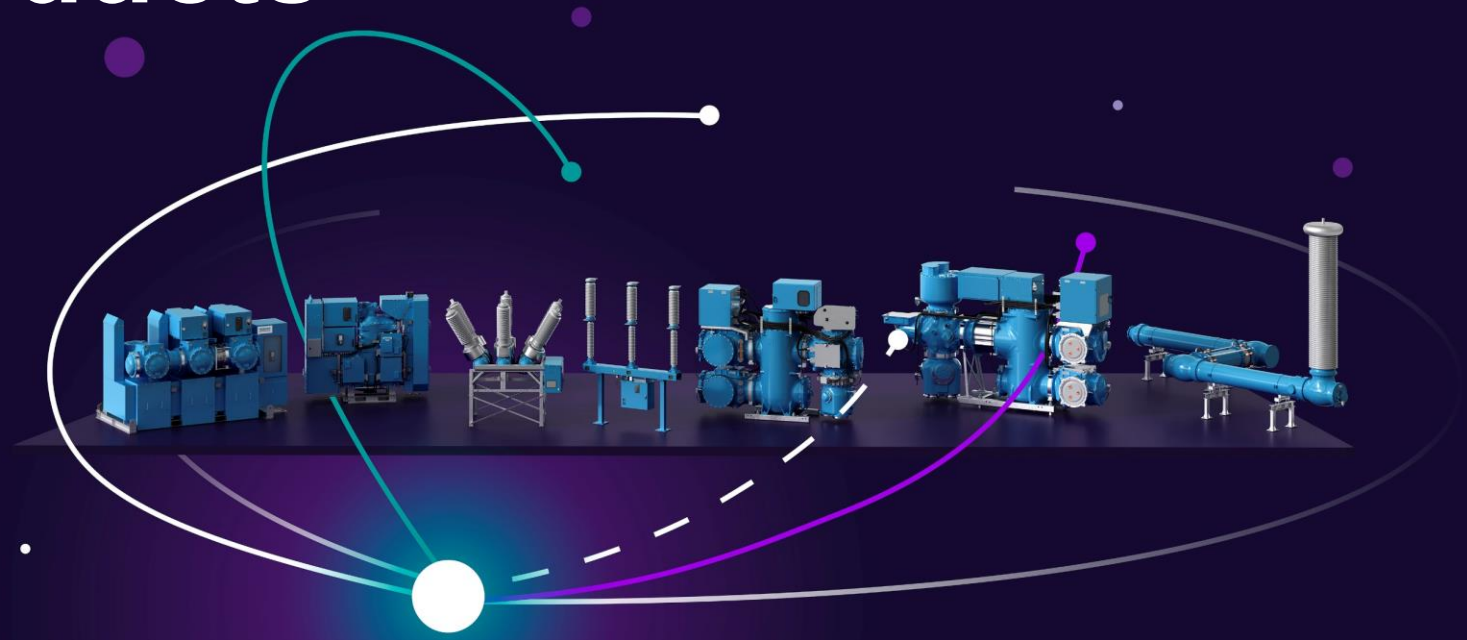
Siemens Energy Blue high-voltage products

Sustainable Zero-impact switchgear for a net Zero future



Status: July 2025

Contents

1. The growing market demand for SF_6-free high-voltage switchgear

There is an increasingly urgent need to achieve decarbonization in all sectors worldwide – actions to reduce GHG emissions must be taken fast

- In the UNFCCC (United Nations Framework Convention on Climate Change) Paris Agreement signed by 189 countries in 2015, it was agreed to limit anthropogenic global warming to well under 2º centigrade
- Each country must determine and report regularly on how it intends to mitigate its greenhouse gas emissions and thus reduce global warming
- Up to now more than 100 countries have submitted a net-zero document (Net-Zero Tracker)

US
2035: 100% clean electricity
2050: Net zero GHG pollution

EU
2050: First climate-neutral continent

China
> 2030: CO_2 emission peak
> 2060: Carbon neutrality

The pressure on power companies to phase out SF_6 and other F-gases is especially high

- With global carbon emissions hitting an all-time high of 47.5 Gt in 2020*, there is growing pressure on power companies to step up their decarbonization efforts
- SF_6 is classified as a strong greenhouse gas (GHG) with a CO_2 equivalent of 24,300, but is still commonly used as an isolation gas in switchgear products
- An increasing number of companies have already committed to switching to SF_6-free alternatives

* Climatewatchdata.org

SF_6 gas has a GWP 24,300 times higher than CO_2 – and the GWP of other F-gas alternatives is also way above zero

What is global warming potential (GWP)?

It represents the heat absorption effect of any GHG relative to CO_2, which has a GWP of 1

SF_6 installations
10,000 tons of SF_6 are installed annually, with leakage[1] of 50 tons and a GWP of around 24,300[2]

It takes **1,000 years** for nature to absorb SF_6

19,440,000,000 trees are needed to absorb the impact of the yearly installations and **89,424,000** to absorb the yearly leakage of SF_6

Fluoronitrile-mix[3]
10,000 tons of Fluoronitrile-mix are installed annually, with leakage[4] of 50 tons and a GWP of around 500

It takes **30 years** for nature to absorb Fluoronitrile-mix

321,600,000 trees are needed to absorb the impact of the yearly installation and leakage

Vacuum and clean air
This is the most environmentally friendly switching technology in the world with a GWP of 0

The leakage rate of clean air is **0.1%** and it is naturally absorbed by the surrounding air

0 trees needed
No greenhouse gases
No impact on health or environment

At the moment, **natural-origin gases** like **clean air** are the **only way to achieve Zero.**

[1]Leakage rate of SF_6 is typically 0.5%. Source MDPI: Evaluation of SF_6 Leakage from Gas Insulated Equipment on Electricity Networks in Great Britain, August 2018
[2]GWP-100 of Sulphur Hexafluoride (SF6) acc. To IPCC Sixth Assessment Report (AR6), 2023
[3]Besides vacuum and clean air, Fluoronitrile-mix is another discussed SF_6 alternative.
[4]Leakage rate of Fluoronitrile-mix is typically 0.5%

Phasing out SF_6 and other F-gas mixes is inevitable – clean air is the only future-proof option

Health and safety risks of F-gases

- SF_6 and fluoronitrile F-gas mixes produce toxic decomposition products during electric arcs and operation
- F-gases belong to the PFAS[1] group:
  more than 4,700 chemicals which accumulate in both humans and the environment, and which are highly persistent and toxic (negative health impact; contamination of water and soil).

Cost risks of SF_6 / F-gas regulations

- F-gas regulation (EU)[2]
- SF_6 ban California (CARB) / New York in discussion
- PFAS ban Maine (DEP) and Minnesota
- ECHA report[3] from 02.2023 includes a restriction proposal for PFAS-F-gases in switchgears starting 2026/27
- Worldwide institutions are following, e.g. Stockholm Convention (UN) or the Environment Protection Agency (EPA) having established a PFAS Council in the US

- **SF_6 is already restricted** and complete phase-out is more than probable
- **F-gases are under investigation** and restriction as well as a ban is possible
- **Clean air** does **not need any regulation** now or in the future

[1] Per- and polyfluoroalkyl substances
[2] The European Commission bans using PFAS and F-gases with a GWP >10 in switchgear (October 2023)
[3] European Chemicals Agency report

Global stakeholders, legislation and regulations embark on the path to decarbonization

Natural origin gases with GWP < 1 are 100% future-proof with no risk for regulatory exposure!

