

GAS-INSULATED SWITCHGEAR | ECO-EFFICIENT GIS

ewz Oerlikon substation, Switzerland

World's first gas-insulated switchgear (GIS) installation with new eco-efficient gas mixture



ABB has commissioned the world's first high-voltage and medium-voltage GIS installation with a new eco-efficient gas mixture as an alternative to sulfur hexafluoride (SF₆) gas for ewz, a power utility in Switzerland.

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*GWP: The global warming potential describes how much heat a greenhouse gas traps in the atmosphere. It compares the amount of heat trapped by a certain mass of the gas in question to the amount of heat trapped by a similar mass of carbon dioxide. GWP is expressed as a factor of carbon dioxide.

Project background

The 170/24 kV substation deploys the first breakthrough GIS with eco-efficient gas mixture with a global warming potential (GWP)* of less than 1 as an alternative to SF₆ gas.

Located in the heart of Zurich, 15 meters underground in a beautifully designed building, it replaces an outdoor air-insulated switchgear (AIS) substation built in 1949. The new substation takes up only 30 percent of the originally used space, thus freeing up land for other city requirements and enhancing the aesthetics of the cityscape.

Advantages of ABB's solution

- GWP of new gas mixture is almost 100 percent lower than GWP of SF₆
- Regulatory procedures for SF₆ such as maintaining inventory, special requirements in gas handling, filling and decommissioning of the equipment will be avoided
- Savings can be made in SF₆ related taxes which are applicable in some countries
- The new gas mixture is the only one available so far that has been type tested according to IEC standards which meets performance criteria and has a GWP ≤1

In addition, with the deployment of high-voltage GIS with the eco-efficient gas mixture, carbon dioxide (CO₂) equivalent emissions can be lowered by up to 50 percent through the lifecycle of the equipment. The CO₂ equivalent emissions consist of approximately 50 percent from raw materials, manufacturing and thermal losses, and 50 percent from SF₆ emissions based on a 30-year service life.

ABB technology and solution

The fluoroketone-based SF₆ alternative gas mixture is a chemical compound developed for switchgear applications in collaboration with 3M.

It has a dielectric performance similar to SF₆ when utilized in indoor applications, but with very low GWP. The new gas mixture also has an adequate current interruption performance but in this respect SF₆ is superior. Therefore the new gas mixture is first deployed for applications with a nominal voltage up to 170 kV where typically short circuit currents are below 50 kA.



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01 High-voltage switchgear type ELK-14 AirPlus

02 Medium-voltage switchgear type ZX2 AirPlus



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ABB's GIS solutions for the Oerlikon substation consist of:

- 8 bays of 170 kV GIS type ELK-14 AirPlus
- 50 panels of 24 kV GIS type ZX2 AirPlus

Other ABB products deployed in the substation include:

- 3 units of 50 MVA low-noise and highly efficient power transformers
- Substation automation protection and control systems

Project	
Substation	UW Oerlikon Neu
Customer	ewz
Country	Switzerland
Year of installation	2015

High-voltage switchgear	ELK-14 AirPlus	
Rated voltage	kV	170
Operating voltage	kV	150
Rated frequency	Hz	50
Rated short-duration power-frequency withstand voltage	kV	325/375
Rated lightning impulse withstand voltage	kV	750/860
Rated normal current (busbar and exit)	A	1250
Rated short-time withstand current	kA	40
Rated peak withstand current	kA	100

Medium-voltage switchgear	ZX2 AirPlus	
Rated voltage	kV	24
Operating voltage	kV	22
Rated short-duration power-frequency withstand voltage	kV	50
Rated lightning impulse withstand voltage	kV	125
Rated normal current (busbar)	A	2000
Rated short-time withstand current	kA	25
Rated duration of short-circuit	s	3
Rated peak withstand current	kA	63

Power transformer	oil-insulated	
Rated power	MVA	50
Voltage ratio	kV	162.8 (±9x2.12) / 24
Rated lightning impulse level	kV	750/325/125
Frequency	Hz	50
Vector group		YNd5
Cooling type		OFAF/OFWF (with waste heat recovery)
Total weight	t	80

Substation automation protection and control systems	
Control (150 kV)	Relion® REC670
Protection (150 kV)	Relion REL670 & RET670
Busbar protection (150 kV)	Relion REB670
Protection & control (22 kV)	Relion REF630
Substation automation solutions	MicroSCADA; SAS 600 Series
Communication networks in substation	IEC 61850
Communication to network control center	IEC 60870-5-104