The impact of F-gas regulation

08/21/2014 - 12.09 pm

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SF6-FREE SOLUTIONS SF_6

A new European Union F-gas regulation comes into force in January 2015. By 2030 the objective is to cut the EU's F-gas emissions by two-thirds compared with 2014 levels. Three experts discuss: Frédéric Camuset, VP EHS & sustainable development (Alstom), Yannick Kieffel, Materials and Eco-Design Department Manager (Alstom) and Haleem Abh, Asset Manager Regional Manager of TNB Malaysia.

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How will the new regulation help the existing measures to cut F-gas emissions?

Frédéric Camuset: F-gas emissions have risen 60 % since 1990 – in contrast to all other greenhouse gases, which have been reduced. So the existing regulation had to be reinforced to stop this negative trend.
The new regulation imposes some additional requirements compared with the 2006 version, including:

- the obligation for operators to prevent unintentional F-gas release and to make repairs “without undue delay” when a leakage is detected;
- the obligation to check leakage detection systems every 6 years;

- training and certification for personnel carrying out installation, servicing, maintenance, repair or decommissioning of electrical switchgear that contains SF_6;
- the obligation to indicate the quantity of SF_6 expressed in CO_2 equivalent and the SF_6 global warming potential (GWP: 22,800 according to the regulation in force) on labels and advertising;
- the obligation to report quantities of SF_6 contained in products placed on the market.

What are the biggest changes compared with the first regulation?

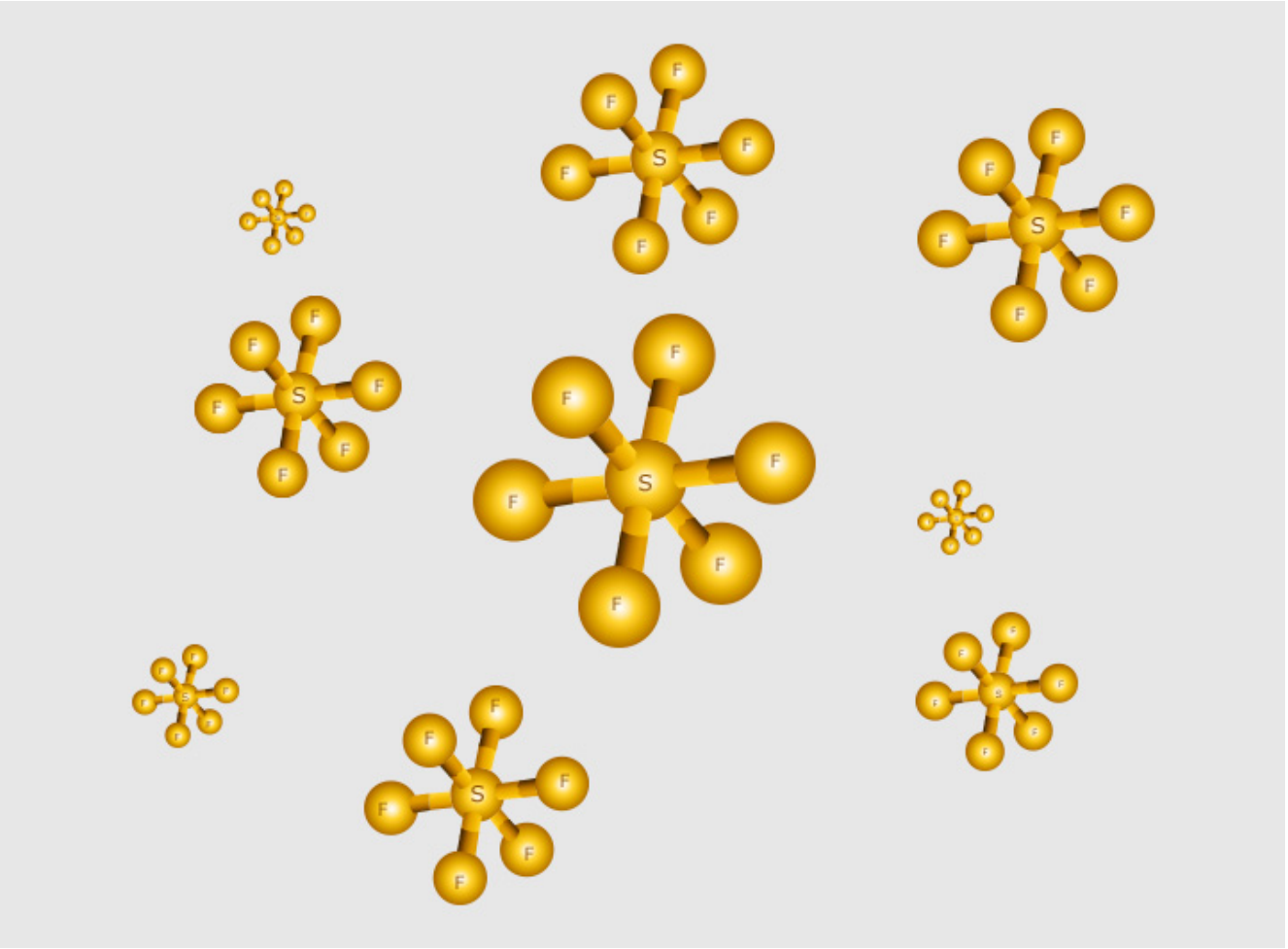
F.C.: The biggest changes concern leakage prevention and repair without delay. This will force operators to institute systematic monitoring and prevention of F-gas leakages. For high voltage switchgear, such systems already exist, and IEC standards limit maximum leakage rates at 0.5 % to 1 % per year per gas-filled compartment.