European Union

United States

Revised F-gas regulation comes into force March 2024:
Prohibition of F-gases or F-gases with GWP ≥ 1 starting in 2026 in MV and 2028 in HV in switchgears

Taxonomy drives sustainable investments, only switchgears with GWP < 10 compliant

California (CARB[2]) law effective and **New York** state in discussion for SF_6 phase-out for new installations starting 2025 in MV and HV – adoption in other parts expected in next years

Restriction proposal for PFAS[1] from 07.02.2023 includes a restriction proposal for switchgears starting in
2027 ≤ 145 kV and > 145 kV in 2033
EU committee opinion currently in progress – results expected in 2024 or beginning 2025

PFAS[1] restrictions: First laws effective – further decision and adoptions expected in next years

- EPA[3] placed a PFAS[1] reporting regulation from 12.11.2024 as a basis for further restriction regulations
- US state Maine placed a first PFAS ban from 01.01.2030
- US state Minnesota placed a PFAS ban from 01.01.2032

1 Per-and polyfluoroalkyl substances including C4FN and C5FK | **2** CARB: California air resources board | **3** EPA: Environmental protection agency

Replacing SF_6 in high voltage

We are doing it with clean air

Proven technology

Already 1,500 units with more than 20 million hours successfully in operation

Peak performance & safety

Highest switching performance, zero toxic by-products, fully compliant with IEC and ANSI/IEEE

GWP < 1

Clean air gives the equipment the lowest carbon footprint across its life cycle

Suitably sized

Our clean air units fit within the footprint of the SF_6 units they replace

Future-proof

Our Blue switchgear is the answer to the EU F-gas regulation GWP < 1

Siemens Energy welcomes the regulatory frame to cut CO_2 emissions for new installations:

Clean air insulation and vacuum switching technology is future-proof and not impacted by any restrictions or obligations with the revised EU F-gas regulation or expected PFAS restrictions!

SF_6-free products are available and in reliable use worldwide up to 420 kV, the majority rely on natural-origin gases to ensure safe power grids!*

1. SF_6-free alternative technology & products **already available**
2. Manufacturers are committed to **close the portfolio gaps**
3. The proposed **transition time is sufficient to close and develop SF_6-free portfolio**

medium voltage	 ABB	 EATON	 efacec	 LS ELECTRIC	 MEIDEN	 MITSUBISHI ELECTRIC Changes for the Better	 nuventura	 ormazabal velatia	 TOSHIBA	 Schneider Electric	 SIEMENS
high voltage	 ILJIN Electric	 Hitachi Energy	 MEIDEN	 MITSUBISHI ELECTRIC Changes for the Better	 TOSHIBA		 HSP	 PFIFFNER	 HYOSUNG HYUNDAI ELECTRIC	 SIEMENS energy	

*Natural-origin gases/F-gas-free with GWP <1

Source: Publications & web sites

● Factory in Europe

2. Siemens Energy Blue high-voltage portfolio

Our Blue switchgear portfolio already offers a solution,
with a greater mission in mind:

Achieving Zero emissions and Zero harm in energy transmission all over the world

Until now, switchgear technology has typically used F-gases...

In particular, SF_6 gas.

But whenever technically possible, we must stop using these gases.

Because SF_6 is 24,300 times more climate-hostile than CO_2, and stays in the atmosphere for over 1,000 years.

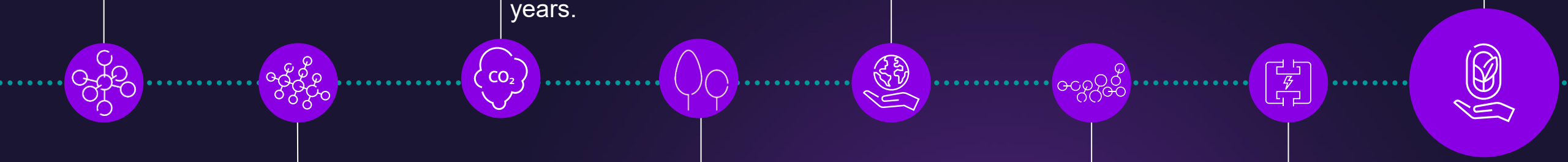
To compensate for the annual global installations of SF_6 would take more than 19 billion trees.

That’s not sustainable. And other F-gases neither.

The only way to achieve carbon neutrality and Zero toxicity is by using clean air.

Zero harmful gases. And Zero contribution to climate change.

That's why our Blue portfolio uses clean air and vacuum switching technology.



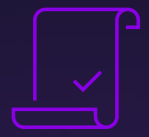
Siemens Energy Blue has a clear Zero-compromise philosophy

Zero environmental impact

- Zero SF_6 and other F-gases
- Zero GHG emissions and Zero GWP
- Long lasting design (> 40 years) and circular materials

Zero impact on health & safety

- Zero toxic insulation gases
- Zero toxic decomposition products



Zero regulation & special handling

- Zero reporting & accounting of gases required
- Zero issues with current & potential F-gas regulation
- Zero special safety measures
- Zero gas disposal required at end of life

Zero compromise on performance

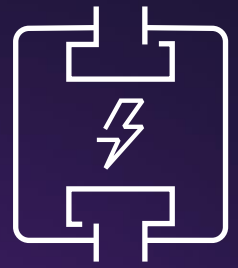
- Voltages from 72.5 to 145 kV
- Highest short-circuit switching capability with Zero degradation
- Full performance down to -60°C
- Maintenance-free interrupter unit („sealed for life“)

The Blue portfolio is based on game-changing technology: vacuum switching and clean air insulation

Clean air (N_2 + O_2) insulation

- Zero CO_2emissions, lowest CO_2 footprint, GWP = 0
- Zero toxicity, highest stability, easiest gas handling
- Zero liquefaction at low temperatures -60° C
- Zero patent dependencies, multiple suppliers

Vacuum interruption



- Zero toxic decomposition products, hermetically tight
- Highest switching performance w/o degradation, scalable short-circuit current capabilities
- Zero maintenance (sealed for life)

Clean, safe and future-proof regarding F-gas and PFAS regulation!

The Blue portfolio comprises individual products & solutions, supporting our clients on their way to Zero

Up to 145 kV

Wind Tower and Offshore Blue GIS™

- 72.5 kV / 31.5 kA
- Optimized switchgear for application in wind turbines, with vacuum CB and clean air insulation

Blue Circuit Breaker™ Live Tank

- up to 145 kV / 40 kA
- World's first LT CB with vacuum interrupter and clean air insulation

Blue GIS™

- 145 kV / 50 kA
- World's first 145 kV GIS switchgear with vacuum CB and clean air insulation
- Optimized footprint by using LPIT[1]

Blue Circuit Breaker™ Dead Tank

- 145 kV / 63 kA
- World's first 145 kV DT vacuum CB with clean air insulation
- Same footprint as SF_6 product

Higher voltages (available)

Blue Clean Air GIB™

- 420 kV / 63 kA
- 245 – 400 kV = combined solution GIS + Blue GIB (30 – 65% less SF_6)

Blue Circuit Breaker™ Live Tank[2]

