in the F-Gas Regulation several countries in Europe have adopted additional policies to support alternative refrigerants to HFCs, ranging from HFC tax and refund schemes to investment grants or accelerated or enhanced depreciation for the use of natural refrigerants. It is recommended to look into these policies and analyse which scheme could be most suitable to be adapted in Ukraine.

Ukraine also ratified the Paris Agreement in 2016. In its INDC from 2015 Ukraine submitted a rather conservative GHG reduction target for 2030, which is expected to be overachieved. Total emissions have been falling since 1990 by approximately 66 percent due to the collapse of the post-Soviet Union heavy

⁷⁰ <http://www.unhpa.com.ua/wp-content/uploads/2018/08/%D0%BD%D0%B0%D0%BA%D0%B0%D0%B7%D0%9C%D0%BD%D1%8052.pdf> (24.02.2020)

industry. In the country's **2050 Low Emission Development Strategy (LEDS)**, modelling results have shown that in 2050 the GHG emissions in the energy sector and industrial processes sector can be reduced in the range of 31 to 34 percent of 1990 levels, provided that the envisaged low carbon policy framework of Ukraine is implemented. So far, the mitigation potential of the RACHP sector in Ukraine has not yet entirely investigated and it is recommended to carry out a more in-depth analysis about GHG emissions in the sector, starting with the development of a GHG inventory that will provide a better insight into the product groups with the highest potential.

Ukraine has also set MEPS for household refrigeration systems and air conditioners based on the EU Ecodesign Directive 2009/125/EC. Regulations for household refrigerators entered into force in September 2019. The technical regulation for air conditioners will enter into force in February 2020. Both is an important step to improve energy efficiency and thus the carbon footprint of these appliances. The EU Ecodesign Directive covers also other products from the RACHP sector, and it is recommended that Ukraine adopts those as well, to pave the way for climate friendly heat pumps (water and space heaters), chillers, and commercial refrigeration equipment. The Association Agreement between the European Union and Ukraine requires Ukraine to transpose the European Eco-design Directive 2005/32/EC and various implementing directives and regulations, within three years after entry into force of the agreement. Since the Ecodesign regulations are gradually updated, **it is important that Ukraine closely follows the developments at EU level and transposes the most up to date regulations into national law.**

This is especially due for the revised Energy Labelling Regulation (EU) 2017/1369 that sets mandatory labelling requirements and a rescaling of the label in line with technological progress at regular intervals. The EU just launched new labels for household refrigerators and for refrigerating appliances with a direct sales function used in shops and vending machines) that need to be applied by March 2021. These new labels use a new and simpler A to G scale together with a rescale trigger mechanism guaranteeing the effectiveness of the label. **Appliances currently subject to energy labeling requirements in Ukraine include household refrigerators and most recently, air conditioners.**

A rather **indirect, but significant impact on RACHP equipment has the EU Energy Performance of Buildings Directive (2010/31/EU)** to enhance the energy performance of buildings in new and existing buildings. The goal is that only nearly zero energy buildings (*NZEB*) will be built after 2020. The directive stipulates various policy measures, including long-term renovation strategies, the implementation of cost optimal minimum energy performance requirements for new buildings and major renovations of existing buildings, the promotion of smart technologies such as building automation and control systems, measures to improve air quality and ventilation, rules of the issuance of energy performance certificates as well as the establishment of inspection schemes for heating and air conditioning systems. Since space cooling, space heating and water heating constitute the main consumption sources in buildings, the deployment of energy efficient air conditioners and heat pumps are vital for the decarbonisation of the building stock. Ukraine has adopted the **Law of Ukraine No 2118-VIII “On Energy Efficiency in Buildings”** which aims to establish conditions to enable reduced energy consumption in buildings in accordance to Directive 2010/31/EU. However, substantial structural differences to EU member countries require the Ukraine to implement legislation that regulates the tenant and owner structure in the housing sector and energy accounting in buildings as a prerequisite. Several laws have been issued to address these issues and a fast implementation is recommended. With regards to the Ukrainian Efficiency Fund that was set up to incentivize energy efficiency programs in Ukrainian buildings sector, it is recommended to consider European best practices for energy-efficient building modernization.

Ukraine has also adopted other legislation equivalent to the EU's regulations that are part of the **Clean energy for all Europeans** package. Besides the EPBD, the package comprises the **EU Directive on the Promotion of the Use of Energy from Renewable Sources (2009/28/EC)**, the **2012 Energy Efficiency Directive (2012/27/EU)** and a new **Governance regulation (EU)2018/1999**. The latter requires member states to 10-year National Energy & Climate Plans (NECPs) for 2021-2030. These directives provide guidelines and common targets and have to be transposed into national law but allow

countries to make flexible adjustments to the exact rules to be adopted. Accordingly, different support schemes were put in place by member states to increase the deployment of renewable energy sources and increase energy efficiency. It is recommended that **a more in-depth analysis of these support policies in various member states is conducted, focusing on the promotion of energy efficient RACHP appliances.** Heat pumps in Ukraine, for example, have only be accepted as a “renewable energy source” since 2016. In 2018, the government approved a method for calculating the energy share, produced by heat pumps from renewable sources. There is an urgent need for action to explore the potential of heat pumps in the country and set an enabling regulatory environment for the technology.

7 Annex

Table 5: Content of F-Gas regulation

Chapter	Content	Articles
I	General Provisions	1-2
II	Containment (“Emission reduction”) - Article 3: Prevention of emission - Article 4: Leak checks - Article 5: Leakage detection systems - Article 6: Record keeping - Article 7: Production - Article 8: Recovery - Article 9: Producers responsibility schemes - Article 10: Training and certification	3-10
III	Placing on market – control of use - Article 11: Restrictions on the <u>placing on the market</u> - Article 12: Labelling (CE marking relevance) - Article 13: Control of use (<u>servicing</u>) - Article 14: Pre-charges equipment	11-14
IV	Reduction of quantity (“Quota allocation”) - Article 15: Reduction of quantity (“of CO₂-Equivalent”) - Article 16: Quota allocation (see below) - Article 17: Registry - Article 18: Transfer of quota	15-18
V	Reporting	19-20
VI	Final provisions	21-27
AI - AVIII	Annex I controlled substances	
	Annex II substances under reporting	
	Annex III Placing on market prohibitions (“Dates”)	
	Annex V Maximum quantities (“Phase down”)	

Source: own compilation