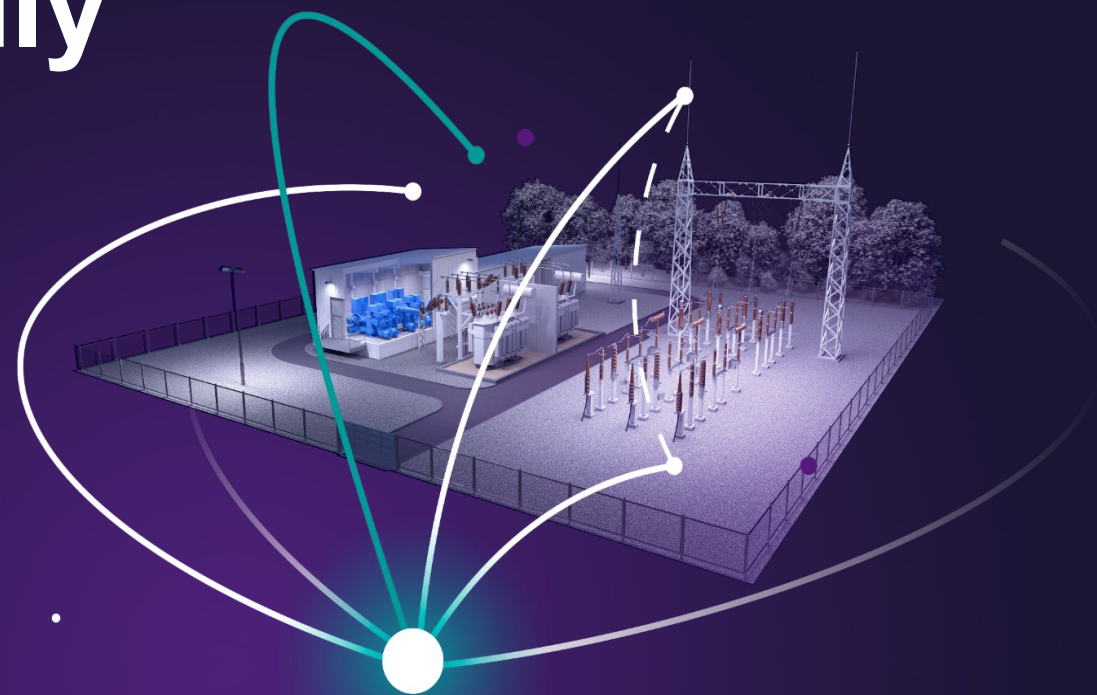


The real challenges in transition to eco-friendly power networks

Product technologies

Dr. Mark Kuschel –
CTO Switching Products & Systems

17/03/2022 - KEMA Labs webinar



Siemens Energy is fully committed to UN Sustainable Development Goals, provide Sustainable Products and enable Energy Transition

Power Grids Action Fields



A F-Gas-Free

B Sustainable

C Resilient

D Embedded DC

E Digital

- **Health and Well-being**
ZERO toxicity, ZERO pollution,
ZERO PFAS F-gases (forever chemicals)
- **Affordable and Clean Energy**
Clean generation: ZERO GHG emission by
renewable generation
Clean grids: ZERO GHG, Low losses,
Ester fluid instead mineral oil, Intelligent
- **Climate Action**
Decarbonised products, green power for own
locations & factories, decarbonised supply chains

F-gas-free grids: Zero compromises on GWP, health, safety and technical abilities and lead to public and market acceptance

Aspects to be considered



Environment



Health & Safety



Regulation



Costs



Technical capability

Clean Air & Vacuum Switching *

Zero GHG (green house gases), GWP = 0

Zero degrading effects during operation
Zero toxicity and hazard, Zero PFAS Gases**