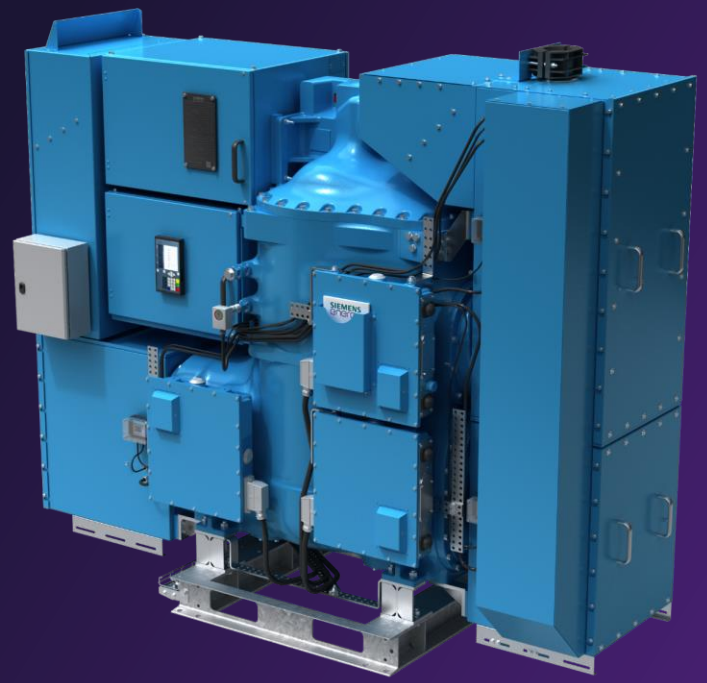
- up to 420 kV / 63 kV
- World's first 420 kV LT breaker with clean air insulation
- Same footprint as SF_6 product

[1] Low Power Instrument Transformer
[2] available 2026

Product one pagers

8VM1 wind tower Blue GIS™ 72.5 kV / 31.5 kA

Designed for wind turbine applications



Product characteristics

- Vacuum interrupter technology | clean air insulation technology
- Weight of SF_6 or other fluorinated greenhouse gases = 0 kg; GWP = 0
- Expected product lifetime > 50 years | first major inspection > 25 years
- No reporting or emission costs during operation and recycling, e.g. taxes or CO_2 emission compensation (no SF_6 or F-gases)

Technical features

- Rated voltage up to 72.5 kV
- Rated frequency 50/60 Hz
- Rated short-circuit breaking current up to 31.5 kA
- Ambient temperature range -30 ºC to +45 ºC
- Stored-energy spring type driving mechanism of circuit-breaker
- Seismic withstand capability 0.5 g
- Leakage rate per year (type-tested) < 0.1%
- Internal arc classification of HV cable compartments IAC A FLR 31.5 kA, 1 s (acc. IEC 62271-200)

Types / variants

- Factory tested GIS with up to three bays mounted on a base frame incl. automation and protection
- Coming soon: Low Power Instrument transformer (LPIT) in the cable bushing

Type tested

- Acc. to IEC / IEEE

8VM3 Blue GIS™ 72.5 kV / 50 kA

Product characteristics

- Vacuum interrupter technology | clean air insulation technology
- Weight of SF_6 or other fluorinated greenhouse gases = 0 kg; GWP = 0
- Expected product lifetime > 50 years | first major inspection > 25 years
- No reporting or emission costs during operation and recycling, e.g. taxes or CO_2 emission compensation (no SF_6 or F-gases)

Technical features

- Rated voltage up to 72.5 kV, rated frequency 50/60 Hz
- Rated short-circuit breaking current up to 50 kA
- Ambient temperature range -50 ºC to +55 ºC
- Stored-energy spring type driving mechanism of circuit-breaker
- Seismic withstand capability 1.0 g
- Leakage rate per year and gas compartment (type-tested) < 0.1%

Types / variants

- Indoor and outdoor installation
- Optional with Low Power Instrument Transformer (LPIT) for reduced bay size / weight

Type tested

- Acc. to IEC / IEEE

8VM3 Blue GIS™ power pack 72.5 kV / 31.5 kA

Ideal for wind turbine applications and small DSOs (indoor)

Product characteristics

- Preassembled Ring Main Unit (RMU)
- Vacuum interrupter technology | clean air insulation technology
- Weight of SF_6 or other fluorinated greenhouse gases = 0 kg; GWP = 0
- Expected product lifetime > 50 years | first major inspection > 25 years
- No reporting or emission costs during operation and recycling, e.g. taxes or CO_2 emission compensation (no SF_6 or F-gases)

Technical features

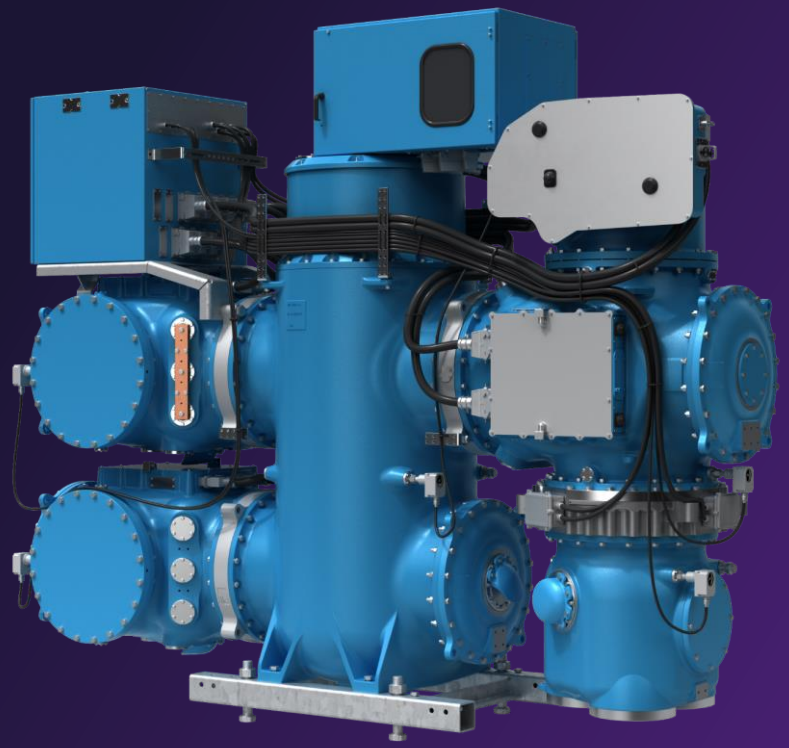
- Rated voltage up to 72.5 kV; rated frequency 50/60 Hz
- Rated short-circuit breaking current up to 31.5 kA
- Ambient temperature range -30 ºC to +40 ºC
- Stored-energy spring type driving mechanism of circuit-breaker
- Seismic withstand capability 0.5 g
- Leakage rate per year and gas compartment (type-tested) < 0.1%
- Internal arc classification of HV cable compartments IAC A FLR 31.5 kA, 1 s (acc. IEC 62271-200)

Types / variants

- Factory tested RMU with up to 3 bays mounted on a base frame incl. automation and protection
- Coming soon: Low Power Instrument transformer in the GIS partition and the cable bushing

Type tested

- Acc. to IEC / IEEE



8VN1 Blue GIS™ 145 kV / 50 kA

Product characteristics

- Vacuum interrupter technology | clean air insulation technology
- Weight of SF_6 or other fluorinated greenhouse gases = 0 kg; GWP = 0
- Expected product lifetime > 50 years | first major inspection > 25 years
- No reporting or emission costs during operation and recycling, e.g. taxes or CO_2 emission compensation (no SF_6 or F-gases)

