

GE unveils world's 1st 420 kV SF₆-free g³ circuit-breaker for gas-insulated substations

- *GE's g³ 420 kV gas-insulated substation (GIS) circuit-breaker prototype demonstrates that g³ technology can be used at Europe's highest voltage level, as well as other global voltage levels*
- *The use of g³ switching and insulation gas to replace SF₆, a potent greenhouse gas, helps reduce the global warming potential (GWP) by more than 99%*
- *The LifeGRID project, co-funded by EU's LIFE Programme, puts GE's Grid Solutions at the forefront of the industry's effort to create a cleaner grid.*

Paris, FRANCE - MARCH 29, 2022 – In a historical milestone for the power industry, GE Renewable Energy's Grid Solutions (NYSE-GE) unveiled the world's first 420 kV, 63 kA g³ gas-insulated substation (GIS) circuit-breaker¹ prototype. The g³ circuit-breaker was presented to a group of leading transmission utilities from across Europe, at a recent virtual roundtable event. The performance achieved by the prototype means that the industry will soon have a viable SF₆-free alternative for high voltage products. GE's 420 kV fully g³ gas-insulated substation (GIS), which includes the g³ circuit-breaker, is expected to be commercially available in 2023.

A circuit-breaker is protective equipment that is critical to any substation and mainly used to cut or redirect power through another path if there is a problem on the electrical grid. This new circuit-breaker relies on GE's game-changing [g³ \(pronounced "g"-cubed\) gas-insulating and switching technology](#). g³ technology allows GE to build electrical equipment with the same high performance and compact size as traditional SF₆ products², along with a gas CO₂e impact reduced by 99%.

"The development of GE's 420 kV g³ circuit-breaker is a historical milestone for the power industry as it will allow utilities to accelerate the decarbonization of their electrical grids. Until today, there was no viable alternative to SF₆ for GIS at the 420 kV level, the highest voltage level in Europe. This means that the g³

technology can also be applied to all existing main voltage levels around the world. We are proud to be at the forefront of the effort to create a cleaner grid and are currently developing other g³ circuit-breaker types, according to [our roadmap](#),” said [Vera Silva](#), Chief Technology Officer at GE’s Grid Solutions.

To develop the 420 kV g³ circuit-breaker, GE’s LifeGRID project received funding from the European Union under the [European Commission's LIFE Programme](#). GE’s Grid Solutions’ research and development experts collaborated with several European partners on the project, including [SSEN Transmission, who contracted with GE in December 2020 to install the world’s first 420 kV g³ GIS](#) featuring the g³ circuit-breaker, at its Kintore substation in Scotland.

“Delivering a network for net zero is core to our long-term strategy—although our environmental commitment extends much beyond that,” said [Matthew Barnett](#), SSEN transmission electrical plant subject matter expert. “To help us achieve this, we’re delighted to support GE with the LifeGRID project, which works to overcome one of the biggest technical challenges in removing SF₆ from new equipment through the development of a 420 kV SF₆-free circuit-breaker. The successful testing performed so far is an important step in showing that the SF₆-free circuit-breaker is technically achievable.”

Today, more than 30 leading electrical utilities from 12 European countries and South Korea have already adopted GE’s g³ products for their high voltage networks, avoiding the addition of more than a million tons of CO₂ equivalent to the grid. That’s the equivalent of removing about half a million petrol cars from the road for one year.

More on the LifeGrid Project

GE’s [LifeGRID](#) project involves development of the 420 kV g³ circuit-breaker that will be the core component of the first-ever 420 kV g³ gas-insulated substation (GIS).

“GE’s LifeGRID project, co-funded by EU’s LIFE Programme, has been a great opportunity for us to collaborate with different partners in Europe to enhance our

knowledge about our g³ gas technology while helping decarbonize electrical grids,” said Yannick Kieffel, GE’s Grid Solutions’ project leader for this EU-funded g³ project and CTO of High Voltage Switchgear-Power Quality Products (HVS-PQP) division. Partners include the Czech Republic’s Brno University and Germany’s Leibniz Institute for Plasma Science and Technology, who built the scientific database; CEA, a leading French technological research center taking part in specific materials and technologies development; and SSEN Transmission in the UK as the Transmission System Operators (TSOs) providing user feedback throughout the phases of product development and resulting final implementation.

For more information on GE’s high-voltage g³ substation equipment and product roadmap, [visit the Grid Solutions website](#).

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Notes to the Editor:

1. **Circuit-breaker:** High-voltage 420 kV circuit-breakers are found at electrical substations on long-distance transmission networks. Circuit-breakers can be air-insulated or, when space is a constraint, gas-insulated.
2. **SF₆:** Due to its strong insulating and arc-quenching properties, SF₆ has been, and continues to be widely used in primary substation equipment in the transmission industry. It is, however, a greenhouse gas that contributes significantly to global warming, if leaked.

About GE’s Grid Solutions

Grid Solutions, a GE Renewable Energy business, serves customers globally with over 12,000 employees. Grid Solutions provides power utilities and industries worldwide with equipment, systems and services to bring power reliably and efficiently from the point of generation to end power consumers. Grid Solutions is focused on addressing the challenges of the energy transition by enabling the safe and reliable connection of renewable and distributed energy resources to the grid. We electrify the world with advanced grid technologies and accelerate the energy transition. For more about GE’s Grid Solutions, visit

<https://www.gegridsolutions.com>.

About GE's g³ gas

GE's alternative to SF₆ is g³ insulating and switching gas, representing the culmination of a decade of research and development by its teams in France, Germany and Switzerland in collaboration with 3M Company. The g³ gas mixture is based on carbon dioxide, oxygen, and 3M™ Novec™ 4710 Dielectric Fluid from the 3M fluoronitrile family. Fluoronitrile was identified by R&D experts as the most suitable additive to CO₂ and O₂ to reach the targeted environmental benefit of an alternative to SF₆, without compromising the equipment's technical performance and footprint. As a result, the global warming potential (GWP) of GE's g³ gas mass in the equipment is 99% lower as compared to SF₆.

GE's g³ gas-insulated products are currently available for [live-tank circuit-breakers](#) and [gas-insulated substations](#) (GIS) up to 145 kV, as well as [gas-insulated lines](#) (GIL) up to 420 kV.

More about g³ – [GE's alternative to SF₆ \(gegridsolutions.com\)](#).

More about g³ development, GE's fluoronitrile based gas mixture: [In search of an SF₆ replacement | Think Grid \(think-grid.org\)](#)

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