

Executive Summary

The F-Gas Regulation adopted in 2024 sets out a clear path to phase out particularly harmful greenhouse gases in electrical switchgear. It already provides the tools needed to support this transition.

A new initiative now proposes to include electrical switchgear in the **Ecodesign for Sustainable Products Regulation (ESPR)**. While well intended, this step could create confusion, contradict existing rules, and slow down progress of phasing out F-gases.

We therefore caution against rushing into this additional regulation (ESPR) and propose targeted improvements to the F-Gas framework instead that support legal certainty, sufficient flexibility, sustainability, and incentivize innovation on SF₆-free solutions.

Key concerns with adding switchgear to ESPR:

- **Conflicting legislation**
Contradictory rules could lead to legal uncertainty and make tenders for new grid equipment more complex and time-consuming.
- **Risk of unintended market distortion**
This may favour technologies with F-gases based on carbon footprint alone. This could result in jeopardising market developments towards F-gas-free alternatives, thus contradicting the intention of the F-Gas Regulation.
- **Dependency risk**
Increases dependency on Chinese manufacturers, as they are currently the only producing C4FN gas, contradicting Europe's ambition for strategic autonomy.
- **Administrative burden**
Life cycle assessments (LCAs) would become mandatory in procurement, adding red tape for operators and public authorities, contradicting the EU's ambition to reduce bureaucracy.

Recommended next steps instead:

- Accelerate the market assessment especially on high-voltage switchgear under Article 35(5) of the F-Gas Regulation.
- Extend the protection against market monopolies by revisiting the two-year limit in Article 13(11)(b).

These steps could better support climate goals while ensuring a secure, affordable, and innovative grid development in Europe.

Context

Regulation (EU) 2024/573 on fluorinated greenhouse gases (“F-Gas Regulation”) was adopted in February 2024 aiming to phase out the use of fluorinated greenhouse gases. Specifically with regards to electrical switchgear, the F-Gas Regulation aims to phase out the use of SF₆¹ as well as other F-Gases such as Fluoronitrile (C₄FN), which grid operators use for insulation.

On 17 June 2025, a non-paper was presented to the EU Environment Council asking the European Commission to start work on a delegated act on the inclusion of electrical switchgear into the Ecodesign for Sustainable Products Regulation (ESPR) framework thereby providing for the requirements to put into effect Article 13(13) of the F-Gas Regulation.

The aim of this paper is to complement the perspective presented in the afore mentioned non-paper.

Technological flexibility in the F-Gas Regulation

Grid operators are committed to their central role in driving forward the energy transition, they ensure security of supply while protecting the climate and work together with manufacturers to replace SF₆. Competitive supply markets are a prerequisite ensuring reasonable prices for grid users, but also for the development of alternative solutions on the path towards phasing-out SF₆ in electrical switchgear for covering all applications needed in the European grid. During this technological transformation, a degree of technological flexibility is indispensable for grid operators.

The F-Gas Regulation currently provides for a level of flexibility to choose between different insulation and circuit-breaking gases, while clearly establishing a preference for GWP<1 from 2028 for switchgear ranging from 52 kV to 145kV as well as from 2032 for switchgear above 145 kV. Similar rules but with a complete F-gas ban exist from 2026 for switchgear below 24 kV and from 2030 for switchgear from 24 kV to 52 kV. If this technology is not sufficiently available, or technically not suitable, grid operators may choose alternatives such as Fluoronitrile-based solutions (C₄FN) **with GWP <1000, according to the so-called “cascade” in Art. 13 (9; 11-12)**. Thus, grid operators may procure and put into operation switchgear operating with natural origin gases (NOG, O₂/CO₂ or O₂/N₂ and vacuum) with GWP <1 (or, in medium voltage, F-gas-free technologies) on the one side, or C₄FN in gas mixture with NOG (GWP <1000) on the other side. This choice is important, since at this moment not all technical solutions with GWP<1 or without F-gases are fully developed and market available for *all applications* on the medium to highest voltage levels.

In addition, where substantiated concerns remain beyond these transition phases, Art 11 (5) allows for competent authorities to apply for further exemptions of up to four years.