Technical features

- Rated voltage up to 145 kV, rated frequency 50/60 Hz
- Rated short-circuit breaking current up to 50 kA
- Ambient temperature range -50 ºC to +55 ºC
- Stored-energy spring type driving mechanism of circuit-breaker
- Seismic withstand capability 1.0 g
- Leakage rate per year and gas compartment (type-tested) < 0.1%
- Equipped with new Sensgear™ technology *(for more info see back-up)*

Types / variants

- Indoor and outdoor installation
- Optional with Low Power Instrument Transformer (LPIT) for reduced bay size / weight

Type tested

- Acc. to IEC / IEEE

8VQ3 Blue clean air GIB™ 420 kV / 63 kA

Product characteristics

- Clean air insulation technology
- Weight of SF_6 or other fluorinated greenhouse gases = 0 kg; GWP = 0
- Expected product lifetime > 50 years | first major inspection > 25 years
- No reporting or emission costs during operation and recycling, e.g. taxes or CO_2 emission compensation (no SF_6 or F-gases)

Technical features

- Rated voltage up to 420 kV
- Rated frequency 50/60 Hz
- Rated short-circuit breaking current up to 63 kA
- Rated continuous current up 5000 A
- Ambient temperature range -50°C to + 55°C
- Leakage rate per year and gas compartment (type-tested) < 0.1%

Types / variants

- Indoor and outdoor installation

Type tested

- Acc. to IEC / IEEE

Coming soon:
2nd generation with enhanced VI and latest drive plus additional FI version

3AV1 Blue live tank circuit breaker™ up to 145 kV / 40 kA

Product characteristics

- Vacuum interrupter technology | clean air insulation technology
- Weight of SF_6 or other fluorinated greenhouse gases = 0 kg; GWP = 0
- Expected product lifetime > 50 years | first major inspection > 25 years
- No reporting or emission costs during operation and recycling, e.g. taxes or CO_2 emission compensation (no SF_6 or F-gases)
- Same dimensions as the equivalent SF_6 circuit breaker

Technical features

- Stored-energy spring drive mechanism
- Rated voltages up to 145 kV, rated frequency for 50/60 Hz
- Rated continuous current up to 3150 A, rated short-circuit breaking current 40 kA
- Perfect for frequent breaking operations and extreme temperatures from -60 °C to +55°C
- 0.5 g seismic conditions, high terminal loads (2 kN stat. / 5 kN dyn.)
- Two-cycle current interruption
- Leakage rate < 0.1% p.a.
- Equipped with new Sensgear™ technology *(for more info see back-up)*

Types / variants

- Three-pole (FG) & single-pole (FI*) operation | composite insulators
- Also available as 60 Hz circuit switcher according to IEEE Std. C37.016

Type tested

- Acc. to IEC 62271-100, -110, -310

*available December 2025

3AV1 Blue dead tank circuit breaker™ up to 145 kV / 63 kA

Product characteristics

- Vacuum interrupter technology | clean air insulation technology
- Weight of SF_6 or other fluorinated greenhouse gases = 0 kg; GWP = 0
- Expected product lifetime > 50 years, first major inspection > 25 years
- No reporting or emission costs during operation and recycling, e.g. taxes or CO_2 emission compensation (no SF_6 or F-gases)
- Same dimensions as the equivalent SF_6 circuit breaker

Technical features

- Proven reliable energy spring-drive mechanism
- Rated voltages up to 145 kV, rated frequency 50 / 60 Hz
- Rated continuous current up to 3000 A, rated short-circuit breaking current up to 63 kA
- Chopped wave (2 µs) voltage 838 kV
- Capacitive switching class (overhead lines and cables) C2
- Perfect for frequent breaking operations and extreme temperatures from -60 °C to +50°C
- Leakage rate < 0.1% p.a.

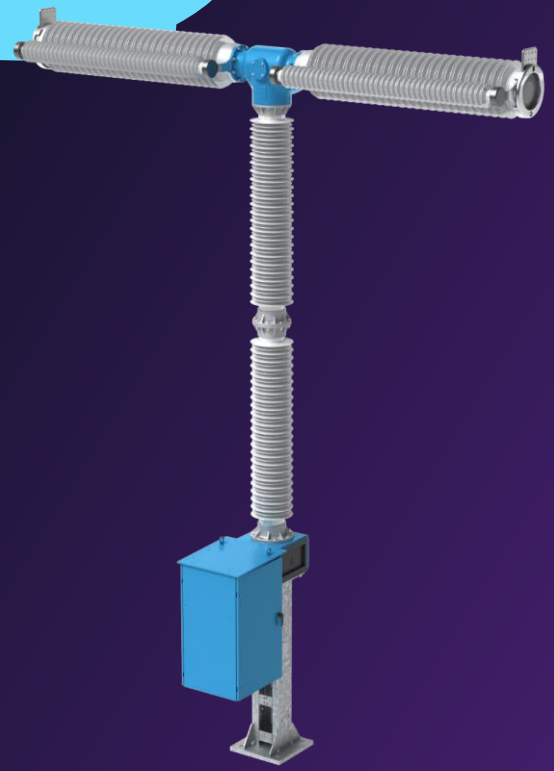
Types / variants

- Three-pole operation (FG)
- Composite insulators

Type tests

- Acc. to IEC / IEEE

Coming soon to the Blue portfolio!



3AV2 Blue live tank CB up to 420 kV

Product characteristics

- Vacuum interrupter technology | Clean air insulation technology
- Weight of SF_6 or other fluorinated greenhouse gases = 0 kg; GWP = 0
- Expected product life-time > 50 years | first major inspection > 25 years
- No reporting or emission costs during operation and recycling, e.g. taxes or CO_{2e} emission compensation (no SF_6- or F-gases)
- Same dimensions as the equivalent SF_6 circuit breaker

Technical features

- Stored energy spring drive mechanism
- Rated voltages up to 420 kV, rated frequency for 50 / 60 Hz
- Rated continuous current up to 5000 A, rated short-circuit breaking current 63 kA / 80 kA
- Perfect for frequent breaking operations and extreme temperatures from -60°C up to +55°C
- 0.5 g seismic conditions, high terminal loads (3 kN stat. / 6 kN dyn.)
- Two-cycle current interruption
- Leakage rate < 0.1% p.a.
- Equipped with new Sensgear® technology *(for more info see back-up)*

Types / variants

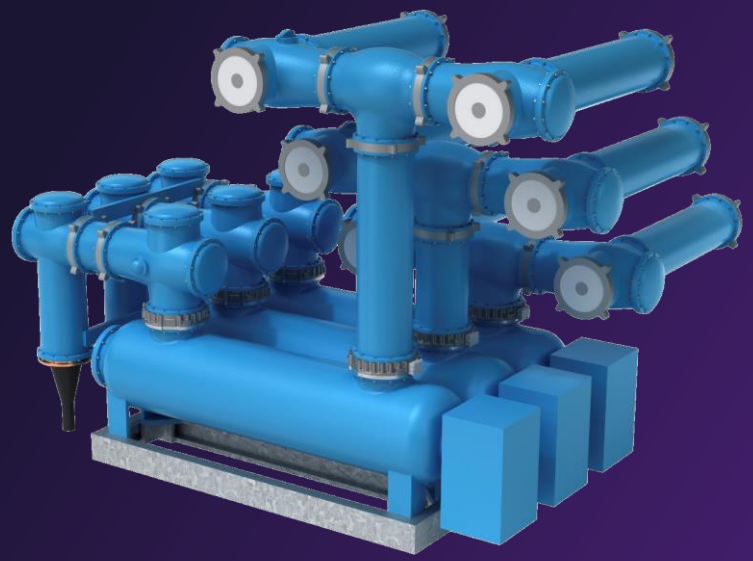
- single-pole operation (FI) | composite insulators

Type tested

- Acc. to IEC 62271-100

MISSION
Co-funded by the European Union

Coming soon to the Blue portfolio!

