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**SUB: Proposed Amendments to the Regulation for Reducing SF6 Emission from GIS**

Respected Ms. Bylin,

Siemens being a pioneer and driver of sustainability, fully supports the California Air Resource Board (CARB) for sustainable development, focused on climate change and clean energy via the amendments to the regulation for reducing sulfur Hexafluoride gas and finding alternative substances for electrical insulation with lower GWP.

- "We develop our products, solutions and services using a life cycle perspective and sound eco-design standards."
- "We minimize the environmental impact of our operations through environmental management programs, and we aim to become carbon-neutral by 2030."
- "We help our customers increase energy efficiency, save resources and reduce carbon emissions."

However, we would like to submit our comments on few clauses related to **Medium Voltage GIE (≤38kV)** as stipulated in the released draft of Proposed Amendments to the Regulation for Reducing Sulphur Hexafluoride Emission from Gas Insulated Switchgear dated July 21st, 2020 as follows.

1- Clause 95351-a (Page 2): **Active GIE**: Active GIE has been defined as only non-hermetically sealed. Is there a valid reason why hermetically sealed GIE is excluded?
2- Clause 95351-a (Page 4): **Gas Insulated Equipment**: Vacuum is not an insulating medium neither in MV nor in HV switchgear. Vacuum technology is used for switching / arc quenching purpose only. Since the clause refer to "insulating and/or interrupting functions", it would be appropriate to eliminate the word "insulating" in the sentence "insulating media".
3- Clause 95351-a (Page 5): **Global Warming Potential or GWP:** We request to have a copy of table A-1 to further comment on its constituent.
4- Clause 95351-a (Page 5): **Global Warming Potential or GWP:** We have noticed that no reporting requirement for the not "covered insulation gases" is stated, meaning insulation gases with GWP less or equal than one (clause 95351-a, page 3). Is there any valid reason why the substance NOVEC 5110 (C5-PFK) is additionally explicitly mentioned not falling under the reporting requirement?
5- Clause 95351-a (Page 5): **Hermetically Sealed GIE:** The definition stipulated is in contradiction to the international standard IEC 62271.
6- Clause 95353-b (Page 10): **Annual Emission Limits:** In the formula for calculating average system capacity, "n" has been referred to the active GIE, i.e only non-hermetically sealed equipment (as per the stipulated definition). Is there any reason why hermetically sealed GIE shall not be part of the calculation?
7- Clause 95353-d (Page 11): **Annual Emission Limits:** As per this clause, we understand that the early credit applies to Circuit Breaker only. Is there an early credit program for the GIE too?

**Further Consideration:**

We recognize an excellent work that CARB has done in establishing a reasonable regulation, however, in addition to the above comments, on the $SF_6$ phase-out dates, we would like to direct CARB's attention towards $SF_6$ alternatives which must fulfil specific requirements: Long-term stability must preserve operator's CAPEX and OPEX and the $CO_2$ equivalent reduction must be assured over lifetime to be real environmentally friendly. Alternatives must also respond to the following questions:

- Shall sustainable $SF_6$ alternatives contain F-gases?
- Which technical performance restrictions are acceptable?
- Which EHS drawbacks offset GWP reduction?
- Are handling and process modifications riskless?
- Which socio economic impact must be considered?
- Are alternatives mirrored in upgrading of Standards – gas handling, GIE standards

Some of these questions are currently addressed by international activities at Study Committees of the International Council on Large Electric Systems (CIGRE). At IEC an ad hoc working group has identified the set of international Standards that will have to be adapted to cover alternative gases or gas mixtures to $SF_6$ in electrical equipment. Today an IEC Maintenance Team only addresses IEC 62271-4 "High-voltage switchgear and control gear - Handling procedures for $SF_6$ and its mixtures" with a targeted publication of the revised Standard by September 2022.

A range of alternative gases and gas mixtures for medium-voltage applications are promoted on the market in hopes of meeting demand for a full $SF_6$ substitute. Those include natural origin gases ($N_2$, $O_2$, $CO_2$) and its mixtures and gas mixtures based on partially new developed other F-gases (e.g. Fluoronitrile, Fluoroketone) targeting to meet, or at least coming close to $SF_6$'s unique technical performance, i.e. among others dielectric behavior, switching and short-circuit capabilities, heat transfer, chemical stability incl. recombination ability. All of those while keeping today's $SF_6$ physical switchgear footprint.

Beside the technical performance of alternative gases and gas mixtures specific attention must be turned to environmental, health and safety (EHS) topics. An indication is given by the alternative substances manufacturer's Safety Data Sheets where the latest findings of applied pure substance research is recorded in revolving document issues. Although data might be available for amount of substance used today, data are missing for amount of substance to fully cover a wide application in industry.
In addition, end-of-life treatment of those substances and its mixtures applied in electrical equipment must be observed just as its alteration during the switchgear equipment's operation by electrical and chemical effects. Those relate e.g. to switching, ordinary or abnormal partial discharge and may produce by-products with anomalous EHS effects or influence the alternative gases' and gas mixtures' overall performance.

CARB's discussion draft of "Potential Changes to the Regulation for Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear", include fixed phase-out dates when owners of medium-voltage $SF_6$ gas-insulated equipment may no longer acquire this kind of equipment.
Considering the fact that significant product development and gaining long-term experience in operation is still required, along with cost-intensive, complex, time-consuming overall industrialization of a comprehensive $SF_6$-free portfolio in order to cover the full range of today's $SF_6$ gas-insulated medium-voltage products and systems, a fixed phase-out date seems not to be appropriate.

It bears the risk that non-sustainable alternatives are forced into operation while important and essential EHS topics are still not exclusively answered.
CARB should allow frequent review of technological development in the area of medium-voltage electrical T&D equipment via piloting rather than providing fixed $SF_6$ equipment phase-out dates and making alignment with other international initiatives via best practice sharing.

**The Siemens approach**

Siemens blue GIS (SF6 free GIE) limited portfolio is based on three conclusive pillars:

- Relying on well-proven and highly reliable vacuum interrupter technology for switching purposes.
- Using natural origin gases based on the components of ambient air (“Clean Air”) for dielectric insulation within the equipment which is environmentally friendly since it comprises no artificial F-gases or chemical additives.
- Keeping all benefits known for decades from matured, high-technology $SF_6$ gas-insulated switchgear.

**Conclusion:**

Effective and economic support for the development and market readiness should be the goal for applications of new medium-voltage $SF_6$-free technologies from 2030 onwards. Economic concerns for manufacturers and operators must be considered, particularly since clear market signals are currently missing for a complete, cost-intensive, complex, time-consuming overall industrialization of a portfolio and for a further portfolio development application by application.

Clear distinction shall be made between medium-voltage sealed pressure system equipment versus high-voltage closed pressure system equipment. The International Electrotechnical Commission supplies a clear definition of those pressure systems which shall be applicable worldwide to avoid any disarray.

Special attention shall be turned to EHS topics and the socio-economic impact of promoted alternatives. Newly developed F-gases and its by-products leave questions open concerning its toxicity and remaining risks concerning carcinogenetic and mutagenic impact.

CARB should allow frequent review of technological development in the area of medium-voltage electrical T&D equipment via piloting rather than fixed $SF_6$ equipment phase-out dates.

Chronological adjustment with standardization activities which describe application, design and performance criteria and handling of alternative gases or gas mixtures in electrical equipment shall be considered. Other regional and international initiatives e.g. European F-Gas regulation, European Manufacturers and grid operator’s self-commitment, CIGRE Study Committees and IEC Standardization shall be reviewed for best practice sharing.

Thanking you,

Hassan Syed Mohammad

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