NAME : PORTAL
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GROUP REF. : D1
PREF. SUBJECT :PS2
QUESTION N° : Q2.02

GWP and future SF_6 regulations

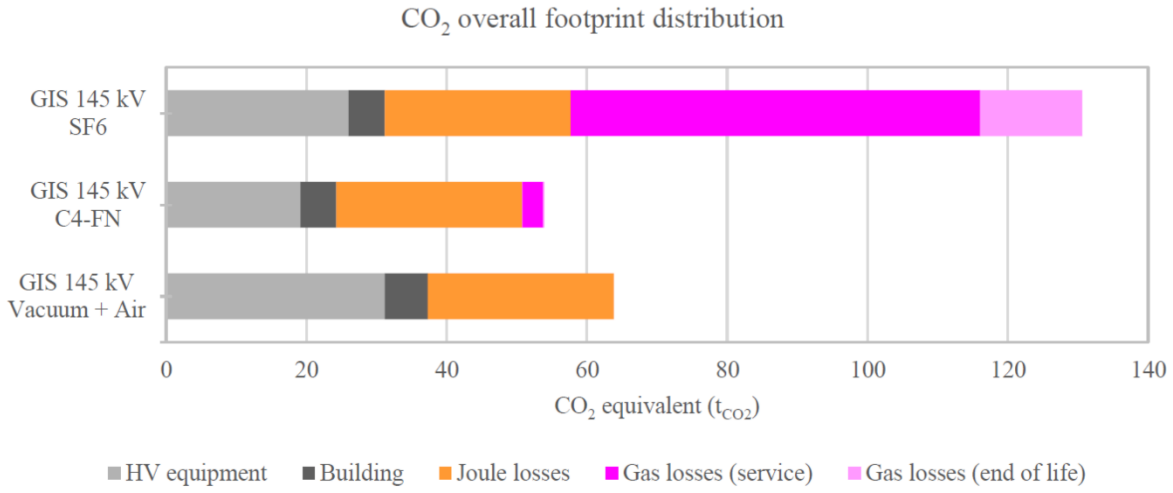
Question Q2.02: Some future legislation and utilities require a GWP below 1 or below 10, which can today be covered by some gases or gas mixtures only. Are there emerging any further new alternatives?

Over the last years, HV equipment manufacturers have made significant progress to develop SF_6-alternatives hence removing the most greenhouse gas from their solutions. One alternative for HV products is the use of C4-FN mixtures, which has been quickly developing thanks to its similarity with SF_6. Another solution is the use of air for insulation combined with vacuum interrupters, which are common in medium-voltage applications.
Some regulations have started to consider threshold on GWP to define which solution was the most suitable to replace SF_6 and mitigate climate change. GWP is a correct criterion when considering the sole gas contribution to the global warming, but a HV switchgear is much more than just a gas and as the gas is acting as insulation medium it is having significant impact on its size and its embedded carbon.

Gas GWP & Switchgear carbon footprint

Lowest gas GWP does not mean lowest carbon footprint for a high voltage switchgear. Indeed, being an insulating gas, it does significantly impact the switchgear design and lower dielectric performances leads to a bigger switchgear and ultimately more embedded carbon.

A comparison[1], helps to understand that selecting air (GWP=0) to replace SF_6 is leading to a higher CO_2 footprint than a mixture with C4-FN (GWP=640)



Gas GWP and future SF_6-free regulations

Last main regulatory move came from European Union in 2022. EU Commission issued in April 2022 a proposal of regulation[2] to limit, if not ban (when alternatives are available) the use of SF_6 for medium and high voltage switchgear.
This proposal has included a criterion based on the sole GWP to define which type of gas shall be selected. A threshold at 10 was introduced without considering the impact of this choice on the complete switchgear and not considering the global carbon footprint.
Feedback was given by the main stakeholders on EU portal[3] in June 2022:
This proposal of threshold at 10 was not welcomed by associations of users:
ENTSO- E[4]
„…recommend keeping only the GWP limit <2000"
Eurelectric[5]
"Revise the GWP (Global Warming Potential) threshold from 10 to 1000 for voltage levels above 24 kV"

While manufacturers of MV and HV switchgear, via their association, reminded that the climate change benefits of any alternative shall be considered taking into account the full product and not only the gas contribution via its GWP.
T&D Europe feedback[6] to the proposed EU regulation:
"… Life Cycle Assessment (LCA) method according to ISO 14040/44 is the state-of-the-art tool to evaluate the impact of products and systems on the environment. The GWP of the gas alone does not enable to assess the global carbon footprint of the electrical switchgear …"

As a conclusion, Is it worth limiting SF_6-free solution with a GWP<1 or 10 for switchgear applications?
The answer is clearly no and there is no new alternative coming in high voltage other than the ones already identified.

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[1] L. Treier et al, "Life Cycle Assessment comparison of different high voltage substation technologies using SF6 and alternative insulation gases" in CIGRE Paper B3-10674, Paris, 2022
[2] 52022PC0150, Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on fluorinated greenhouse gases, amending Directive (EU) 2019/1937 and repealing Regulation (EU) No 517/2014, Strasbourg, April 5th 2022.
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52022PC0150
[3] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12479-Fluorinated-greenhouse-gases-review-of-EU-rules-2015-20-/feedback_en?p_id=30057883
[4] ENTSO-E response to EC feedback period regarding the legislative F-Gas Regulation proposal published on 5 April, June 29th 2022.
https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12479-Fluorinated-greenhouse-gases-review-of-EU-rules-2015-20-/F3318600_en
[5] Revision of the F-Gas Regulation, A Eurelectric position paper, June 28th 2022.
https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12479-Fluorinated-greenhouse-gases-review-of-EU-rules-2015-20-/F3318181_en
[6] T&D Europe feedback on EU Regulation proposal, June 29th 2022.
https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12479-Fluorinated-greenhouse-gases-review-of-EU-rules-2015-20-/F3318603_en