Alstom already complies with most of the new regulation. The greatest impact is related to training: this represents over 1,000 people to train by 2015. It will be done through our Technical Institutes and a dedicated e-learning programme, combined with hands-on training.

How will it stimulate innovation and job creation?

F.C.: The new regulation will stimulate innovation and green growth and jobs by encouraging the use of green technologies based on less climate-harmful alternatives. It should also improve prospects for a future global agreement to phase down the use of F-gases under the Montreal Protocol on the protection of the ozone layer.

Member states are encouraged to develop "producer responsibility schemes", which means that specific programmes will be deployed in each country to reach the level of requirements expected. Innovation in this domain will therefore continue and create expertise and jobs around eco-design and green technologies.



« The new EU F-gas regulation confirms our voluntary commitment to cut SF_6 emissions. »

How did the drafting of the regulation evolve from the industry's point of view?

Yannick Kieffel: Alstom Grid, as a member of the T&D Europe Association, was actively involved in the drafting process. For example, when the Committee on the Environment, Public Health and Food Safety issued a report proposing to prohibit SF_6 in medium-voltage secondary switchgear from January 2020, the association explained that the technology is not mature enough to meet that target. As a result, the final text was

modified, replacing the SF_6 ban by a report to be published in 2020 assessing whether alternatives exist to replace fluorinated greenhouse gases in new medium-voltage secondary switchgear.

What solutions can electrical equipment manufacturers like Alstom propose?

Y.K.: The new EU F-gas regulation confirms our voluntary commitment to cut SF_6 emissions. Many developments have centred on that target: improving technology and design, reducing leakage through an optimised gasket, and improving SF_6 handling and recovery techniques. One solution is to develop fully SF_6-free technologies for circuit breakers, based on a vacuum interrupter in combination with nitrogen for insulation. This technique is now in use in the VL109, the 72.5 kV SF6-free live tank circuit breaker. Another solution could be a new gas, a solution that you might discover at CIGRE in Paris this week or in the next issue of Think Grid in 2 weeks.

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Does the latest EU F-gas regulation influence non-European utilities installing gas-insulated equipment?

H.A.: The F-gas regulation is a structured and systematic way of organising and managing SF_6 and its by-products. It forces the industry to minimise its usage and consequently its impact in case of leakage or contamination through flashover. It even perhaps motivates the industry to look for an alternative or focus on vacuum technology. Utilities still need equipment with GIS capability owing to limited land availability,

logistics and security of supply. The GIS product itself will see an evolution to improved design or, eventually, the total replacement of SF_6.

Is there a national regulation of this kind in your country, or plans to introduce one? If so, how will it impact your network development?

H.A.: So far, there is no specific regulation on SF_6. However, our utility has adopted the Kyoto Protocol and is currently developing SF_6 accounting tools to help better manage this gas in our business. At the moment, this has no negative impact on network development, and domestic demand continues to rise in line with the national rate of economic development thanks to the build-up of capacity on the transmission network.

Calculating the greenhouse gas effect

The global warming potential (GWP) is the measure used to ascertain the contribution of a gas to global warming. It is not an absolute figure, but indicates the climatic warming potential of a greenhouse gas relative to that of carbon dioxide (with a GWP of 1). Specifically, it is calculated in terms of the 100-year warming potential of 1 kilogram of the gas relative to 1 kilogram of CO_2.

The GWP includes 2 key parameters: the radiative efficiency of the gas (the absorption in the atmosphere) and the timescale (how long it takes for the substance to be removed from the atmosphere).

The formula for calculating the GWP of a given substance is:

$$GWP_x = \frac{\int_0^{ITH} F_x C_{x_0} e^{(-t/\tau_x)} dt}{\int_0^{ITH} F_{CO_2} C_{CO_2}(t) dt}$$

where ITH is the Integration Time Horizon over which the calculation is considered (here we consider 100 years), F_x is the radiative efficiency due to a unit increase in atmospheric abundance of the substance in question, C_{x0} is the instantaneous release of the substance and τx being the atmospheric lifetime of the substance. In the calculation the $e(-t/\tau x)$ represents the time-dependent decay in abundance of the substance, and the corresponding quantities for CO_2 are in the denominator.
The GWPs of various greenhouse gases can therefore be easily compared to determine which will cause the greatest integrated radiative forcing over the time horizon of interest. The atmospheric lifetime of the gas in the atmosphere is, of course, a key parameter. The higher the atmospheric lifetime, the higher the GWP is. For SF_6, atmospheric lifetime is 3,200 years.

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