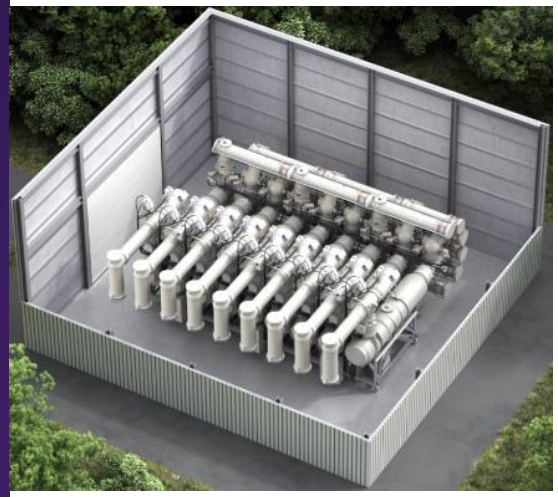


LifeBlue Project GIS 420 kV

Co-funded by the European Union

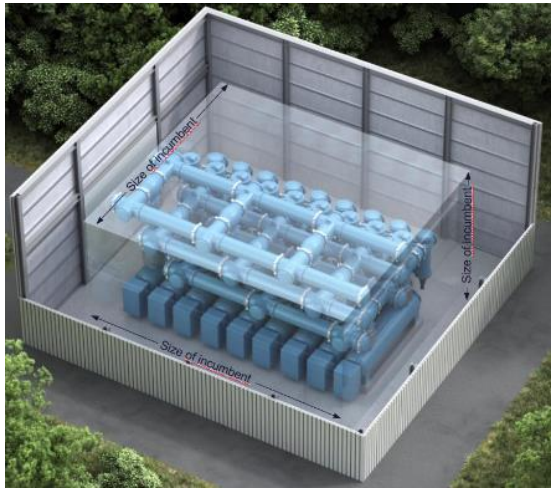
8VQ3 Blue GIS 420 kV

Exemplary comparison of footprint



Previous SF_6 generation (2010)

Current SF_6 generation



New design with clean air

Same bay width as previous SF_6 generation enables **easy replacement** and several **extension options**.

3. Blue product evaluation

Customer product evaluation criteria for switchgear products

Three isolation mediums: a comparison

Vacuum / clean air

N_2 and O_2 (80% / 20%)

CO_2-F mix fluoronitrile[1]

$(CF_3)_2CFCN$

SF_6 sulfur hexafluoride

SF_6

[1] Fluor-ketone gas mix is not considered due to its inability to withstand temperatures below 5°C

Criteria 1: Environmental impact

Vacuum / clean air

Zero greenhouse gas
GWP = 0
(Immediately absorbed)

CO_2-F mix fluoronitrile

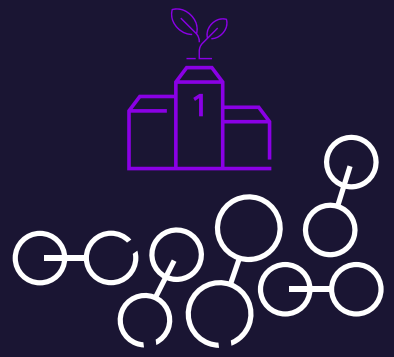
Greenhouse gases
GWP ~ 500
(Lifetime 30 years)

SF_6 sulfur hexafluoride

Greenhouse gas
GWP ~ 24,300
(Lifetime 1,000 years)

Vacuum / clean air is the **most environmentally friendly** switching technology in the world

Criteria 2: Health & safety



Vacuum / clean air

Vacuum: Zero decomposition products; sealed for life

Clean air: non-toxic decomposition products, non-hazardous

Gas leakage < 0.1% p.a./compartment

CO_2-F mix fluoronitrile

Toxic decomposition products (details unknown)

Hazardous (details unknown)

Gas leakage < 0.5% p.a./compartment (details unknown)

SF_6 sulfur hexafluoride

Toxic decomposition products

Hazardous when inhaled, causes skin and eye irritation

Gas leakage < 0.1% p.a./compartment

Vacuum / clean air is **non-toxic, non-hazardous** and does not require special safety systems such as ventilation or CO_2-monitoring

Criteria 3: Performance

Vacuum / clean air

Vacuum circuit breaker can switch up to 30 times 40 kA currents

Zero degradation of short-circuit switching performance

From -60 °C to +55 °C

CO_2-F mix fluoronitrile

CO_2-F mix shows decreasing switching performance

Does not recombine completely after arcing

From -30 °C to +55 °C

SF_6 sulfur hexafluoride

SF_6 CB can switch up to 10 times 40 kA currents

Long term stability (SF_6 gas recombines)

From -40 °C to +55 °C

Vacuum / clean air offers the **highest short-circuit switching capability** without degradation and can be operated in a wide temperature range, being especially suitable for **very low temperature applications**

Criteria 4: Gas handling & costs

Vacuum / clean air

Vacuum interrupter is sealed for life > Zero maintenance

No special tools, training, ventilation or reporting

No recycling or special EOL treatment necessary

Lowest lifecycle costs

CO_2-F mix fluoronitrile

unknown

Special tools, training, ventilation and reporting

No recycling option, disposal can cause extra CO_2

Higher lifecycle costs

SF_6 sulfur hexafluoride

Additional gas maintenance

Special tools, training, ventilation and reporting

Can be cleaned and re-used (extra effort)

Higher lifecycle costs

Vacuum / clean air is maintenance- and regulation-free and requires no special EOL treatment.
Overall it has the lowest lifecycle costs