However, some grid operators have expressed concerns that the existing derogations may not be sufficient, given their plans to invest in Fluoronitrile-based solutions over the coming decades. Some therefore call for ecodesign provisions on electrical switchgear in order to open the possibility to use the derogation in Art. 13 (13) F-Gas Regulation. However, from our point of view,

¹ SF₆ is the world’s most potent greenhouse gas, with a Global Warming Potential (GWP) of 23.500. This means that SF₆ is 23.500 times as harmful as CO₂, which serves as a reference gas.

<https://ghgprotocol.org/sites/default/files/2024-08/Global-Warming-Potential-Values %28August 2024%29.pdf>

this would lead to overregulation and further unintended consequences as explained further below.

Avoiding a monopoly situation on GWP<1 level

An issue that is often overlooked is the fact that the market situation is very different for air-insulated switchgear (AIS) and gas-insulated switchgear (GIS). GIS is much more compact in size and thus typically used in densely populated areas or where space limitations exist (e.g., on offshore platforms). For AIS, SF₆ has been replaced with natural origin gases (GWP<1), with at least three European suppliers ensuring sufficient market availability. A study among 6 European TSOs shows that until 2032, for voltage levels >145 kV the need for AIS is twice as high as for GIS.² For such GIS, however, alternatives with GWP<1 are still in the piloting phase and not available for all grid applications yet. Thus, in the transition towards GWP<1 (e.g., natural origin gases), GWP<1000 (C4FN) will have to play a role to avoid SF₆.

Grid operators have stressed many times that for GIS, a **supplier monopoly on the GWP<1 level might be looming after the ban dates**. There is indeed no reasonable justification for the two-year limitation of the “monopoly clause” in Art. 13 (11) b, which allows grid operators to resort to GWP<1000 in case only one manufacturer is bidding on a GWP<1 tender. On lower voltage levels, with different products being on the market in principle, existing manufacturing facilities struggle to keep up with demand for F-gas-free solutions, delivering on time, volume and in a cost-effective manner. **We call on policymakers to put measures in place to reduce the risk of creating supply-side monopolies, price spikes and supply shortages** combined with incentives to adopt SF₆-free and F-gas-free technologies. The two-year limitation to the monopoly-clause should thus be removed to ensure competition and to boost research and development.

The case against invoking Art. 13 (13) and the inclusion of electrical switchgear into the Ecodesign for Sustainable Products Regulation (ESPR) framework

Overregulation

In the European Union, approximately 80% of the market for high-voltage air-insulated switchgear is already served by manufacturers offering solutions with GWP<1. These technologies fully comply with the current F-Gas Regulation. However, should Art 13(13) be invoked, all of these switchgears would in addition need to comply with ESPR requirements. The reason is that the F-Gas Regulation does not distinguish switchgear across different types (e.g. AIS or GIS, complete switchgear assemblies or single components). **Thus, all switchgear (AIS equipment as well as GIS at all voltage levels) would fall into the full scope of the ESPR framework and have to comply with respective additional requirements.**

The ESPR would be poised to become a mandatory key criterion in the procurement of electrical switchgear, in addition to existing sustainability criterions. It may however result in narrowing the allowed solutions for special technical requirements. While its environmental goals are commendable, its implementation could significantly complicate public tenders, as is further explained below. This is because legal compliance would hinge on CO₂-emissions calculated in Life Cycle Assessment (LCA) results, introducing complexity, uncertainty and potential delays in procurement processes.

² [Future Needs and Common Approach of the Implementation of SF6 Free Equipment in the Grid of Six European TSOs - Session Materials | eCIGRE](#)

Creating legal uncertainties and administrative burden

The phrasing of Art. 13 (13) holds several legal uncertainties with regards to the conditions themselves and in relation to other articles of the F-gas Regulation. The wording of Art. 13 (13) could, in a worst-case scenario, be interpreted as Art. 13 (13) overriding Art. 13 (9) - which “shall not apply” -, resulting in Art. 13 (9) (as well as the transition rules in Art. 13 (11) and 13 (12)) no longer to apply. Subsequently, equipment offered on the basis of Art. 13 (13) obtains the priority: this would lead to a situation where all procurement of switchgear would be subject to ESPR and where the switchgear with the lowest carbon footprint on an LCA basis would have to be purchased, irrespective of the GWP of the insulation gas.