Zero cost risks due to F-gas regulations

Zero maintenance (VI is sealed for life)
Minimum lifecycle and end-of-life costs

Zero degrading effects of the switching gas
Highest short-circuit capability



80 % N₂ + 20 % O₂



Vacuum



Maximum
stakeholder
acceptance



* Clean Air = 80 % Nitrogen N₂ + 20 % Oxygen O₂ for insulation and VI = Vacuum Interrupter for switching ** Per- und polyfluoroalkyl substances as e.g. Fluoronitrile C₄FN & Fluoroketone C₅FK

T&D equipment manufacturers committed to ZERO F-gases

**Toward T&D equipment
free of fluorinated gases
for sustainable, climate-neutral power grids**

A joint statement of T&D equipment manufacturers

2021/11/02

The recently published 6th Intergovernmental Panel on Climate Change (IPCC) report shows the seriousness of the climate crisis. Human activity is changing the climate in unprecedented and sometimes irreversible ways. The electrical transmission and distribution (T&D) industry has an opportunity to lead society's response to deliver infrastructures that are targeting climate-neutral objective to underpin the transition to net zero emission economies.

The clean transport of low-carbon electricity is an essential element of national decarbonization plans, which will underpin the sustainable economies of the future. In conjunction with decarbonized power generation using renewable energy sources, it is vital to do the same for T&D power grids upon which the system relies.

For over 50 years, the recognized insulation and switching performance as well as proven and stable characteristics of SF₆ have contributed to the reliability, efficiency, and resilience of power network facilities, enabling compact equipment for all voltage classes. However, because SF₆ has a global warming potential over 25,000 times greater than CO₂, action is now required to achieve truly sustainable power grids. To enable this change, we need to limit the SF₆ emissions and install new electrical equipment using clean reliable and non-toxic alternatives.

As equipment manufacturers, we embrace our responsibility to society and are fully committed to the net zero goal. Each of the undersigned has already developed or is in the process of developing T&D equipment completely free of fluorinated gases. The phase-out of fluorinated and PFAS-gases (per- and polyfluoroalkyl substances) in electrical T&D equipment, where alternatives are available, would accelerate progress toward a more sustainable future.

Each of the undersigned is committed to delivering T&D equipment free of fluorinated-gas and PFAS-gas needed to enable this transition. The first F-gas free products are successfully in operation, and each of the signing companies is committed to close the remaining portfolio gaps in the upcoming years in order to deliver on science-based net zero targets (SBTi) that companies are setting. These products will help deliver our own company health and climate commitments while enabling environmental improvements.

You are welcome to join in delivering this ambition and building truly sustainable clean power grids for a climate-neutral future.

The undersigned will continue to develop, manufacture, sell, and service independently. This statement shall in no way create any joint responsibility or liability or any form of cooperation or joint venture.



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President Critical
Systems Division
Electrical Sector EMEA
Eaton



Sao Huang
President & CEO
LJIN Electric Co.,
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SIEMENS

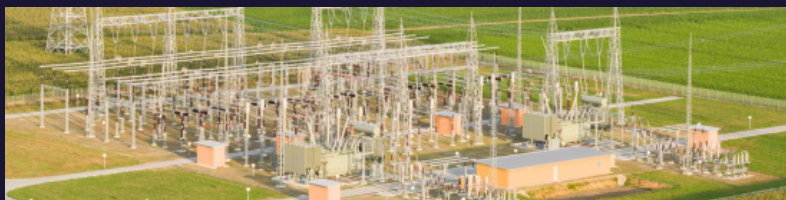
Stephan May
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TOSHIBA

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Toshiba Energy Systems &
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A joint statement of Pfiffner and Trench as AIS Instrument Transformer manufacturers

Environmental aspects are drastically gaining importance and becoming an essential part of today's society. Recent natural disasters, floods and drought followed by wildfires send a clear signal that the status quo needs to change.

The decarbonization of the power generation sector is ongoing with renewable energy making an essential contribution. The T&D sector needs to follow and foster the decarbonization process.

With its outstanding insulation and safety properties, SF₆ is traditionally used in AIS High Voltage Instrument Transformers. SF₆ is, however, considered to be a gas contributing to global warming when it is released into the atmosphere.