Criteria 5: Manufacturer competence

1970

First HV GIS with air insulation 170 kV

1976

First MV vacuum CB

2010

First HV vacuum CB with clean air 72.5 kV

2017

First HV vacuum GIS with clean air 72.5 kV

2017

First HV vacuum CB with clean air 145 kV

2018

First HV vacuum GIS with clean air 145 kV

2022

First GIB with clean air 420 kV

2024

New wind tower GIS with clean air 72.5 kV

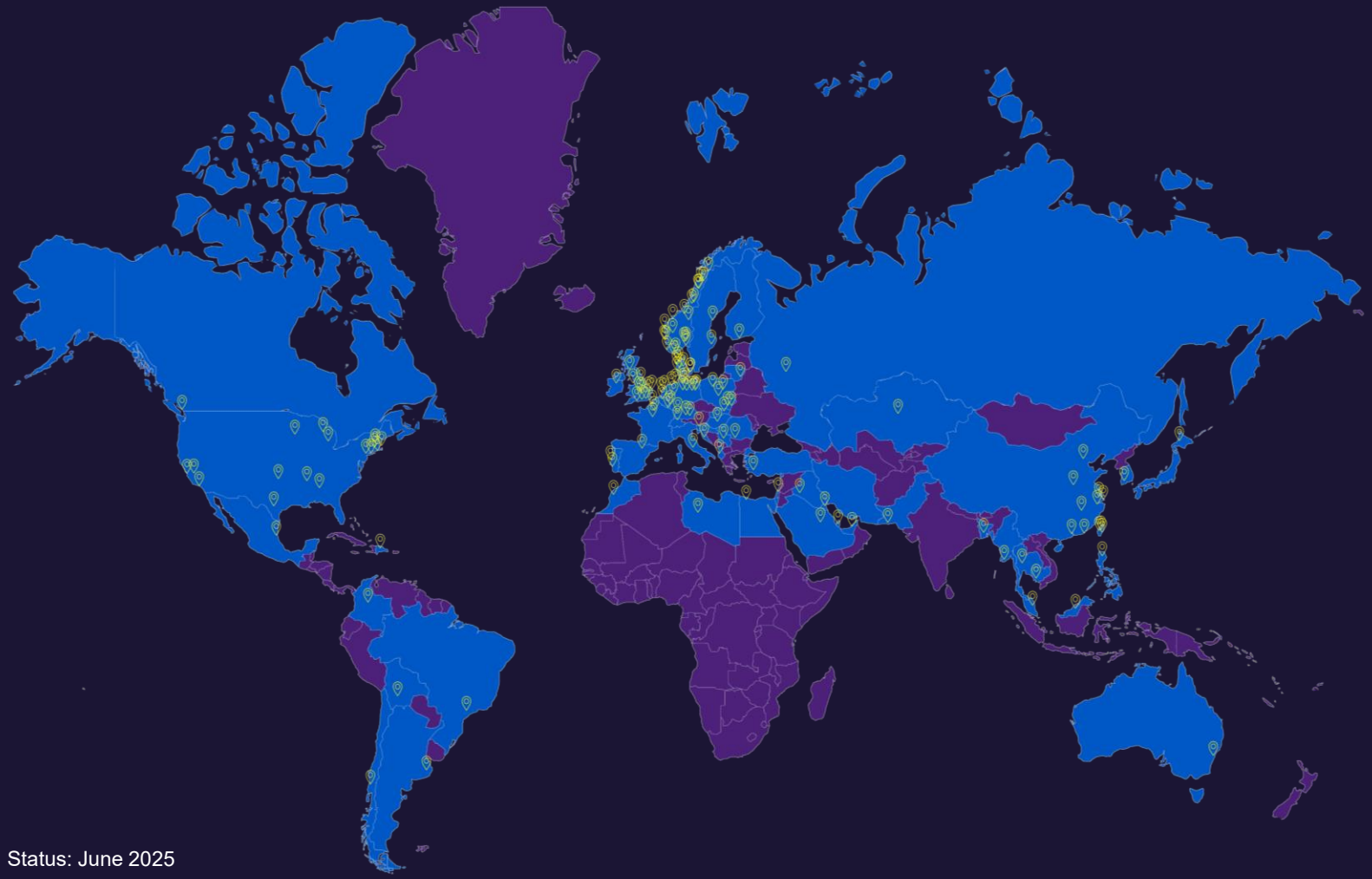
Design & engineering → **Manufacturing** → **Test lab** → **Supply** → **Installation, testing, commissioning** → **Training & after sales**

Siemens Energy has **over 60 years of experience** in switchgear with **global production** of 48,000+ GIS bays and 165,000+ CBs as well as more than **50 years of experience in vacuum and air insulation** technology

Customer product evaluation criteria for switchgear products

4. Blue success stories

Zero-harm energy transmission is already becoming a reality around the world



Status: June 2025

> 40 million hours
of commercial operation

~ 8,500,000 tons
of CO_2-equivalent saved

> 6,700 units
sold

> 2,450 units
already in operation

Notable case studies

Leading grid operators install clean air technologies

Globally around 6,700 Blue CB und GIS sold and 2,450+ units successfully in operation.

~8,500,000 tons of CO_2-equivalent saved

2010 72.5 kV	
2017 145 kV	
2017 72.5 kV	
2019 145 kV	
2022 145 kV	
2023 420 kV	

Status: June 2025

A € 60 million investment in clean air technology

Key facts

- Transformation of 6,200 m^2 site in Berlin
- Production of vacuum interrupters for clean air Blue switchgear being ramped up
- Powered 100% by renewable energy
- Project announced: 2021
- Operational: 2024

Berlin factory

- Highly automated, fully digitally connected
- Entirely green energy supply
- Clear commitment to climate-neutral power transmission
- Major boost to local economy

Vacuum interrupter

- Eliminate need for climate-hostile F-gases
- Enable Blue products to achieve Zero GWP
- Future-ready: not subject to EU F-gas legislation

The world's first SF_6-free high-voltage switchgear with clean air insulation

Key facts

- Customer: Netze BW GmbH, Germany
- Modernization of a 110 kV substation in Noerdlingen
- Operation requires no SF_6 or any other greenhouse gas
- Year of order: 2017
- Energization: 2018

Circuit breakers

- Installation of two SF_6-free 3AV1 Blue Circuit Breakers™ for 145 kV
- Vacuum interrupter technology
- Clean air insulation technology

Instrument transformers

- Six SVAA voltage and current transformers with clean air insulation

The world's first SF_6-free gas-insulated switchgear with clean air and vacuum technology

Key facts

- Customer: BKK Nett, Norway
- Modernization of a 145 kV Koengen substation in Bergen – Norway's largest cruise port
- Operation requires no SF_6 or any other greenhouse gas
- Year of order: 2018
- Energization: 2020

Gas-insulated switchgear

- Installation of 3 bays of the 8VN1 Blue GIS™ for 145 kV
- Vacuum interrupter technology
- Clean air insulation technology

Low-power instrument transformers

- GIS includes low-power instrument transformers (LPIT) to ensure a compact design

The world's first facility combining eco-efficiency and digitization

Key facts

- Customer: Netze BW, Burladingen, Germany
- Capacity of 80 MVA
- Blue portfolio goes digital with Sensgear™
- Year of order: 2020
- Energization: 2022

Gas-insulated switchgear

- Installation of five 8VN1 Blue GIS™ bays with low-power instrument transformers (LPIT)
- Vacuum interrupter technology
- Clean air insulation technology

Sensgear GIS

- Smart sensors record all relevant product operating data: gas pressure, temperature, and number of switching cycles
- Service life of around 40 years

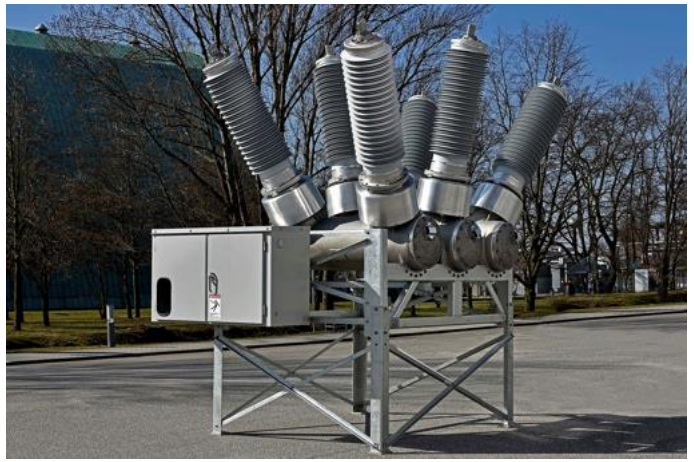
Cutting-edge substation upgrade using our F-gas free Blue circuit breaker technology