Grid operators need a regulatory framework which grants legal certainty. As mentioned above, invoking Art. 13 (13) would cause the exact opposite. If grid operators read Art. 13 (13) as a derogation they might face litigation, meaning every tender’s outcome could, in the worst-case scenario, be legally challenged by competing manufacturers or suppliers that have not been chosen, as ESPR focuses on essential operational needs (durability, reliability, repairability) but does not consider technical or project-related specificities laid down in the procurement process. Further uncertainty results from the fact that C4FN, besides being an F-Gas, is also a PFAS. This is relevant not only in the context of the ongoing PFAS restriction process at the European Chemicals Agency ECHA. Even if ECHA concludes not to prohibit C4FN for now, a potential prohibition in the future could complicate the handling of the gas as the assets have a lifetime of several decades. Further concerns relate to workers’ safety, emission levels for the environment, secure supply of C4FN and permitting.

On top of that, even with a standardized methodology for conducting an LCA, the outcome of the LCA is driven by the underlying data and by a variety of influencing factors. This additional need for verification and documentation implied by this, both for operators but also for national authorities, would likely create significant administrative burden.

Art. 13 (13) risks limiting the supply market and distorting competition

In our view, invoking Art. 13 (13) would not contribute to broadening the market for all alternative switchgear technologies. On the contrary, the introduction of ecodesign requirements and the application of the existing Art.13 (13) of the F-Gas Regulation could have the opposite effect especially for AIS-equipment.

Art. 13 (13) of the F-Gas Regulation focuses merely on the CO₂-footprint of the electrical switchgear. If ESPR provisions for electrical switchgear were adopted, even high-GWP solutions as C4FN could be favoured due to less use of raw materials like steel and aluminium, both of which are already going to be covered in the next ESPR working plan. This could result in jeopardising market developments for SF₆ alternatives especially with GWP <1, thus contradicting the intention of the F-Gas Regulation. A monopoly on the required GWP <1 or F-gas-free solutions can only be avoided if incentives for such technologies remain in place, ensuring a level playing field for all manufacturers.

What is more, the market signals could be potentially misleading since the LCA resulting from the ESPR framework only considers life-cycle greenhouse gas emissions. Other environmental dimensions of the LCA of switchgear are not considered (e.g., eco-toxicity for freshwater and soil, human toxicity, etc.).

C4FN dependency on China

Some network operators hesitate to use C4FN-based switchgear to avoid reliance on China. 3M, the former patent holder of the C4FN gas, announced ending global production of PFAS (incl. C4FN)³ due to environmental concerns and legal challenges in the EU and US. This has resulted in a Chinese monopoly on C4FN exports, which are essential for C4FN gas mixtures (GWP<1000). Invoking Art. 13 (13) could potentially promote solutions using C4FN, which may increase dependency on China for the procurement of the gas.

Conclusion

The F-Gas Regulation certainly holds room for improvement. However, an inclusion of switchgear in the ESPR framework at this point is neither necessary nor beneficial, as it creates a competing legal framework that provides legal and market insecurity for the whole sector. Despite its deficiencies, the F-Gas Regulation provides a predictable legal framework and holds flexibility to procure all technical alternatives to SF₆. Ultimately, and in the long term, the ambition level of the F-Gas Regulation regarding the phase-out of F-gases should be maintained and not undermined via the inclusion of electrical switchgear in the ESPR framework.

Instead, we recommend other measures that could significantly improve the application of the F-Gas Regulation and avoid a monopoly situation for gas-insulated switchgear.

- Instead of including electrical switchgear in ESPR, advance now the planned report of Art. 35(5) F-Gas Regulation on medium- and high-voltage switchgear and a potential monopoly situation.
 - This would contribute to assessing the market situation and exploring ways for a targeted and structured review of certain provisions in the F-Gas Regulation.
- Remove the two-year limitation of the “monopoly clause” in Art. 13 (11) b)
 - Also 2 years after the individual ban date of each voltage level have elapsed, this would uphold the competition between technologies based on gases with different GWP values as long as there is only a single manufacturer offering GWP <1 (or F-gas-free technologies in medium voltage levels). It would boost competition and innovation and avoid spiking prices due to a potential monopoly.

³ <https://news.3m.com/2022-12-20-3M-to-Exit-PFAS-Manufacturing-by-the-End-of-2025>