Trench and Pfiffner, both leading manufacturers of AIS High Voltage Instrument Transformers with SF₆ insulation, with the aim to support decarbonization efforts, commit to focus their development activities in this product application on entirely F-gas free solutions. Both companies consider pure Air as a suitable solution in AIS applications to reduce the environmental impact to the maximum extent possible and contribute significantly to the decarbonization required to safeguard our planet.

The "Clean Air or SynAir Technology" is based on field proven SF₆ designs offering the same operational benefits such as explosion safety, > 95% recyclability, maintenance freedom, and reliability.

While both companies will continue to develop their Air-based technology independently, they will work on standardizing aspects relevant to customers (e.g., diameter of filling devices) to reduce complexity for the Transmission Operators and their service teams.



TRENCH

Dr. Bahadır Basdere
President Trench Group



Current and voltage – our passion

Dr. Jürgen Bernauer
Group CEO Pfiffner International

SIEMENS
energy

Press release

Berlin, November 22, 2021

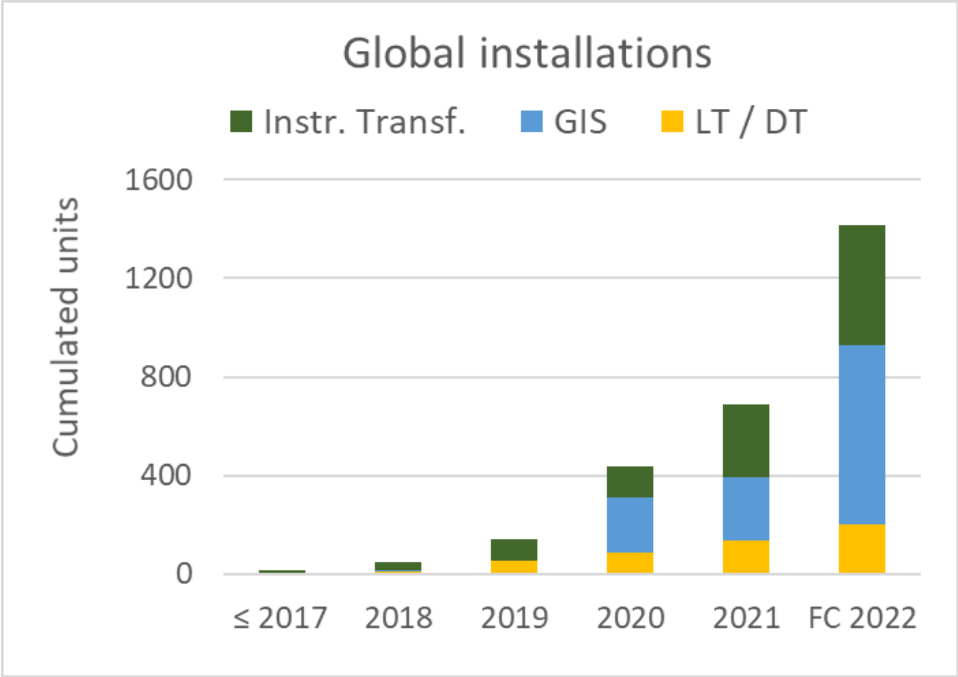
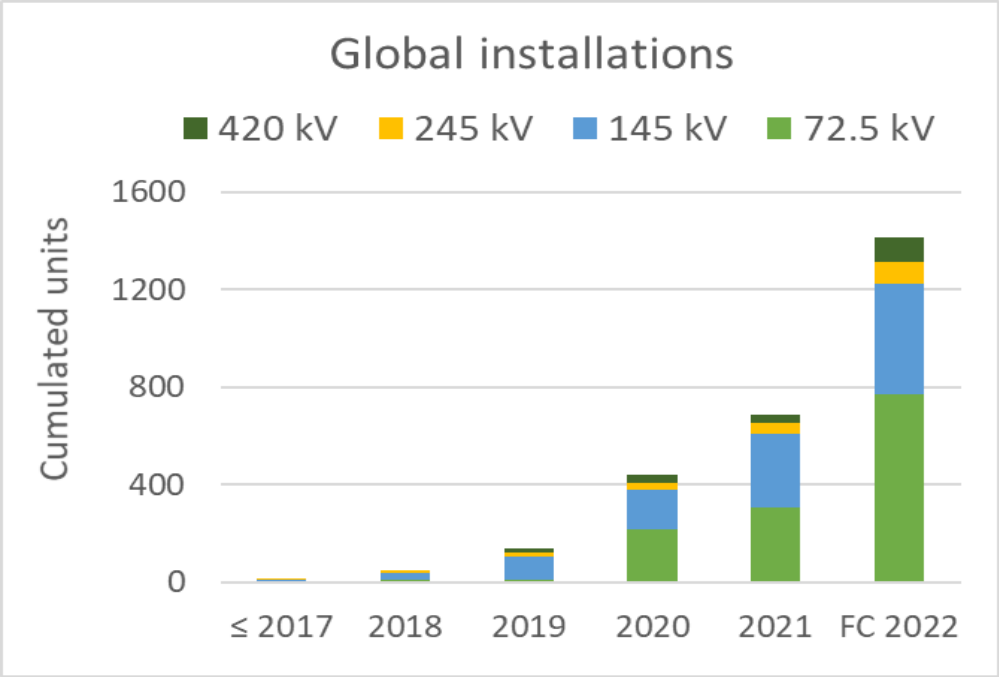
New production facility in Berlin: Siemens Energy wants to eliminate the world's most potent greenhouse gas from power transmission