Key facts

- Customer: National Grid
- Location: Ayer, Massachusetts, US
- Operation requires no SF_6 or any other greenhouse gases
- Year of order: 2022
- Energization: 2023

Gas-insulated switchgear

- F-gas free DT CB to serve several North Central Massachusetts communities
- First Siemens Energy project of in total 18 Blue DT breakers for the installation in National Grid's U.S. electricity network



Customer benefits

- Replace harmful gases in switchgear with clean air to fulfill commitment to decarbonize switchgear technology
- Easiest gas handling process

Hollandse Kust Zuid: an offshore project including the 1000th 8VM1 Blue GIS bay

Key facts

- Customer: Siemens Gamesa Renewable Energy for Vattenfall
- Offshore wind farm located just off the north coast of the Netherlands
- Operation of GIS requires no SF_6 or any other greenhouse gas
- Year of order: 2021
- Energization: 2023

Gas-insulated switchgear

- Installation of 140 bays of the 8VM1 Blue GIS™ for 72.5 kV
- Vacuum interrupter technology
- Clean air insulation technology
- Project including the 1000th 8VM1 bay

Customer benefits

- Zero direct CO_2 emissions
- Easiest gas handling process
- Reduced quantities of cable
- Reduced cable installation times
- Improved efficiencies in power transmission

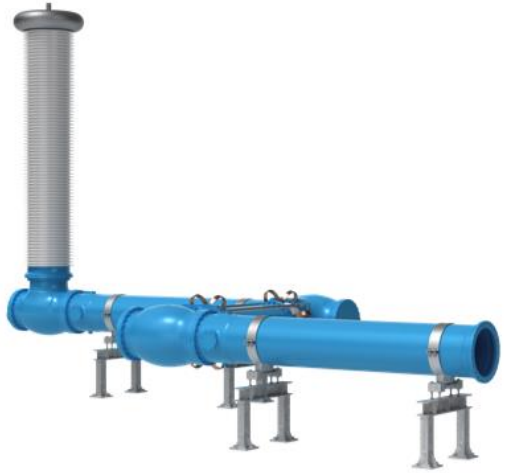
First SF_6-free gas-insulated busducts with clean air for Alyth substation

Key facts

- Customer: Scottish & Southern Electricity Networks
- Location: United Kingdom
- Operation of GIB requires no SF_6 or any other greenhouse gas
- Year of order: 2022
- Energization: 2023

Gas-insulated busduct

- New switchgear for 275 kV Alyth substation, including infrastructure ready for future scalability to 400 kV
- Project involves the installation of 8VQ3 Blue clean air gas-insulated bus ducts (GIB) measuring a length of more than 500 meters



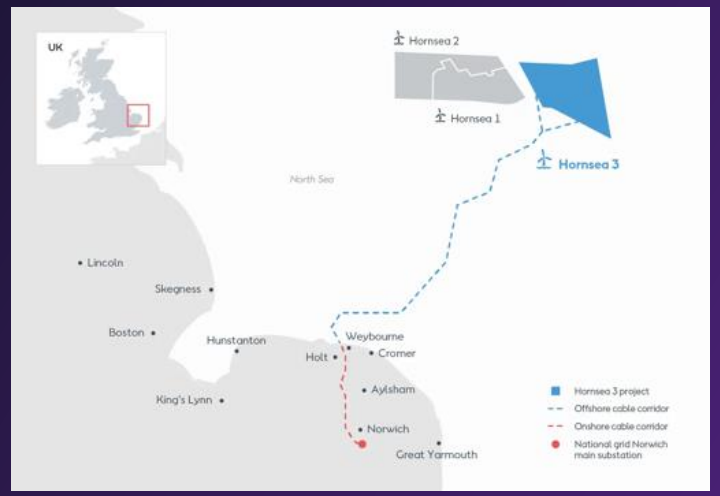
Customer benefits

- Blue GIB technology replaces SF_6 with clean air and has Zero direct CO_2 emissions
- Easiest gas handling process
- More than 2 million kg CO_2e saved compared to a SF_6-based GIB during a lifetime of 40 years

Hornsea 3: the largest wind park worldwide including the 2000th 8VM1 Blue GIS bay

Key facts

- Customer: Siemens Gamesa Renewable Energy for Ørsted
- 2.9 GW-capacity offshore wind farm located off the east coast of the UK
- Operation of GIS requires no SF_6 or any other greenhouse gas
- Year of order: 2024
- Energization: 2027



Gas-insulated switchgear

- Installation of 197 bays of SF_6-free 8VM1 Blue GIS™ for 72.5 kV within an area of 696 km²
- set to provide over 3 million UK homes with green energy
- Vacuum interrupter technology
- Clean air insulation technology

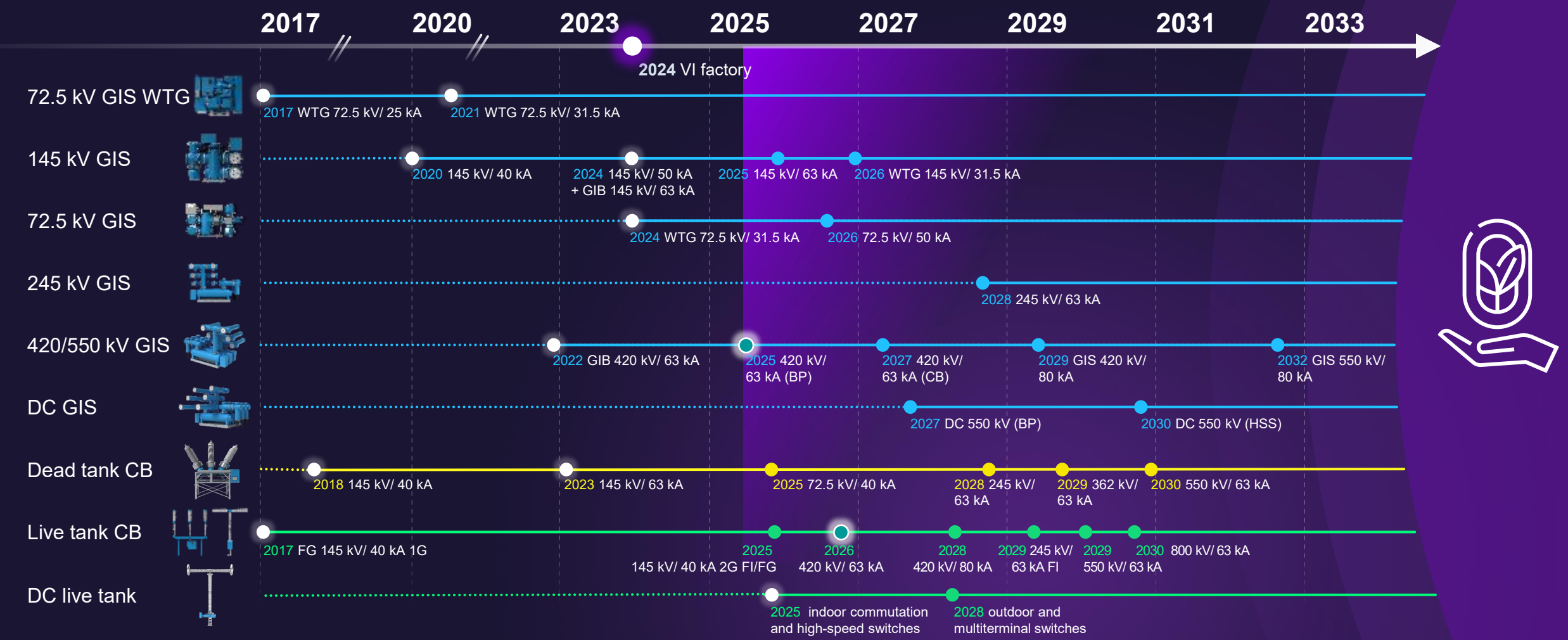
Customer benefits

- Zero direct CO_2 emissions
- 1.8 million tons CO_2e saved through avoidance of installed SF_6
- Easiest gas handling process
- Reduced quantities of cable
- Reduced cable installation times

