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HOW DO WE SEE CLIMATE CHANGES REGARDING REFRIGERANTS

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Abstract

In this paper, is presented our opinion regarding „How do we see Climate Changes in Refrigeration" focussed by comparative study of refrigerants.

Decarbonization is the goal of EU by 2050. Reduction of carbon dioxide emissions by using low-carbon energy sources, resulting in less production of greenhouse gases in the atmosphere is an important target.

1. Refrigerants Situation

In the last ten years, a lot of research has been done in the field of AF, at international level, taking into consideration the severe restrictions stipulated by law: Kyoto Protocol, Regulation (EU) 2024/573, Paris Agreement / 2015, Kigali Amendment / 2016 / Montreal Protocol [1,3,4,5]. Other important events in connection with CC:

January 1, 2019 the Kigali amendment imposed regulations to reduce the production an usage of hydrofluorocarbons (HFC's), greenhouse gases (temperature increase 0.4°C)

All countries signing the Montreal Protocol agreed to phase out HFC's by more than 80% over the next 30 years (replacing environmentally friendly alternatives).

Kigali amendment (elimination of up to 80 billion tons of CO2 emissions by 2050)

Significant contribution to the objective of the Paris Agreement to limit the increase in global average temperature to a maximum of 2°C.

Figure 1. Climate changes [9,10]

In figure 2 it is shown the situation of climate impact of cooling sector.

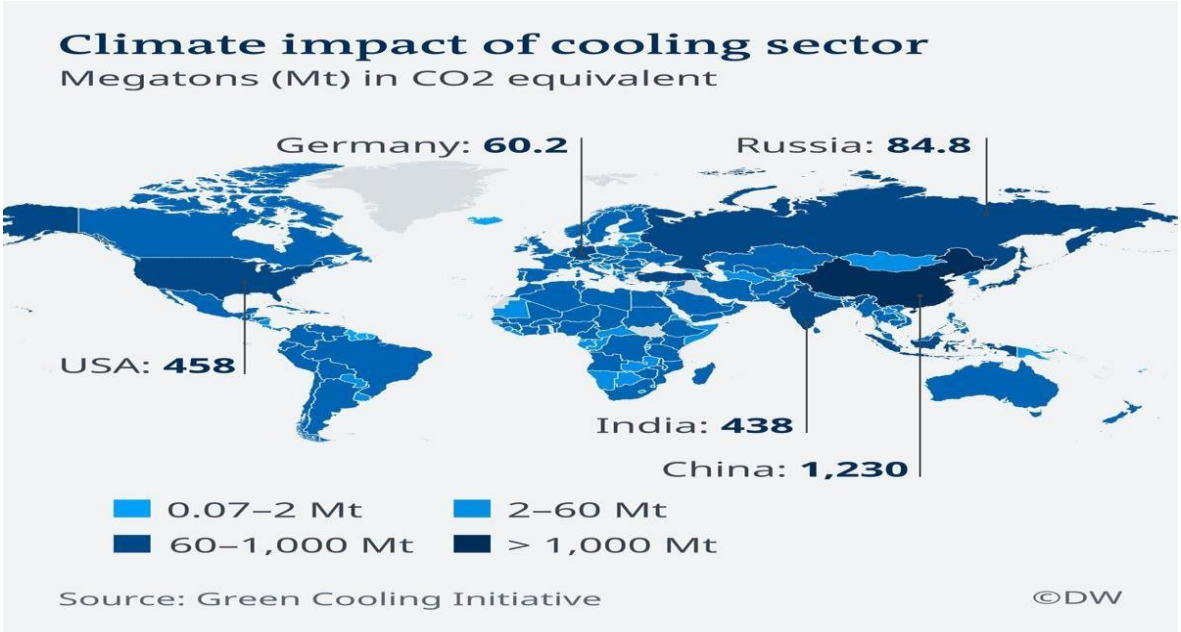

Figure 2. Cooling Sector

2. Decarbonization

Decarbonization is the reduction of carbon dioxide emissions by using low-carbon energy sources, resulting in less production of greenhouse gases in the atmosphere [2,5,6,7]. In our field

must be done some important measures:

- ▶ Use of low GWP (global warming potential) refrigerants while maintaining energy efficiency;
- ▶ Calculated TEWI (Total Equivalent Warming Impact) Factor for the refrigeration systems (heat pump).

3. Using Low GWP Refrigerants

Using low GWP refrigerants, we could minimize the risk of deteriorating the ozone layer from refrigerant leaks.

Figure 3. Low GWP refrigerants

Two of the lowest GWP refrigerants are R-744 (CO2), with a GWP of 1 and R-717 (Ammonia) with a GWP of 0.

In our opinion R-717 it is better than the R-744 for many reasons [8].

Ammonia has better efficiency than CO2 so it would use less electrical power to operate.

Ammonia has lower operating pressure than CO2 and also could reach highercondensation temperatures, so it would be a good alternative for heating as well.

4. Starting from our homes

Almost every house in Europe has at least one air conditioning unit and most of these units are using outdated refrigerants and without proper maintenance could appear leaks contributing at the depletion of the ozone layer.

It would be a more efficient way to centralize the cooling of our homes. Using this method, we can keep the refrigeration systems in a district cooling point and use an intermediary cooling agent to cool our homes. This system could be used for heating as well.

In this way we could use the old but reliable R-717 (Ammonia) which has GWP 0 and it is very efficient. Indeed, it is toxic for people, but the system would be in a closed environment and would be equipped with a leak detection system.

Figure 4. Connection of HVAC systems starting from our homes

At the moment the cooling sector still has a huge impact in the climate change. The big and developed countries around the world have pretty high CO2 emissions.

One of the many solutions is decarbonization, which basically means to reduce CO2 emissions using low-carbon energy sources. Two main solutions are use of low GWP refrigerants while maintaining energy efficiency and using in the designing stage the TEWI factor for refrigeration. Using low GWP refrigerants we could minimize the risk ofdeteriorating the ozone layer, but we have to keep in mind that energy efficiency is also important. Like better efficiency than CO2, which means lower power consumption, a factor that also contributes at lowering the CO2 emissions, given that about 60% of the electric energy is produced from burning coal. Another advantage is lower operating pressure. And the higher condensation temperature makes it suitable for usage in heat pumps.

5. Conclusions

We could start this change from our homes. Given that almost every house in Europehas at least one air conditioning unit, in many cases they use outdated refrigerants which without proper maintenance could lead to leaks.

In our opinion a better alternative would be centralization of the cooling system. With this method smaller district cooling plants could be created. This kind of system would use an intermediary cooling agent to cool our homes and it would be much safer. In the cold season this system could be used in a heat pump setup and supply heat to our houses.

For industrial application we think it would be suitable to use Ammonia, it is a natural refrigerant with a GWP of 0 and has high efficiency. Because Ammonia is toxic for people, the district plant would be equipped with safety systems for leak detection.

CUM VEDEM SCHIMBĂRILE CLIMATICE CU PRIVIRE LA AGENTII FRIGORIFICI

6. Rezumat

În această lucrare, este prezentată opinia noastră cu privire la "Cum vedem schimbările climatice în refrigerare", axată pe studiul comparativ al agenților frigorifici.

Decarbonizarea este obiectivul UE până în 2050. Reducerea emisiilor de dioxid de carbon prin utilizarea surselor de energie cu emisii reduse de carbon, este un obiectiv important, ceea ce duce la o producție mai mică de gaze cu efect de seră în atmosferă.

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