- Siemens Energy invests over €60 million in Berlin site
- New vacuum interrupter production is a clear commitment to climate-neutral power transmission and the Berlin location

Siemens Energy is investing over €60 million in a new production facility in Berlin. In the future, vacuum interrupters will be manufactured in the company's switchgear plant in 6,200 m² of space. The vacuum interrupters are the technological core of the Blue Portfolio, which comprises climate-neutral power transmission products in the high-voltage range and uses industrially purified air for insulation and vacuum as the switching medium instead of climate-damaging fluorinated gases. The new manufacturing facility is scheduled to go into operation in 2023.

"The consequences of rapidly advancing global warming require a fundamental change in the way we deal with energy, including power transmission," said Ulf Katschinski, Senior Vice President Switching Products and Systems at Siemens Energy. "Siemens Energy aims to sell only F-gas-free high-voltage switching technology starting in 2030 at the latest. With our new vacuum interrupter production, we're laying the groundwork to achieve this goal and meet the growing demand for climate-neutral switchgear."

Clean Air for F-gas-free grids is reality today!



~ 6 Million hours
in commercial operation

~ 2.500.000 tons
CO₂-Äquivalent saved

> 1,900 units
contracted

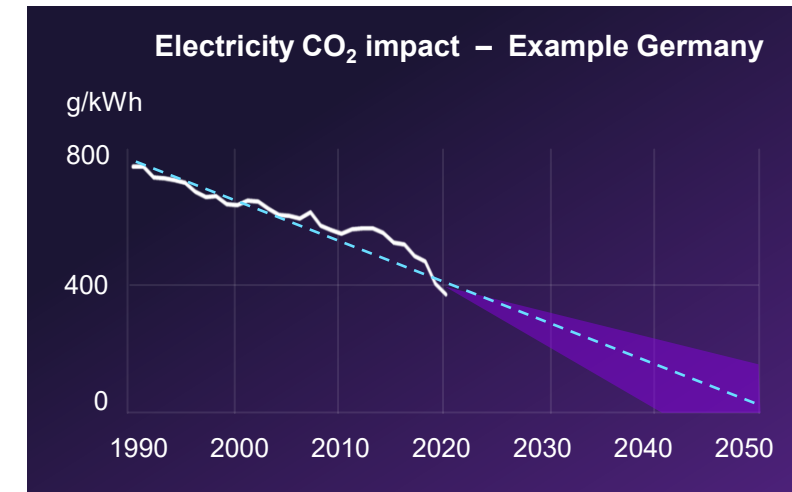
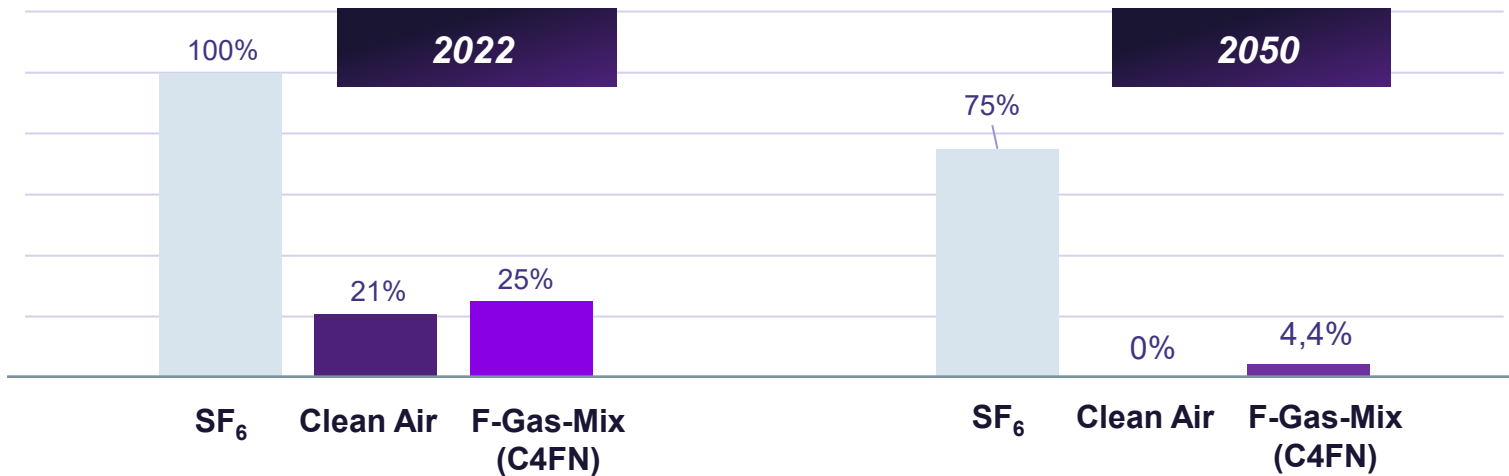