5. Outlook for the future

Roadmap from Zero to Zero

Offering a fully F-gas-free, climate-neutral Blue portfolio by 2032



All dates/milestones shown as sales readiness | status: March 2025

Pilot sales now ready

Product available

Gas-insulated switchgear

Dead tank circuit breaker

Live tank circuit breaker

BP - back parts
CB - circuit breaker
GIB – gas insulated busbar
HSS - high-speed switches

FI – Single pole drive
FG – Common drive

2025-03-21

Disclaimer

Subject to changes and errors. The information given in this document contains only general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

All product designations, product names, etc. may contain trademarks or other rights of Siemens AG, its affiliated companies or third parties. Their unauthorized use may infringe the rights of the respective owner.

Thank you for your attention!

Published by Siemens Energy
Grid Technologies

E-mail:
support@siemens-energy.com

Further reading:

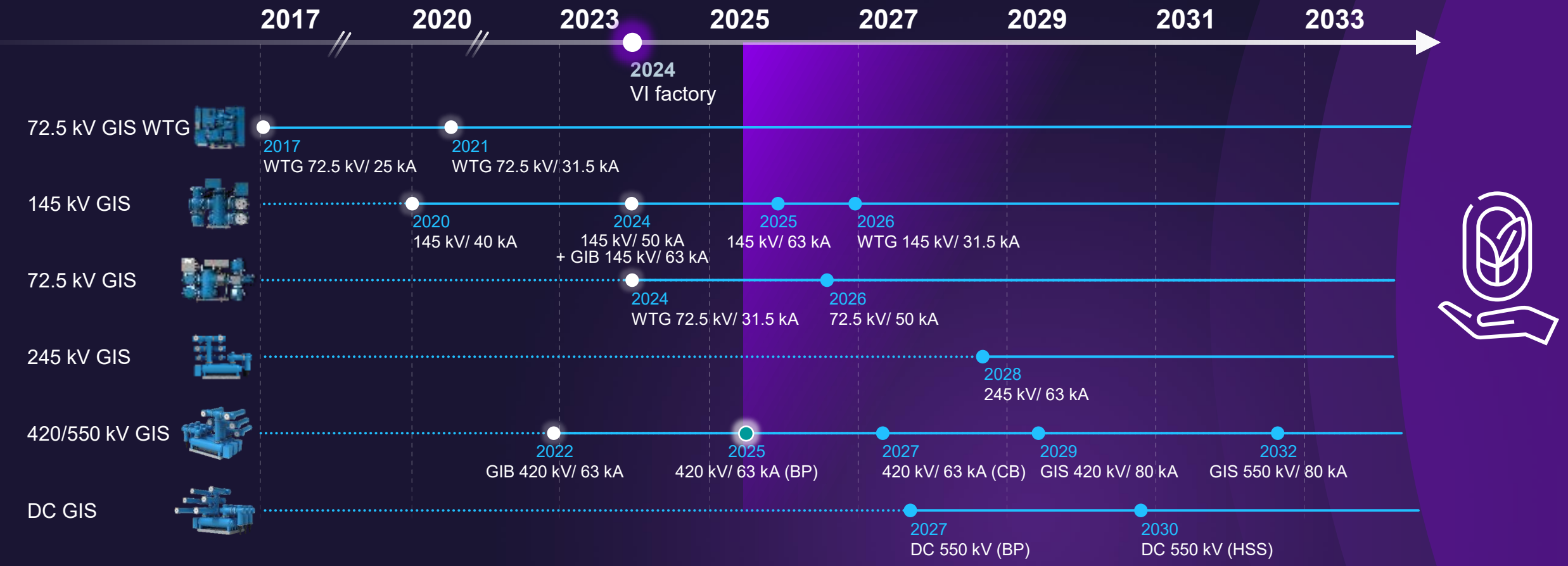
- Siemens Energy Blue products
- Siemens Energy Blue partnerships & more

siemens-energy.com

Back-up

Roadmap from Zero to Zero

Offering a fully F-gas-free, climate-neutral **Blue GIS** portfolio by 2032



All dates/milestones shown as sales readiness | status: March 2025

Pilot sales now ready
Product available

Gas-insulated switchgear
Dead tank circuit breaker
Live tank circuit breaker

BP - back parts
CB - circuit breaker
GIB – gas insulated busbar
HSS - high-speed switches

FI – Single pole drive
FG – Common drive

Roadmap from Zero to Zero

Offering a fully F-gas-free, climate-neutral **Blue AIS** portfolio by 2032

2017 2020 2023 2025 2027 2029 2031 2033

2024
VI factory

Dead tank CB

2018
145 kV/
40 kA

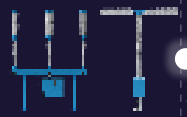
2023
145 kV/
63 kA

2025
72.5 kV/
40 kA

2028
245 kV/
63 kA

2029
362 kV/
63 kA

2030
550 kV/
63 kA



Live tank CB

2017
FG 145 kV/
40 kA 1G

2025
145 kV/ 40 kA
2G FI/FG

2026
420 kV/
63 kA

2028
420 kV/
80 kA

2029
245 kV/
63 kA FI

2029
550 kV/
63 kA

2030
800 kV/
63 kA

DC live tank

2025
indoor commutation and
high-speed switches

2028
outdoor and
multiterminal switches

All dates/milestones shown as
sales readiness | status: March 2025

Pilot sales now ready
Product available

Gas-insulated switchgear
Dead tank circuit breaker
Live tank circuit breaker

BP - back parts
CB - circuit breaker
GIB – gas insulated busbar
HSS - high-speed switches

FI – Single pole drive
FG – Common drive

From products to system intelligence: converting switchgear into Sensgear™

Besides general data such as local weather information or GPS location, the new technology provides also specific data:

Sensformer™ and arc suppression coil with Sensgear™

- oil level alarm
- top oil temperature
- low-voltage winding current

GIS and circuit breaker with Sensgear™

- gas density
- CB counter, position, readiness
- temperature (local control cubicle)

Surge arrester and disconnector with Sensgear™

- AR: surge counter
- AR: leakage current
- DS: drive current

Instrument transformer with Sensgear™

- gas density
- oil level alarm

For more info click here

Added transparency, enhanced productivity and advanced intelligence:

- software apps and digital services
- data generation, collection, analysis and utilization
- secure data transmission through GSM to cloud with state-of-the art cyber security measures