

Adoption of SF₆-free equipment

Answer to question 1.16. According to the papers, the most important scope 1 emissions for transmission system operators are linked with SF₆. This gas being a very potent GHG contributor measures are taken to limit leakages in the atmosphere during erection, operation, maintenance, end-of-life management, and failure of gas insulated equipment. As shown in the paper from manufacturers, technical solutions exist to replace SF₆ in power equipment, even if the dielectric and arch switching characteristics of the gas are unbeatable. What are the development pathways to adopt SF₆-free equipment? What R&D and pre-normative activities are deemed important in view of the deployment of such technologies?

SF₆ is the main insulating and interrupting medium used in high voltage switchgear. It has excellent dielectric, thermal, and arc quenching properties. However, SF₆ is also the most potent greenhouse gas and its use in high voltage equipment results in non-negligible emissions in the atmosphere.

As part of the global effort to reduce the CO₂-equivalent emissions, the electricity generation and transmission actors have a key role to play. Specifically, regarding switchgear, the use of SF₆ drastically dominates the high-voltage switchgear applications. Leading to high-performance and compact equipment, SF₆ is a good technical solution. However, it is also very polluting with the highest Global Warming Potential (GWP) of 25200 and it is directly targeted by the Kyoto's protocol.

To replace SF₆ in high voltage switchgear, C₄-FN gas mixtures, where C₄-FN (C₄F₇N) is mixed with O₂, CO₂ and/or N₂, are being developed and installed all over the world. C₄-FN gas mixtures technology maintain the dimensional footprint and performances of SF₆ equipment while drastically reducing their total carbon footprint.

SF₆ regulations

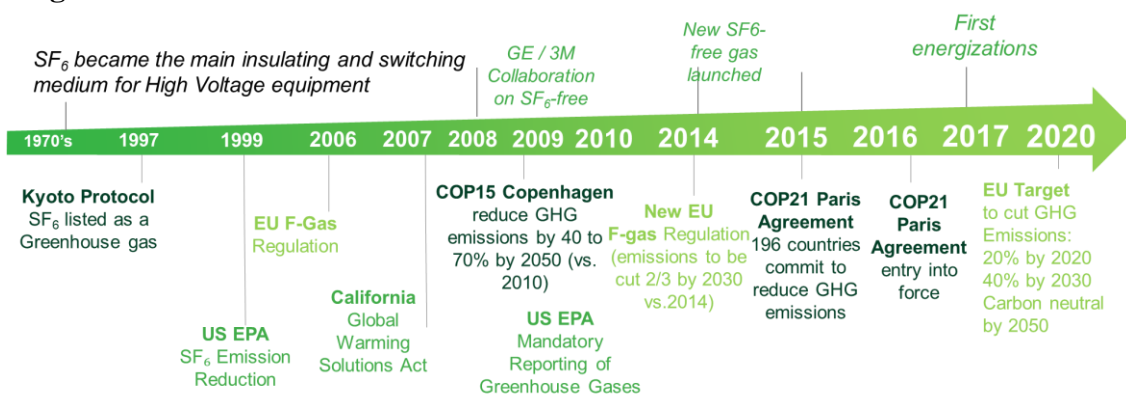


Fig. 1 :

Growing number of SF₆ regulations in the world.

Standardization and pre-normative activities is moving forward

CIGRE Working Groups working on Alternatives for SF₆

- B3.45 Application of non-SF₆ gases or gas-mixtures in medium voltage and high voltage gas-insulated switchgear. Piet KNOL (NL) (Brochure no. 802)
- D1.51 Dielectric performance of eco-friendly gas insulated systems. Hiroyuki HAMA (JP) (Brochure no. 730)
- D1.66 Requirements for PD monitoring. Wojciech KOLTUNOWICZ (AT)
- D1.67 Dielectric performance of non-SF₆ gases. Christian FRANCK (CH) (Brochure no. 849)
- A3.41 Interruption, switching performance with SF₆ free switching equipment. Rene SMEETS (NL) (Brochure no. 871)



Outlook :

New JWG B3/A3.60: User guide for non-SF₆ gases and gas mixtures in Substation

Scope:

• Practical user aspects on application of non-SF₆ gases or mixtures in MV and HV GIS

Outcome: Provide guidance to following aspects

- 1) Handling guide with a focus on achievable filling accuracy and maintainability,
- 2) Gas measurement guide according to TB 723,
- 3) Tightness guide and requirements,
- 4) Environmental, health and safety aspects,
- 5) End-of-life treatment and recycling guide according to TB 234

Conclusion: Cigre, IEC, IEEE are jointly working to set the regulatory framework for the adoption of SF₆-free equipment.