> 700 units
successfully in operation



Life cycle assessment (LCA) according ISO 14040

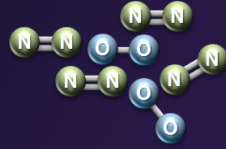
-> Clean Air has the lowest LCA carbon footprint!

*Total LCA (40 years) CO₂ Emission Footprint, Example 145 kV GIS**



- ✓ The total LCA CO₂ footprint is significantly lower without SF₆
- ✓ In a CO₂-neutral economy, e.g. in 2050 only the gas remains climate-impacting, Clean Air enables zero emission and climate-neutral power grids without any CO₂ compensation

* own evaluation for a typical GIS cable bay incl. materials, logistics, manufacturing, operation, end of life with a continuous operation load of 800 A



**F-gas-free clean air
& vacuum switching
technology set
sustainable
standards and is
the future of global
power grids!**

3 Summary and Q&A

- 1** Most environment-friendly technology,
Zero emission: GWP = 0
- 2** No special health and safety requirements,
Zero pollution: non-toxic, non-hazardous,
F-gas-/ PFAS-gas-free
- 3** Out of any F-gas & chemical regulations now & in future!
- 4** No degrading effects during operation, long-term stable &
reliable at improved technical performance!
- 5** Lowest lifetime costs, Simple gas handling,
No recovery & recycling needed! Multiple gas supplier!

Siemens Transmission products for clean energy:

**Environmentally friendly, safe, reliable and
economical over the lifetime**

**Thank you for
your attention**



Published by Siemens Energy

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